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3.3.1. Number of research papers in the Journals notified on UGC website during the last five years

<b>Sl.No</b>	<b>Year</b>	<b>Total Number of Research Paper Published</b>
1	2018-19	37
2	2019-20	35
3	2020-21	56
4	2021-22	83
5	2022-23	103

Title of paper	Name of the author/s	Name of journal	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number
				Link to website of the Journal
<b><u>2018-19</u></b>				
Dielectric, Photophysical, Solvatochromic, and DFT Studies on Laser Dye Coumarin 334	Prof. G. H. Malimath	Brazilian Journal of Physics		<a href="https://link.springer.com/article/10.1007/s13538-018-00628-3">https://link.springer.com/article/10.1007/s13538-018-00628-3</a>
Studies on photosensitization of TiO <sub>2</sub> nanoparticles by novel 1,3,4-oxadiazoles derivatives	Prof. G. H. Malimath	OptiK	<b>Print ISSN: 0030-4026, Online ISSN: 1618-1336</b>	<a href="https://www.sciencedirect.com/science/article/abs/pii/S030402619302621">https://www.sciencedirect.com/science/article/abs/pii/S030402619302621</a>
Photophysical and computational studies on optoelectronically active thiophene substituted 1,3,4-oxadiazole derivatives	Prof. G. H. Malimath	Journal of photochemistry and photobiology	<b>Online ISSN: 1873-2666, Print ISSN: 1010-6030</b>	<a href="https://www.sciencedirect.com/science/article/abs/pii/S1010603018310979?via%3Dihub">https://www.sciencedirect.com/science/article/abs/pii/S1010603018310979?via%3Dihub</a>
Optical thermal and microstructural studies of epoxy-CoSo <sub>4</sub> -7H <sub>2</sub> O hybrid material	Prof. Blaise Lobo	International Journal of Polymer Analysis and Characterization	<b>Print ISSN: 1023-666X Online ISSN: 1563-5341</b>	<a href="https://www.tandfonline.com/doi/abs/10.1080/1023666X.2018.1498998">https://www.tandfonline.com/doi/abs/10.1080/1023666X.2018.1498998</a>
Mechanical and Dynamic Mechanical Studies on Epoxy-Cobaltous Sulfate Polymer Hybrids	Prof. Blaise Lobo	Springer Link		<a href="https://link.springer.com/article/10.1007/s12221-018-8031-4">https://link.springer.com/article/10.1007/s12221-018-8031-4</a>
Multistage thermal decomposition in films of cadmium chloride doped PVA-PVP polymeric blend	Prof. Blaise Lobo	Journal of thermal Analysis and Colorimetry		<a href="https://link.springer.com/article/10.1007/s10973-018-7289-5">https://link.springer.com/article/10.1007/s10973-018-7289-5</a>
Temperature Dependent Electric properties and Magnetoelectric effects in Ferroelectric rich Ni <sub>0.8</sub> Mg <sub>0.2</sub> Fe <sub>2</sub> O <sub>4</sub> +BaZr <sub>0.2</sub> Ti <sub>0.8</sub> O <sub>3</sub> Magnetoelectric composites	Prof. Geeta Chavan	Journal of alloys and compounds	<b>Print ISSN: 0925-8388, Online ISSN: 1873-4669</b>	<a href="https://typeset.io/papers/temperature-dependent-electric-properties-and-51hg2u5elr">https://typeset.io/papers/temperature-dependent-electric-properties-and-51hg2u5elr</a>
Effect of amino anilines on the fluorescence of coumarin derivative	Prof. Nirupama M. Jagadeeshwar	Journal of Luminescence	<b>Print ISSN: 0022-2313, Online ISSN: 1872-7883</b>	<a href="http://www.elsevier.com/locate/jlum">www.elsevier.com/locate/jlum</a>
Libraries of C-5 substituted imidazoles and Oxazoles by sequential van Leusen(VL)-Suzuki, VL-Heck and VL-Sonogashira in Imidazolium-Ils with Piperidine-Appended-IL as Base	Prof. Rajesh G Kalkhambkar	European Journal of Organic Chemistry	<b>Online ISSN: 1099-0690, Print ISSN: 1434-193X</b>	<a href="https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/ejoc.201800804">https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/ejoc.201800804</a>
Synthesis and Molecular Modeling studies of coumarin and 1-Aza-Coumarin-Linked Miconazole Analogues and their antifungal activity	Prof. Rajesh G Kalkhambkar	Chemistry Select	<b>Online ISSN: 2365-6549, Print ISSN: 2365-6549</b>	<a href="https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/slct.201801408">https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/slct.201801408</a>
Click Chemistry inspired design, synthesis and Molecular docking studies of coumarin, Quinolinone Linked 1,2,3-Triazoles as promising anti-microbial	Prof. Rajesh G Kalkhambkar	Biological chemistry & chemistry Biology	<b>Online ISSN: 2365-6549, Print ISSN: 2365-6549</b>	<a href="https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/slct.201800319">https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/slct.201800319</a>

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Assessment of Feed stock properties of seed oil of amora rohitutuka and heptapleurum venulosum for the biodiesel production	Prof.Kariya ppa S. Katagi	International Journal of computational intelligence research	ISSN:0973-1873	-
Oleo Chemistry and Combustion characteristics of plectranthus mollis,syn.Plectranthus,Seed Oil	Prof.Kariya ppa S. Katagi	Journal of Applicable Chemistry	ISSN:2278-1862	<a href="http://www.joac.info/AbstractPaper/2018/15-7-6-17-10A.pdf">http://www.joac.info/AbstractPaper/2018/15-7-6-17-10A.pdf</a>
Glycerol mediated synthesis and spectral characterization of 4-(2,4-dihydroxyphenyl)(phenylmethyl)benzene-1,3-diol and its derivatives	Prof.Kariya ppa S. Katagi		ISSN:2277-2723	<a href="https://scholar.google.com/citations?view_op=view_citation&amp;hl=en&amp;user=iTI07esAAAAJ&amp;citation_for_view=iTI07esAAAAJ:u-x6o8ySG0sC">https://scholar.google.com/citations?view_op=view_citation&amp;hl=en&amp;user=iTI07esAAAAJ&amp;citation_for_view=iTI07esAAAAJ:u-x6o8ySG0sC</a>
Synthesis and computational studies on optoelectronically important novel acridin-isoindoline-	Prof.Kariya ppa S. Katagi	Journal of Fluorescence	ISSN:	<a href="https://pubmed.ncbi.nlm.nih.gov/31030338/">https://pubmed.ncbi.nlm.nih.gov/31030338/</a>
Design synthesis,antibiofilm,quorum sensing inhibition,anticancer and docking studies of novel 2-(4-acridine-9-ylamino)isoindoline-1,3-dione	Prof.Kariya ppa S. Katagi	Chemical Data Collections	ISSN:Online ISSN: 2405-8300	<a href="http://www.elsevier.com/locate/cdc">www.elsevier.com/locate/cdc</a>
A Geographical Study of Social Well-being:Health and education Services in Dharwad District,Karnataka,India	Prof.L.T.N ayak	Regional Symbiosis		-
Impact of Cement Dust on Physico-chemical Properties of Soils around a Cement factory in Bagalkot,Karnataka,India	Prof.V.B.S avirmath	Journal of Geography,Environment and Earth Science international	ISSN:2454-7352	-
Impact Assessment of Elephant Barging into the Farms:A Case Study of Kalaghatagi Taluk,District Dharwad,Karnataka state,India	Prof.V.B.S avirmath	Regional Symbiosis		-
Floristic Assessment of Panchlingeshwar Sacred Grove, Nandikurali,Raibag Belgavi, Karnataka	Prof.K.Kotr esha	Indian Forester	ISSN:0019-4816(Print) ISSN:2321-094x(Online)	<a href="http://www.indianbotsoc.org">www.indianbotsoc.org</a>
Assessment of plant diversity in the community protected forest of Kusnur Village,Hangal,Haveri District Karnataka India	Prof.K.Kotr esha	Biodiversity International journal	eISSN: 2575-906X	<a href="https://medcraveonline.com/BIJ/assessment-of-plant-diversity-in-the-community-protected-forest-of-kusnur-village-hangal-haveri-district-karnataka-india.html">https://medcraveonline.com/BIJ/assessment-of-plant-diversity-in-the-community-protected-forest-of-kusnur-village-hangal-haveri-district-karnataka-india.html</a>
Optimal control analysis of deterministic and stochastic epidemic model with media awareness programs	Shrishail Ramappa Gani	an International journal of optimization and control:Theories & Applications	ISSN:2146-0957 eISSN:2146-5703	<a href="https://www.proquest.com/openview/4ba1438d12337a2fa557348c71ca63b5/1?pq-origsite=gscholar&amp;cbl=2045877#:~:text=For%20the%20deterministic%20problem%20of.%E2%89%A4%20u%20%E2%89%A4%20u%20a.s.%7D%20.">https://www.proquest.com/openview/4ba1438d12337a2fa557348c71ca63b5/1?pq-origsite=gscholar&amp;cbl=2045877#:~:text=For%20the%20deterministic%20problem%20of.%E2%89%A4%20u%20%E2%89%A4%20u%20a.s.%7D%20.</a>

A note on repeated significance test procedure for testing exponentiality against increasing failure rate average alternatives based on subsamples	Prof.Keerti Ashstagi math	IJRAR	ISSN:2348-1269	<a href="http://www.ijrar.org">www.ijrar.org</a>
Statistical modelling on the impact of migration and urbanization on agriculture production in India	Prof.M.N. Megeri	Int.J.Agricult. Stat.Sci	ISSN:0973-1903e	<a href="https://connectjournals.com/file_full_text/2979601H_103-109.pdf">https://connectjournals.com/file_full_text/2979601H_103-109.pdf</a>
Oncontrol Delta Generalized Pre-Continuous Functions	Prof.J.B.To rangatti	International Journal of Scientific Research In Mathematical and Statistical Sciences	ISSN:2348-4519	<a href="https://www.isroset.org/journal/IJSRMSS/full_paper_view.php?paper_id=738">https://www.isroset.org/journal/IJSRMSS/full_paper_view.php?paper_id=738</a>
Graphs Equienergetic with their complements	Prof.B.Parvathalu	Communications in Mathematical and in Computer Chemistry	ISSN:0340-6253	<a href="https://match.pmf.kg.ac.rs/electronic_versions/Match82/n2/match82n2_471-480.pdf">https://match.pmf.kg.ac.rs/electronic_versions/Match82/n2/match82n2_471-480.pdf</a>
Dispersive parameters of oxidised PVA-PVP blend films	Prof.Blaise Lobo	Turkish Journal of Physics	1300-0101	<a href="https://doi.org/10.3906/fiz-1808-21">https://doi.org/10.3906/fiz-1808-21</a>
conductivity measurements on CdCl <sub>2</sub> doped pva solid polymeric electrolyte for battery application	Prof.Blaise Lobo	Aip conferring processing	1551-7616	<a href="https://doi.org/10.1063/1.5028807">https://doi.org/10.1063/1.5028807</a>
Experimental investigations on potassium permanganate doped polyvinyl alcohol - polyvinyl pyrrolidone blend	Prof.Blaise Lobo	Aip conferring processing	1551-7616	
Investigation into the influence of filler piper nigrum leaves extract on physicochemical and antimicrobial properties of chitosan/ polyvinyl alcohol blend films	Prof. sarawasti masti	Journal of polymer & environment	1566-2543	<a href="https://doi.org/10.1002/app.46188">An Investigation into the Influence of Filler Piper nigrum Leaves Extract on Physicochemical and Antimicrobial Properties of Chitosan/Poly (Vinyl Alcohol) Blend Films   Journal of Polymers and the Environment (springer.com)</a>
Influence of Syzygium Cumini Leaves Extract on morphological ,Thermal Mechanical and antimicrobial properties of PVA and PVA/Chitosan blend films	Prof.sarawasti masti	Applied Polymer		<a href="https://doi.org/10.1002/app.46188">https://doi.org/10.1002/app.46188</a>
microstructure of cadmium chloride doped pva/pvp blend \films	Prof.Blaise Lobo		Online ISSN: 2214-7853	<a href="https://doi.org/10.1016/j.matpr.2018.01.104">https://doi.org/10.1016/j.matpr.2018.01.104</a>
UV irradiation induced microstructural changes in CdCl <sub>2</sub> doped pva -pvp blend	Prof.Blaise Lobo	materials in electronics		<a href="https://doi.org/10.1016/j.matpr.2018.01.104">UV irradiation induced microstructural changes in CdCl<sub>2</sub> doped PVA-PVP blend   Journal of Materials Science: Materials in Electronics (springer.com)</a>
spectroscopic studies on films of lead nitrate doped polyvinyl alcohol - polyvinyl pyrrolidone blend	Prof.Blaise Lobo	material science research	ISSN:0973-3469	



optical structural and thermal propertise of bismuth nitrate doped poly carbonate composite	Prof.Blaise Lobo	Aip confeering processing	<b>1551-7616</b>	<a href="https://doi.org/10.1063/1.5028817">https://doi.org/10.1063/1.5028817</a>
Conductivty and free volume studies on bismuth sulfide/pva :polypyrole nano composite	Prof. sarawasti masti	Journal of polymer & environment	<b>1566-2543</b>	<a href="https://doi.org/10.1002/slct.201903572">Conductivity and free volume studies on bismuth sulfide/PVA:polypyrole nanocomposites   Indian Journal of Physics (springer.com)</a>
Synthesis molecular modelling studies of coumarin and 1- aza coumarin linked micoazole analogues and their antifungal activity	prof. rajesh kalkhamba kar	Chemistry Select		<a href="https://doi.org/10.1002/slct.201903572">https://doi.org/10.1002/slct.201903572</a>

***2018-19***

# Dielectric, Photophysical, Solvatochromic, and DFT Studies on Laser Dye Coumarin 334

Atomic Physics | Published: 07 January 2019

Volume 49, pages 151–160, (2019) [Cite this article](#)

C. V. Maridevarmath, Lohit Naik & G. H. Malimath 

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## Abstract

The absorption and fluorescence spectra of laser dye, 10-acetyl-2,3,6,7-tetrahydro-1H,5H,11H-pyrano[2,3-f]pyrido[3,2,1-ij]quinolin-11-one [C-334], are recorded. The ground-state dipole moments ( $\mu_g$ ) were determined from density functional theory (DFT) computations, Guggenheim's, and solvatochromic methods. The excited-state dipole moments ( $\mu_e$ ) were determined from Lippert's, Bakhshiev's, Kawski-Chamma-Viallet's, and McRae's equations. The  $\mu_e$  values are found to be higher than  $\mu_g$  values and this suggest that the probe molecule is more polar in the excited state. The absorption maxima and emission maxima of C-334 undergo bathochromic shift as the polarity of the solvent increases and indicates that the transitions involved are  $\pi \rightarrow \pi^*$ . The change in dipole moment ( $\Delta\mu$ ) and the angle between  $\mu_e$  and  $\mu_g$  is calculated. The absorption and fluorescence emission of the probe C-334 were investigated theoretically with the help of Gaussian 09W for all the studied solvents by using time-dependent (TD)-DFT combined with conductor-like polarizable continuum model (CPCM) solvation model and were compared with the experimental results. Further, the ground- and excited-state dipole moments were also estimated for all the studied solvents by using CPCM solvation model and are compared with the experimental results. The HOMO-LUMO energy gaps

Original research article

# Studies on photosensitization of TiO<sub>2</sub> nanoparticles by novel 1,3,4-oxadiazoles derivatives

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## Abstract

In the present work, photosensitization of TiO<sub>2</sub> nanoparticles (<25 nm) from three novel 1,3,4-oxadiazole derivatives namely TTO, TBO and TMO has been investigated using steady-state absorption, steady-state fluorescence and time-resolved fluorescence methods. Increase in absorbance and broadening of the absorption spectra for all the dyes in the presence of different concentrations of TiO<sub>2</sub> nanoparticles confirm the possibility of interactions involving dyes and nanoparticles. Fluorescence quenching has been observed for all the dyes in the presence of colloidal TiO<sub>2</sub> nanoparticles. Analysis of the cyclic voltammetric experimental data using Rehm-Weller relation shows that, fluorescence quenching is due to electron transfer from dye to TiO<sub>2</sub> nanoparticles and confirms the photosensitization of TiO<sub>2</sub> nanoparticles. Theoretical studies too confirmed the electron transfer from dye to TiO<sub>2</sub> nanoparticles Hence, we infer that dyes used in the present studies may be useful for dye-sensitized solar cell (DSSC). Further, Stern-Volmer studies suggest that, the fluorescence quenching mechanism follows dynamic process along with minor static quenching. The apparent association constant ( $k_s$ ) of the interaction is also calculated using Benesi-Hildebrand model.

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## Introduction

In the recent years, a lot of research work is going on using Titanium dioxide nanoparticles (TiO<sub>2</sub> NPs) for many applications like Photocatalysts for solar energy conversion, photovoltaic cells, air filters, photodegradation of organic pollutants, biosensors and for optical filters. They are also used to detect important class of neurotransmitters like Catecholamines, which happens to be cardiotoxic. To improve the performance of the solar cells, dyes are adsorbed to the surface of the colloidal nanoparticles and electron transfer to the conduction band of the nanoparticle is made possible through photoexcitation of the dye. Further, from fluorescence quenching techniques, the mechanisms involved in the Photosensitization are investigated. Dyes like cyanine, erythrosin B, eosin, oxazines, chlorophyllin, phthalocyanines, Ru(bpy) and derivatives etc. are used for photosensitization of SnO<sub>2</sub>, TiO<sub>2</sub> and ZnO nanoparticles [[1], [2], [3], [4], [5], [6], [7], [8], [9], [10], [11], [12], [13]].



# Photophysical and computational studies on optoelectronically active thiophene substituted 1,3,4-oxadiazole derivatives

Lohit Naik<sup>a</sup>, C.V. Maridevarmath<sup>b</sup>, I.A.M. Khazi<sup>c</sup>, G.H. Malimath<sup>a</sup>  

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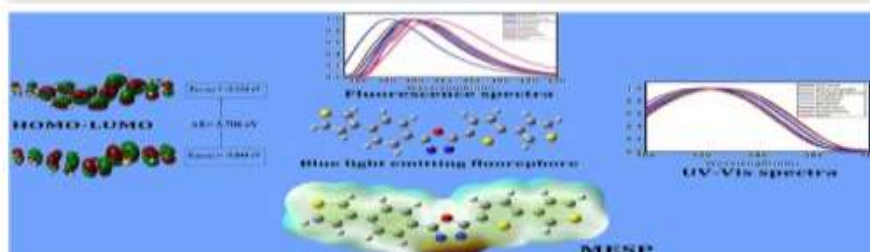
<https://doi.org/10.1016/j.jphotochem.2018.09.038>

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## Abstract

In the present work, the photophysical properties of three novel optoelectronically active thiophene substituted 1,3,4-oxadiazole derivatives, namely 2-(4-(1H-inden-2-yl)phenyl)-5-(5-(1H-inden-2-yl)thiophen-2-yl)-1,3,4-oxadiazole [TIO], 2-(4-(thiophen-3-yl)phenyl)-5-(5-(thiophen-3-yl)thiophen-2-yl)-1,3,4-oxadiazole [TTO] and 2-(4-(benzo[b]thiophen-2-yl)phenyl)-5-(5-(benzo[b]thiophen-2-yl)thiophen-2-yl)-1,3,4-oxadiazole [TPO] have been investigated. The ground and excited state dipole moments ( $\mu_e$ ) were determined experimentally by solvatochromic shift method using various solvatochromic correlations like Lippert's, Bakhshiev's, Kawski-Chamma-Viallet's and solvent polarity parameter ( $E_T^N$ ) equations. The ground state dipole moments ( $\mu_g$ ) were also estimated from *ab initio* computations using Gaussian 09 W software. It is observed that, the excited state dipole moments are higher than the ground state dipole moments for all the probe molecules. This indicates that, the probe molecules are more polar in the excited state than in the ground state. The HOMO-LUMO energy gap computed using density functional theory (DFT) and from absorption threshold wavelengths are found to be in good agreement. The chemical hardness ( $\eta$ ) was determined for all the probes from HOMO-LUMO energies and results suggest the soft nature of the molecules. Further, the reactive centers like electrophilic site and nucleophilic site were identified with the help of molecular electrostatic potential (MESP) 3D plots using DFT computational analysis. Our preliminary investigations suggest that, the derivatives of 1,3,4-oxadiazoles namely TIO, TTO and TPO could play an important role in photonic, sensor and optoelectronic devices in future.

## Graphical abstract



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# Optical, thermal and microstructural studies of epoxy-CoSO<sub>4</sub>·7H<sub>2</sub>O hybrid material

Shruti S. Devangamath & Blaise Lobo 

Pages 517–528 | Received 04 Jun 2018, Accepted 27 Jun 2018, Published online: 07 Sep 2018

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## Abstract

Organic–inorganic polymer hybrid films of epoxy polymer were prepared, using Cobaltous sulfate heptahydrate (CoSO<sub>4</sub>·7H<sub>2</sub>O) as a filler component, by physical blending method. UV–Vis optical absorption spectra were analyzed to determine optical band gaps ( $E_g$ ) of the hybrid material. FTIR studies revealed the interaction of inorganic component with molecules of the polymer matrix. Glass transition temperature ( $T_g$ ) and degradation temperature were determined by DSC. TG analysis showed the improvement in thermal stability of prepared hybrid films. XRD patterns revealed the amorphous nature of the pure epoxy polymer. Additional sharp peaks were seen for higher filler levels (FLs), indicating self formed nanostructures in the material, which was also evident from SEM analysis.

**Q Keywords:** [Epoxy polymer](#) [hybrid materials](#) [cobaltous sulfate](#) [spectroscopy](#) [thermal analysis](#) [microstructure](#)

## Acknowledgements

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# Multistage thermal decomposition in films of cadmium chloride-doped PVA–PVP polymeric blend

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Volume 134, pages 865–878, (2018) [Cite this article](#)

Basavarajeshwari M. Baraker & Blaise Lobo 



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 [A Correction](#) to this article was published on 12 May 2018

 This article has been [updated](#)

## Abstract

Films of cadmium chloride ( $\text{CdCl}_2$ ) doped polyvinyl alcohol (PVA)–polyvinyl pyrrolidone (PVP) polymer blend have been studied using thermogravimetry (TG) and differential scanning calorimetry (DSC), for doping levels ranging from 0.0 mass% to 50.5 mass%. At high doping levels (beyond 10.2 mass%), TG scans of these films showed several stages of decomposition at temperatures beyond 100 °C, indicating that the incorporation of  $\text{CdCl}_2$  results in deterioration of PVA–PVP blend, on thermal activation. The presence of melting peaks, which is due to melting of crystalline regions in  $\text{CdCl}_2$ -doped PVA–PVP blend samples and the occurrence of thermal decomposition, in different stages, is confirmed by DSC curves. There is a decrease in decomposition temperature of the doped PVA–PVP blend, with an increase in salt ( $\text{CdCl}_2$ ) concentration. Kinetic analysis has been performed using iso-conversional models, using Flynn–Wall–Ozawa (FWO) equation, Kissinger–Akahira–Sunose (KAS) equation and Kissinger relation at four different stages of thermal decomposition, for the 10.2 mass%  $\text{CdCl}_2$ -doped PVA–PVP blend. The higher values of activation energy,  $E_a = 197.5$ , 196.0 and 175.3  $\text{kJ mol}^{-1}$  obtained from FWO, KAS and Kissinger models reveal that  $\text{CdCl}_2$ -doped PVA–PVP sample has more thermal stability when compared to the undoped PVA–PVP blend.

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# Temperature Dependent Electric Properties and Magnetoelectric Effects in Ferroelectric rich $\text{Ni}_{0.8}\text{Mg}_{0.2}\text{Fe}_2\text{O}_4 + \text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$ Magnetoelectric Composites

Pradeep Chavan<sup>a</sup>, L.R. Naik<sup>a</sup>, P.B. Belavi<sup>b</sup>, Geeta Chavan<sup>c</sup>, V.T. Muttannavar<sup>d</sup>, B.K. Bammannavar<sup>e</sup>, R.K. Kotnala<sup>f</sup>

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## Abstract

The magnetoelectric composites with the compositions of ferrites & ferroelectrics having the general chemical formula  $(x) \text{Ni}_{0.8}\text{Mg}_{0.2}\text{Fe}_2\text{O}_4 + (1-x) \text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$  (in which  $x = 0.1, 0.2, 0.3$ ) were synthesized by using double sintering ceramic technique. From XRD, the phase formation of ferrites with cubic structure and ferroelectrics with tetragonal perovskite structure was confirmed through the measurement of XRD. The two phase ME composites have larger saturation magnetization and dielectric constant; it is because of the effect of interfacial strain on  $\text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$  ferroelectric phase. Furthermore, the ME response  $4.262 \text{ mVcm}^{-1}\text{Oe}^{-1}$  was observed for (30%)  $\text{Ni}_{0.8}\text{Mg}_{0.2}\text{Fe}_2\text{O}_4 + (70\%) \text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$  composites at 5.0 kOe applied DC magnetic field; it shows the success of magnetic control of the dielectric response via the mechanical coupling which can be exploited in the future applications of multiferroic composites.

## Introduction

In the current decades, ME composite materials fascinated the widespread attention of the researchers in solid state physics and in the field of abundant industries [1]. The cross coupling between the orders of magnetic and electric field is known as magnetoelectric (ME) coupling. This cross coupling gives electrical polarization of ME composites which is to be controlled by means of magnetic field and on the contrary, the manipulation of saturation magnetization by the varying of electric field [2]. A giant ME voltage coefficient can be achieved in two-phase ME composites through the product property of ferrites and ferroelectrics [3]. Therefore, if the magnetic field is applied to two phase ME composite materials, it consequences the mechanical strain in ferrite phase (because of magnetostriction) and which applies stress on to the ferroelectric phase to produce electric field comparative to the applied magnetic field [4]. The significant applications of ME composites in several technologies and devices such as transformers, sensors, actuators and transducers, storage devices, etc [5]. Therefore, from the improvement point of view, ME composites cannot require any external power to operate since they transmute magnetic field changes into voltage output and vice-versa [6].

In the present report, ME composites  $(x) \text{Ni}_{0.8}\text{Mg}_{0.2}\text{Fe}_2\text{O}_4 + (1-x) \text{BaZr}_{0.2}\text{Ti}_{0.8}\text{O}_3$  (with  $x = 0.1, 0.2$  and  $0.3$ ) were synthesized. In order to study the magnetic and ME properties exhibited by these composites, the results obtained were correlated with the microstructural features of the composites.



# Effect of amino anilines on the fluorescence of coumarin derivative

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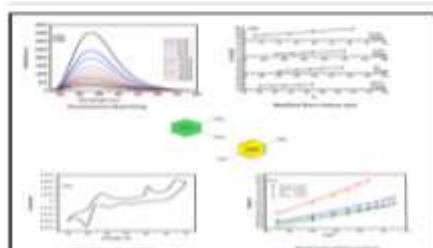
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## Abstract

The effect of stereo electronic factors of amino anilines such as *ortho*-phenylenediamine (OPD) and *para*-phenylenediamine (PPD) on the fluorescence of 5,6-benzo-4-azidomethyl coumarin (5BAMC) in polar aprotic and polar protic solvents has been studied. From UV absorption and <sup>1</sup>H NMR studies, observed blue shift in the presence of PPD is due to H-bonding with 5BAMC. Fluorescence quenching studies indicate the role of static and dynamic quenching mechanisms for both the quenchers and larger quenching efficiency of PPD than OPD. The sphere of action static quenching and finite sink approximation models reveal static effect in the excited state and diffusion limited bimolecular quenching reactions. Electrochemical analysis indicates that quenching efficiency of PPD is more than OPD based on the magnitudes of free energy change for electron transfer. Binding equilibria analysis confirms that the magnitude of binding between PPD and 5BAMC is stronger compared to OPD. It is also noticed that the binding between PPD and 5BAMC in polar protic solvents is stronger than that in aprotic solvents. Lastly, from the magnitudes of thermodynamic parameters, interaction between PPD and 5BAMC is hydrophobic and spontaneous. Thus from the present investigation, it is concluded that the separation between two -NH<sub>2</sub> groups in amino anilines plays role in their interaction with coumarin derivative 5BAMC.

## Graphical abstract



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## Introduction

Recognising the molecule using fluorescence spectroscopy was first proposed in 1980's by Tsien et al. for the detection of calcium [1]. Among various analytical methods such as solid phase micro extraction high performance liquid chromatography, atomic absorption spectroscopy, Plasma emission spectroscopy and fluorescence spectroscopy, fluorescence spectroscopy is simple and more sensitive method. Fluorescence quenching is a non-invasive method for detecting the analytes and has been widely used in the detection of toxic substances [2]. Quenching mechanisms depend on the chemical properties of the individual molecules [3]. Few applications of fluorescence quenching studies are the

Communication

# Libraries of C-5 Substituted Imidazoles and Oxazoles by Sequential Van Leusen (VL)–Suzuki, VL–Heck and VL–Sonogashira in Imidazolium-ILs with Piperidine-Appended-IL as Base

Hemantkumar M. Savanur, Rajesh G. Kalkhambkar ✉, Kenneth K. Laali ✉

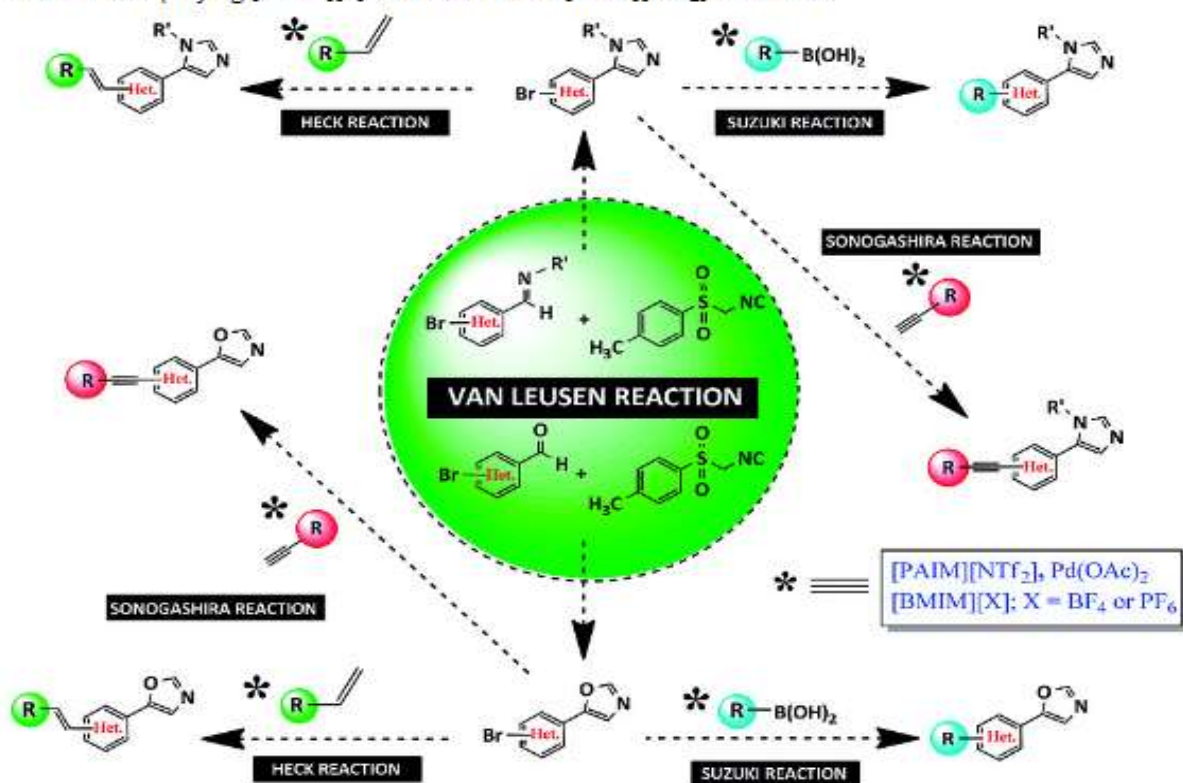
First published: 20 August 2018 | <https://doi.org/10.1002/ejoc.201800804> | Citations: 33

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## Graphical Abstract

By sequencing the Van Leusen imidazole and oxazole syntheses with Suzuki, Heck and Sonogashira reactions, diverse libraries of C5-functionalized imidazoles and oxazoles were synthesized in one-pot reactions employing [BMIM][X] as a solvent and [PAIM][NTf<sub>2</sub>] as a base.





## Abstract

Facile access to diverse C5-substituted imidazoles and oxazoles via sequential Van Leusen–Suzuki, Van Leusen–Heck, and Van Leusen–Sonogashira protocols, employing imidazolium-ILs as solvents along with piperidine-appended imidazolium [PAIM][NTf<sub>2</sub>] as task-specific basic IL has been demonstrated, in a high-yielding one-pot method, starting with readily available aldimines (for imidazole) or aldehydes (for oxazole) and tosylmethylisocyanide (Tos-MIC), under mild conditions with potential for recycling and reuse of the IL solvent. The scope of the method is supported 49 examples.



Full Paper

# Synthesis and Molecular Modeling Studies of Coumarin- and 1-Aza-Coumarin-Linked Miconazole Analogues and Their Antifungal Activity

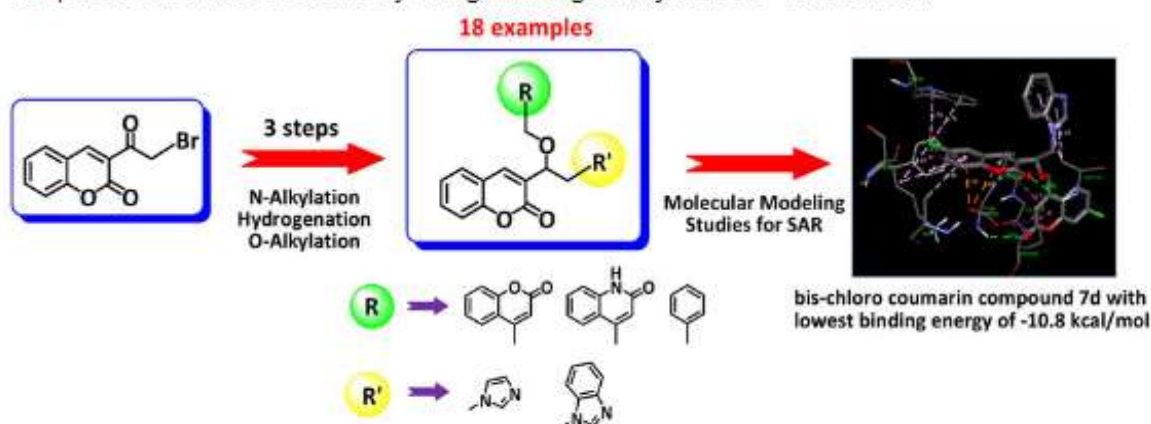
Hemantkumar M. Savanur, Geeta M. Pawashe, Dr. Kang Min Kim , Dr. Rajesh G. Kalkhambkar First published: 05 September 2018 | <https://doi.org/10.1002/slct.201801408> | Citations: 10

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## Graphical Abstract

A series of new coumarin and 1-aza coumarin analogues of miconazole (**6 a-j**) were synthesized from 3-bromoacetyl coumarins. Further diversification was achieved by synthesizing coumarin-benzimidazole hybrids of miconazole (**7 a-j**) and evaluated for *in-vitro* anti-microbial activities. The present investigation has shown that the introduction of benzimidazole in coumarin analogues of miconazole instead of imidazole (**7 d**) has marked effect on its anti-fungal activity, i.e. the presence of chloro and benzimidazole further enhances its activity, which is not only evident from MIC values comparable to standard but also by its high binding affinity value at  $-10.8$  kcal/mol.



## Abstract

A series of new coumarin and 1-aza coumarin analogues of miconazole (**6 a-j**) were synthesized from 3-bromoacetyl coumarins. Further diversification was achieved by synthesizing coumarin-benzimidazole hybrids of miconazole (**7 a-j**) and evaluated for *in-vitro* anti-microbial activities. Amongst the tested compounds, **7 d** was found to be particularly effective as anti-fungal agents against *C. albicans* and *C. krusei*, with activity comparable to that of the standard. Comparative Docking studies with mevalonate-5-diphosphatedecarboxylase shows better binding affinity than imidazole counterparts which is primarily attributed to extended  $\pi$ -alkyl interactions facilitated by benzimidazole.



# Click Chemistry Inspired Design, Synthesis and Molecular Docking Studies of Coumarin, Quinolinone Linked 1,2,3-Triazoles as Promising Anti-Microbial Agents

Hemantkumar M. Savanur, Krishna N. Naik, Shallaja M. Ganapathi, Kang Min Kim, Dr. Rajesh G. Kalkhambkar

First published: 22 May 2018 | <https://doi.org/10.1002/slct.201800319> | Citations: 28

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## Graphical Abstract

A series of new coumarin, quinolinone and benzyl linked 1,2,3-triazole derivatives have been synthesized via click chemistry and subjected for their anti-microbial activities. Molecular modeling study indicates that the designed molecular scaffold shows outstanding interaction with human cytochrome P450 lanosterol 14- $\alpha$ -sterol demethylase (CYP51). Results of bioassay indicate that, compounds containing chloro and methoxy substituents in the title compounds (**6j**, **6e**, **7g**, **7f** and **8f**) exhibit excellent anti-bacterial and anti-fungal activities. Thus, these compounds represent new platform that can be further optimized to seek novel anti-fungal agents with structures significantly different from those of existing anti-microbials.



## Abstract

A series of new coumarin, quinolinone and benzyl linked 1,2,3-triazole derivatives have been synthesized and screened for their anti-bacterial and anti-fungal activities. Results of bioassay indicate that, compounds containing chloro and methoxy substituents in coumarin (**6j**), chloro substitution in quinolinone (**7g**) and 3-chloro benzyl analogue (**8f**) exhibit excellent anti-bacterial activities. The results of anti-fungal activities also reveal that methoxy and chloro substituted coumarins (**6e** and **6j**) were highly active against yeast strains. In addition, chloro and methyl substituted coumarins (**6h** and **6i**) were also exhibited excellent activity. Further, methyl substituted quinolinone with chloro substituted coumarin (**7f**) was found to highly active against yeast fungi and filamentous strain *A.niger*. It is evident from the results obtained and SAR studies that electron withdrawing or donating character of the substituents do not seem to be a major factor in increasing or decreasing anti-microbial activity.



**ASSESSMENT OF FEED STOCK PROPERTIES OF SEED OIL OF AMOORA ROHITUKA AND HEPTAPLEURUM VENULOSUM FOR THE BIODIESEL PRODUCTION**

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**Abstract**—The production of biodiesel from non edible seed oils as an alternative fuel has gained significant attention due to the predicted depletion of conventional fuels and due to environmental concerns. The seed oils of *Amoora rohituka* (AR) and *Heptapleurum venulosum* (HV) plant species are selected for this screening. These species yield 41.7% & 50.0% non edible oil respectively. The details of component fatty acids (CFAs) are extracted from the literature. The other necessary analytical data like iodine value, saponification value and the various parameters of biodiesel viz., cetane number, density, viscosity, flash point, lower heating value, higher heating value, cloud point, and pour point of fatty acid methyl esters (FAMES) of AR and HV respectively are computed empirically. The biodiesel properties FAMES of these seed oils are compared with petro-diesel. This work reports the suitability of these selected species as feedstock for the biodiesel production.

**Keywords**— Edible Seed oil, *Amoora rohituka*, *Heptapleurum venulosum*, Biodiesel, Fatty acid methyl esters

I. INTRODUCTION

Sustainability, in essence is the development of methodologies to meet the needs of the present without compromising those of future generations. It has become a watchword for modern society, with developed and developing nations and multinational corporations promoting international research programs into sustainable food, energy, materials, and even city planning. As there is over exploitation of the non renewable fossil fuels meeting the demands of the present life style, it has become necessary to find out alternative renewable fuels.

Due to its clean emissions profile, ease of use and many other benefits, biodiesel is quickly becoming one of the fastest growing alternative fuels in the world [1]. The advantages of biodiesel comprise its domestic origin, renewability, biodegradability, higher flash point, inbuilt lubricity, higher cetane number than that of petro diesel, low viscosity, improved heating value which yield shorter ignition delay and longer combustion duration leading to low particulate emissions, reduction in emissions of CO<sub>x</sub>, SO<sub>x</sub>, etc.

Researchers in the recent times, are focusing on non edible seed oils for the biodiesel production to mitigate the consequences of usage of edible oils for the production of biodiesel which otherwise, would lead to adverse effect on food security [2]. There are several methods used for biodiesel production like pyrolysis, micro emulsification and transesterification. Among these, transesterification is a simple and feasible method used for the biodiesel production [3].

Transesterification is a triacylglycerol (TAG) reaction with a short chain monohydric alcohol normally at elevated temperatures in the presence of catalyst to form fatty acid alkyl esters and glycerol. Three moles of biodiesel and one of glycerol is produced for every one mole of TAG (Fig. 1).

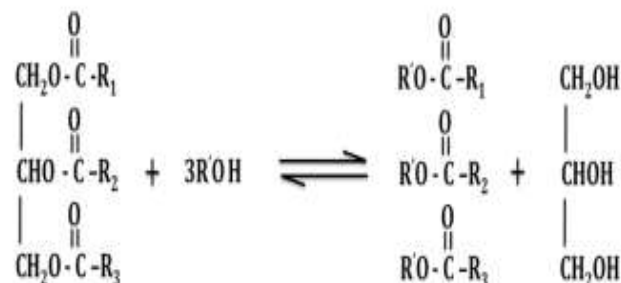


Figure 1: Transesterification reaction

II. SEEDS UNDER STUDY

A. *Amoora Rohituka*

*Amoora rohituka*, (*Aphanamixis polystachya*), is a species of tree in the family Meliaceae. It is a deciduous tree distributed all over India, Western Peninsula, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Malaya and Srilanka. It is widely used as a medicinal plant in Ayurveda. Oil is not edible and can be used for biodiesel production. The very fine wood is used for construction and ship-making. Fruit is a single seeded pale-reddish with subglobose capsule (Fig. 2).



Figure 1: *Amoora rohituka*



**Oleo Chemistry and Combustion Characteristics of *Plectranthus mollis*,  
syn. *Plectranthus incanus*, Seed Oil**

**Kariyappa S Katagi\* and Nikhil S Kadam**

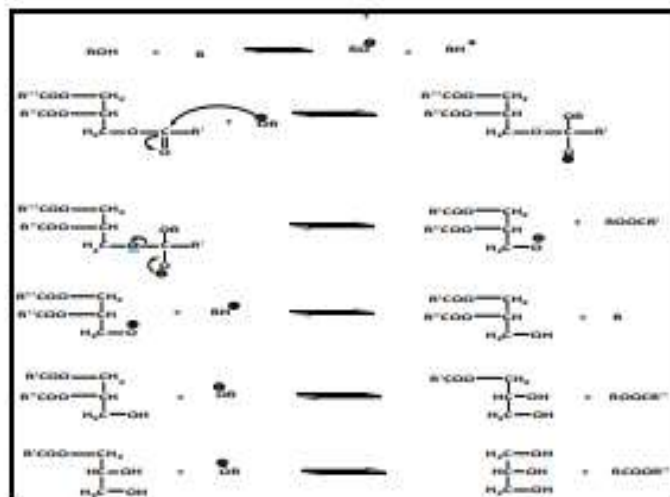
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Accepted on 22<sup>nd</sup> October, 2018

**ABSTRACT**

In this work new feedstock for biodiesel production has been screened. Non-edible seed oil species like *Plectranthus mollis* (PM) plant species yield 40% seed oil. The molecular weight (MW) of oil is calculated based on the percentage component fatty acids of the seed oil. The cetane number (CN), lower heating value (LHV) and higher heating value (HHV) of these fatty acid methyl esters (FAMES) are empirically evaluated. The combustion characteristics /bio-diesel properties of *Plectranthus mollis* seed oil methyl esters (PMSOMEs) of *Plectranthus mollis* seed oil (PMSO) is compared with existing bio-diesels. The PMSO selected in this investigation convene the major specification of biodiesel standards. This work reports the suitability of PMSO for the bio-diesel productivity.

**Graphical Abstract**



Mechanism of the alkali-catalyzed transesterification of vegetable oils


**Keywords:** *Plectranthus mollis*, Industrial utilization, Biodiesel, Fatty acids, Fuel properties, *Plectranthus mollis* seed oil methyl esters.




# Synthesis and Computational Studies on Optoelectronically Important Novel Acridin-Isoindoline-1,3-Dione Derivatives

ORIGINAL ARTICLE | Published: 27 April 2019

Volume 29, pages 653–663, (2019) [Cite this article](#)


[Smita Mane](#), [Kariyappa Katagi](#)  & [Raveendra Melavanki](#)

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## Abstract

A series of novel 2-(4-(acridin-9-ylamino)phenyl)isoindoline-1,3-dione derivatives were designed and synthesized namely 2-(4-(4-methoxyacridin-9-ylamino)phenyl)isoindoline-1,3-dione [S1], 2-(4-(3-chloroacridin-9ylamino)phenyl)isoindoline-1,3-dione [S2], 2-(4-(2-fluor oacridin-9ylamino)phenyl)isoindoline-1,3-dione [S3], 2-(4-(1,4-dichloroacridin-9ylamino)phenyl)isoindoline-1,3-dione [S4]. The photophysical, thermal properties of these compounds were characterized by the spectroscopic and thermographic method. The absorbance and fluorescence spectra of these derivatives were recorded in different solvents to understand the role of solute and solvent interaction. The compounds showed high thermal stability with thermal decomposition temperatures at 5% weight loss in a range of 250–287 °C. Compared with these compounds, donor groups containing derivatives exhibited excellent properties as fluorescent compounds. Computational studies were done using DFT (Density Functional Theory) G09 software (B3LYP/6-311G++V(d,p)) basis sets in order to calculate the optical band gap and FMO (Frontier Molecular Orbital) energies. The chemical stability of the four derivatives was determined by means of chemical hardness ( $\eta$ ) using HOMO-LUMO energies.





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# Design, synthesis, antibiofilm, quorum sensing inhibition, anticancer and docking studies of novel 2-(4-acridine-9-ylamino)isoindoline-1,3-dione

Smita G. Mane<sup>a</sup>, Kariyappa S. Katagi<sup>a</sup>  , Pramod Bhasme<sup>b</sup>, Sridhar Pattar<sup>c</sup>, Qing Wei<sup>d</sup>, Shrinivas D. Joshi<sup>e</sup>

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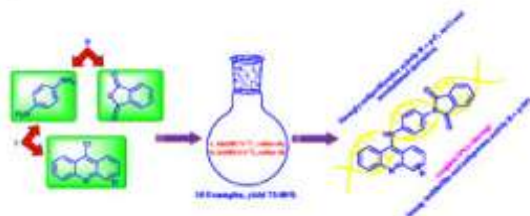
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## Abstract

A series of novel 2-(4-(acridin 9yl amino)phenyl)isoindoline-1,3-dione derivatives **6a–6j** were synthesized and screened for antibiofilm, antiquorum sensing and *in-vitro* anticancer activity against MCF-7 cell lines. The obtained result indicates that the potent compounds are promising chemical entities for the new class of potential antibiofilm and anticancer drug-like molecules. Further, molecular docking has shown that compounds have good binding affinities with protein and ligands. Whereas, DNA cleavage by gel electrophoresis method revealed that compounds 6g and 6h cleaved the DNA completely.

## Graphical abstract



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### Rationale

Our present work is based on the synthesis of novel acridine-phthalimide hybrids, which were synthesized by conjugating acridine with phthalimide moiety. The Phthalimide ring (*isoindoline-1,3-dione*) represents a very important substructure in organic synthesis due to its diverse pharmacological properties [1], [2], [3], [4], [5], [6]. Especially, the most important biological effects that have been reported for phthalimide derivatives are anticancer [7], antimicrobial [8], antioxidant [9],...

### Materials and methods

Melting points were determined with an open capillary method on a Buchi apparatus and are uncorrected. The IR spectra were recorded on a Nicolet 5700 FT-IR spectrometer in KBr disc method.  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra were recorded on Bruker 400MHz Spectrometer using DMSO- $d_6$  as solvents and TMS as an internal standard. All chemical shifts were reported as  $\delta$  values (ppm). Mass spectra were recorded using Shimadzu GCMSQP2010S and the elemental analyses were carried out using Heraeus CHN rapid analyzer...

### Chemistry

The synthetic procedure to obtain the potent target compound is depicted in Scheme 1. 2-(phenylamino) benzoic acid (3) was synthesized from *o*-chloro benzoic acid (1) and aniline (2) and this was cyclised by using phosphochloric acid to yield corresponding 9-chloroacridine (4) according to the literature [38] to this by treatment with the *p*-phenylene diamine to get amine derivatives (5). Further, the target compound (6) 2-(4-acridine-9-yl-aminophenyl)isoindoline-1,3-dione was easily achieved by...

### Conclusion

In this work, the newly synthesized acridine isoindoline derivatives were subjected for antibiofilm and quorum sensing inhibition, where the compound **6g** inhibited 70% PA01 biofilm activity. Further, the molecular docking studies revealed that the binding sites with their interactions at the active site of the enzyme with the PI3Ks kinase proteins. Furthermore, all the synthesized compounds were evaluated against MCF-7 in vitro cancer cell lines. The results revealed that out of ten compounds,...

### Acknowledgments

Authors are very much thankful to the Department of Chemistry, Karnataka University's Karnataka Science College, Dharwad, for providing necessary Research facilities. Further, Smita. G. Mane and Dr. Kariyappa. S. Katagi highly acknowledges to UGC New Delhi, India for providing Rajiv Gandhi National Fellowship (RGNF) (F117.1/ 2016-17/ RGNF-2015-17-SC-MAH-26074/(SAILI/Website) and UGC-SWRO, Bangalore for granting research project no. F.2070-MRP/15-16/KAKA056/UGC-SWRO respectively....

### Declaration of interest

None....





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## **Impact of Cement Dust on Physico-chemical Properties of Soils around a Cement Factory in Bagalkot, Karnataka, India**

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<sup>1</sup>*Department of Studies in Geography, Karnatak University Dharwad, India.*

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### ***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

**Aims:** To study the physicochemical properties of soil around the cement factory, to examine the effect of the industrial dust on the soil properties and to analyse the relation between the proportion of pollutants and the distance from the cement factory.

**Study Design:** Were used to analyse the relationship between soil samples at four different locations within the study area. Statistical methods such as; percentage, graph and Pearson correlation method.

**Place and Duration of Study:** For this study soil samples were collected around J k cement factory near Muddhapura of Mudhol Taluk of Bagalkot district in the pre monsoon period at four directions. Samples were analysed using titrant method, flame photometer method, oslen method to determine physicochemical properties. Pearson correlation method was used to analyse the relation between concentration of different elements in the soil samples and distances in four directions.

## Floristic Assessment of Panchlingeshwar Sacred Grove, Nandikurali, Raibag, Belagavi, Karnataka

*The Sacred groves are forest patches conserved by the local people based on the socio-cultural and religious practices. The sacred groves are rich in diversity and play a significant role in the conservation of biodiversity. The present work was carried with the aim to document the floristic account and its assessment in the Panchlingeshwar sacred grove, Nandikurali, Raibag, Belagavi. A total of 171 taxa belonging to 145 genera distributed in 59 families were recorded, also the grove representing with 54 medicinal plant species belonging to 48 genera and 28 families.*

**Key words:** Sacred groves, Nandikurali, Conservation, Belagavi.

### Introduction

Prehistoric man was well cherished with their surroundings. The ancient generation gave importance to trees and surrounding forests, and they worshipped and protected these forests and trees. The protection of these forest patches as sacred groves and several tree species as sacred trees belong to the religion based conservation of ancient people all over the world. Sacred groves are community based repositories of biological diversity and got protected on the basis of religious practices and faith (Hasting, 1934).

In India, about 13,720 sacred groves have been enumerated from different states. Andhra Pradesh, Kerala, Maharashtra and Tamil Nadu have the maximum number of these forests. In Karnataka, Western Ghat have has maximum number of sacred patches with compare to Deccan terrain, namely Uttara Kannada, Shimoga, Udupi, Mangalore, Dakshina Kannada and Kodagu harbour 1477 sacred groves (Kalam, 1996; Malhotra, 1998; Gokhale *et al.*, 1998). Western Ghats sacred groves broadly fall under two categories, small groves are entirely protection, biomass extraction may be allowed. Larger groves function sustained and ecological security (Chandran and Gadgil, 1993). Sacred groves are referred to by different names in local languages (in Kannada) Devarbana, Devarakadu, Hulidevarakades, Nogabana, Bhutappanbana, Jataka-panbana, Chowdibana, etc.

These sacred groves are protected by some ethnic communities. The ethnic people all over the world have affecting and symbiotic relationship with biodiversity, which they have been protecting and conserving since ancient time. These sacred groves forest harbouring rich biodiversity protected by the local people based on the ground of indigenous cultured and religious belief and taboos (Airi *et al.*, 2000). These ethnical peoples protect the plants because of worshipping and also medicinal value.

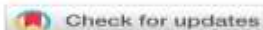
These medicinally important sacred plant species were used to treat diverse type diseases and to maintain good health. These groves provides very basic of human survival and economic well-being and comprises the resources upon which families, communities, nations and future generations depend and also they have some ecologically valuable species such as *Albizia lebbek* and *Ficus* spp. which have high amount of nitrogen, phosphorous, magnesium and calcium in their leaves (Singh *et al.*, 1994). Apart from this, many sacred groves hold water resource in the form of

*The  
Panchlingeshwar  
Sacred grove,  
Nandikurali  
is the site of  
conservation of  
ecological and  
medicinal plant  
species.*

**SIDANAND V. KAMBHAR, TEJA B. JAGATAP,  
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## Assessment of plant diversity in the community protected forest of Kusnur Village, Hangal, Haveri District, Karnataka, India

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### Abstract

An assessment was carried out through random quadrates plot in the study area. A total 129 plant species were documented. Frequency and density varied greatly among the taxa, while many species were not evenly abundant in the study areas. The present study revealed that there are many medicinal plants which are used by local peoples, who residing near the forest area. Besides medicine, plant resources were found utilized as other sources as vegetables and also for forage, manure, sheltering and religious purposes which indicates diversity of the study area and needs urgent conservation.

**Keywords:** biodiversity, invasive species, medicinal plants, plant diversity

### Introduction

India is one of the 12 centres of mega-diversity in the world and encompass of 17,500 flowering plant species. It exhibits a wealth of complex and diverse ecosystems with a great deal of variation.<sup>1</sup> It accounts for 8% of the global biodiversity with only 2.4% of the total land area in the world.<sup>2</sup> Plants are one of the major component of biodiversity, thus the knowledge of plant species found in the different areas of the world is a pre-requisite to conserve the ecological biodiversity and an essential resource for human well-being.<sup>3,4</sup> For this reason precise information of the known local plant species from a given area is essential. It is worth to explore any area with wide range of forest types and identify the economically and medicinally important plant species found there. Further the knowledge about the plants in the region is essential with the increasing conspicuous of people about the environment and its impact on living organisms in general.

### Material and methods

The study area Kusnur is located at 14. 69 42.41 N 75.23 00.89 E in the outskirts of Western Ghats lies in a maiden with a few outcrops of low hills. The topography of the area is not even, so it create many minor as well as major tanks. The soil pattern changes variably and annual rainfall is fairly good. The survey was carried out in 2009-2010. The sufficient sample plots of 30 x 30m were laid out randomly, covering the entire forest area about 339 acres. The trees were identified and the density and diameter of each tree species per plots were recorded<sup>5-7</sup> and analyzed for carbon sequestration followed by Pearson et al.<sup>8</sup> The collected specimens were identified with the aid of floras.<sup>9-12</sup> The collected specimens were pressed and prepared herbarium followed by dry method of Jain and Rao.<sup>13</sup> The specimens were deposited in the Herbarium of Botany Department, Karnataka Science College, Dharwad.

### Results and discussion

#### Floristic

The survey indicates that, they are about 129 species belonging to 109 genera under 52 families (Table 1). Of the 52 families documented, the family Fabaceae is the dominant family, comprising 9 spp., the dominance of Fabaceae may be due to the nitrogen-fixing bacteria with which these taxa often are associated, allowing these species to improve their soils.<sup>14</sup> This was followed by *Caesalpiaceae* (8 spp.), *Euphorbiaceae* (7 spp.), *Capparaceae* and *Mimosaceae* (6 spp. each), *Asclepiadaceae*, *Asteraceae*, *Malvaceae*, *Tiliaceae* are represented by 5 species each. The families

RESEARCH ARTICLE

## Optimal control analysis of deterministic and stochastic epidemic model with media awareness programs

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ABSTRACT

The present study considered the optimal control analysis of both deterministic differential equation modeling and stochastic differential equation modeling of infectious disease by taking effects of media awareness programs and treatment of infectives on the epidemic into account. Optimal media awareness strategy under the quadratic cost functional using Pontrygin's Maximum Principle and Hamiltonian-Jacobi-Bellman equation are derived for both deterministic and stochastic optimal problem respectively. The Hamiltonian-Jacobi-Bellman equation is used to solve stochastic system, which is fully non-linear equation, however it ought to be pointed out that for stochastic optimality system it may be difficult to obtain the numerical results. For the analysis of the stochastic optimality system, the results of deterministic control problem are used to find an approximate numerical solution for the stochastic control problem. Outputs of the simulations shows that media awareness programs place important role in the minimization of infectious population with minimum cost.



# Glycerol mediated synthesis and spectral characterization of 4-((2, 4-dihydroxyphenyl)(phenyl) methyl) benzene-1, 3-diol and its derivatives.

## Authors

Sneha S Kulkarni, Ravindra S Munnolli, Kariyappa S Katagi

## Description

Biodiesel synthesis is increasing day by day due to fast depleting fossil fuels. As a result glycerol production also increasing. Glycerol is becoming popular due to its eco-friendly nature compared to fossil based solvents. Thus in this paper an approach made to synthesize 4-((2, 4dihydroxyphenyl)(phenyl) methyl) benzene-1, 3-diol and its derivatives using glycerol as media. Further these synthesized compounds are characterized by FTIR, NMR and Mass spectral analysis.

## Scholar articles

[Glycerol mediated synthesis and spectral characterization of 4-\(\(2, 4-dihydroxyphenyl\)\(phenyl\) methyl\) benzene-1, 3-diol and its derivatives.](#)  
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## STATISTICAL MODELLING ON THE IMPACT OF MIGRATION AND URBANIZATION ON AGRICULTURE PRODUCTION IN INDIA

M. N. Megeri<sup>1\*</sup>, Manoj Kumar G.<sup>2</sup> and Huchesh H. Budihal<sup>1</sup>

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**Abstract :** India has steps forward towards the transformation from primary based economy to secondary and tertiary sectors as a result of structural change in the development process. In this point of view, an attempt has been made to understand the behavioral phenomenon of urbanization and rural urban migration with its impact on agricultural production in India through mathematical and statistical modeling based on Dey *et al.* (2010) model. The data has been incorporated from Census of India and Agricultural Statistics of India for the different time periods. Three ordinary differential equations have been modeled to deal with the interactions between these three interactive elements. By solving it analytically the simulation results are provided with support of statistical data. The results put forward that the current growth rate of rural urban migration and urbanization is not constructive for agricultural production and rural India. The growth of this behavior creates imbalance between urban and rural in terms of food scarcity and rural development. The government should focus on the policies which will bridge the gap between them for sustainable progress of the country.

**Key words :** Statistical Modelling, Migration, Agricultural Production.



## On Contra Delta Generalized Pre-Continuous Functions

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**Abstract-** In this paper, the notion of contra  $\delta$ gp-continuous functions is introduced by utilizing  $\delta$ gp-closed sets in topological spaces. Some of their fundamental properties are studied the relationships of contra  $\delta$ gp-continuous functions with other related functions are discussed.

**Keywords-**  $\delta$ gp-open set, contra continuous function, contra pre-continuous function, contra  $\delta$ gp-continuous function.

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# Graphs Equienergetic with Their Complements\*

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(Received February 12, 2019)

## Abstract

The energy  $E(G)$  of a graph  $G$  is the sum of the absolute values of its eigenvalues. In this paper, we present several classes of non-self-complementary graphs, satisfying  $E(G) = E(\overline{G})$ , where  $\overline{G}$  is the complement of  $G$ .



## Dispersive parameters of oxidized PVA-PVP blend films

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[GOPUTTA VEENA](#)

[BLAISE LOBO](#)

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### DOI

10.3906/fiz-1808-21

### Abstract

Oxidized (ox) polyvinyl alcohol (PVA)-polyvinyl pyrrolidone (PVP) blend films were prepared by solution casting technique, with doping levels of the oxidizer, potassium permanganate ( $\text{KMnO}_4$ ), varying from 0.01 up to 4.70 weight percent (wt.%). Optical (UV-Vis) spectral measurements in the wavelength range varying from 190 nm to 1000 nm were used to extract the band gap information and to calculate various optical parameters of the ox-PVA-PVP blend films. The electronic transitions on absorption of photons of suitable energy are of indirect allowed type. The corresponding optical band gap ( $E_g$ ) has been determined. Optical dispersion parameters for ox-PVA-PVP films were determined using the Wemple and DiDomenico method. Complex dielectric constants, relaxation time ( $\tau$ ), dissipation factor ( $\tan \delta$ ), ratio of charge carrier concentration to effective mass ( $N/m^*$ ), plasma frequency ( $\omega_p$ ), average oscillator wavelength ( $\lambda_o$ ), oscillator strength ( $S_o$ ), optical conductivity ( $\sigma$ ), and optical momenta of spectra (M-1 and M-3) were determined.

### Keywords

Oxidized polymer, PVA-PVP blend, optical analysis, potassium permanganate, UV-Vis spectra

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RESEARCH ARTICLE | APRIL 10 2018

## Conductivity measurements on $\text{CdCl}_2$ doped PVA solid polymeric electrolyte for battery application

Basavarajeshwari M. Baraker; Blaise Lobo



+ Author & Article Information

*AIP Conf. Proc.* 1942, 070009 (2018)

<https://doi.org/10.1063/1.5028807>



Ionic conductivity of pure polyvinyl alcohol (PVA) and 6.3 wt% of  $\text{CdCl}_2$  doped PVA solid polymeric electrolyte have been studied using DC and AC electrical measurements. From DC electrical results, the determination transference number confirmed that ions are the dominant charge carriers in  $\text{CdCl}_2$  doped PVA. Interestingly, the ion transference number ( $t_i$ ) for 6.3 wt%  $\text{CdCl}_2$  doped sample is significantly more (0.993), when compared to that of pure PVA (for which,  $t_i$  is 0.988). Temperature dependent dielectric studies showed interesting results at different frequencies: 120 Hz, 500 Hz, 1 kHz, 5 kHz, 10 kHz and 100 kHz.

Topics

[Ionic conductivity](#), [Dielectric properties](#), [Electric measurements](#), [Electrolytes](#), [Batteries](#), [Polymers](#)

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## An Investigation into the Influence of Filler Piper nigrum Leaves Extract on Physicochemical and Antimicrobial Properties of Chitosan/Poly (Vinyl Alcohol) Blend Films

March 2019 - Journal of Polymers and the Environment 27(4)

DOI:10.1007/s10924-018-1353-x

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Abstract and Figures

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## Influence of *Syzygium cumini* leaves extract on morphological, thermal, mechanical, and antimicrobial properties of PVA and PVA/chitosan blend films

Deepak Kasai <sup>1</sup>, Ravindra Chougale <sup>2</sup>, Saraswati Masti <sup>3</sup>, Raju Chalannavar <sup>4</sup>,  
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**ABSTRACT:** In the present work, poly(vinyl alcohol)/*Syzygium cumini* leaves extract (PSN) and poly(vinyl alcohol)/chitosan/*S. cumini* leaves extract blend films were prepared by solution casting technique. The films were characterized by using scanning electron microscopy, atomic force microscopy, X-ray diffraction study, Fourier transform infrared spectroscopy, thermogravimetric analysis, and universal testing machine. The results indicated that the appreciable physical interaction at lower concentrations of *S. cumini* leaves extract in the PVA and PVA/chitosan films contribute to the smooth uniform morphology, increased the degree of crystallinity, degradation temperature, and improved mechanical properties. Further, films were analyzed with water contact angle analyzer which illustrates that blend films were hydrophilic (PSN-1) and hydrophobic (PCS-1) in nature. However, blend films were also subjected to the antimicrobial study, which revealed that inclusion of *S. cumini* leaves extracts significantly enhanced the antibacterial activity in the PVA and PVA/chitosan film. With all of these results, fabricated blends can find potential applications in packaging material to extend the shelf life of foodstuffs. © 2018 Wiley Periodicals, Inc. *J. Appl. Polym. Sci.* 2018, 135, 46188.

**KEYWORDS:** biodegradable; films; packaging; polysaccharides; morphology

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Article

## Microstructure of Cadmium Chloride Doped PVA/PVP Blend Films

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DOI:10.1016/j.matpr.2018.01.104

Authors:



**Basavarajeshwari Baraker**  
Karnatak University, Dharwad



**Blaise Lobo**  
Karnatak University, Dharwad

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Citations (13)

References (14)

### Abstract

The structural features of Cadmium Chloride (CdCl<sub>2</sub>) doped polyvinylalcohol (PVA)-Polyvinylpyrrolidone (PVP) blend films are correlated with their optical and electrical properties. Doping results in formation of self-grown nano-crystalline features; SEM images show the nano-crystals changing shape from spherical to rod-shaped structures, and with further increase in doping level flower shaped crystalline features are observed. There is formation of crystalline micro-globules (10.2 wt%) which modifies to bowl shape, and these crystalline regions disintegrate at 12.1 wt% dopant level. A homogeneous amorphous domain is observed from 15.5 wt% up to 40 wt%. AFM images, XRD patterns and DSC scans are used to complement the discussion based on SEM micrographs in order to explain the electrical and optical properties of this material at different doping levels. The electrical measurements reveal an increase in electrical resistivity at low dopant levels (from 0.5 wt% up to 5.4 wt%), and a decrease in its value on further doping, saturating beyond 15.5 wt% doping level. Optical

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# UV irradiation induced microstructural changes in CdCl<sub>2</sub> doped PVA–PVP blend

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Volume 29, pages 4106–4121, (2018) [Cite this article](#)[Journal of Materials Science: Materials in Electronics](#)[Aims and scope](#) →[Submit manuscript](#) →[Basavarajeshwari M. Baraker & Blaise Lobo](#) 352 Accesses 9 Citations [Explore all metrics](#) →

## Abstract

Films of cadmium chloride (CdCl<sub>2</sub>) doped polyvinyl alcohol (PVA)–polyvinyl pyrrolidone (PVP) blend were irradiated with ultraviolet (UV) light, of wavelength 254 nm. Modification in band structure of the doped polymeric blend films has been studied using optical (UV–Visible) and fluorescence (photo-luminescence) spectral analysis. On exposure to UV radiation, the PVA–PVP samples doped with CdCl<sub>2</sub> from 5.4 up to 12.1 wt% (doping level) get blackened, possibly due to carbonization. Microstructural modifications in these films caused by UV irradiation have been studied with the help of scanning

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## Spectroscopic Studies on Films of Lead Nitrate Doped Polyvinyl Alcohol – Polyvinyl Pyrrolidone Blend

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Department of Physics, Kamatak University's Kamatak Science College,  
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### Abstract

Films of polyvinyl alcohol (PVA)–polyvinyl pyrrolidone (PVP) blend doped with lead nitrate( $\text{Pb}(\text{NO}_3)_2$ ) were prepared by solution casting method, with doping level (DL) of  $\text{Pb}(\text{NO}_3)_2$  in PVA – PVP polymeric blend varying from 2.7 up to 50.5 wt%. The prepared films were characterized using UV-Visible spectroscopy, fluorescence (or photo- luminescence) spectroscopy, FTIR and Raman spectroscopy. Parameters like optical bandgaps due to indirect allowed transition (IAT) and direct allowed transition (DAT), as well as the activation energy ( $E_a$ ) for optical transitions are extracted from the UV- Visible (or optical) spectra of these films. Objective of the FTIR, Raman and Fluorescence spectroscopic study is to understand the molecular chemical changes in PVA and PVP caused by the dopant ( $\text{Pb}(\text{NO}_3)_2$ ). There is an enhancement of fluorescence intensity at DLs of 2.7wt%, and at DL 7.6 wt%, the fluorescence intensity decreases (quenching). PVP acts as a capping agent for the dopant species, and is considered to be responsible for changes in fluorescence intensity. Signature of nitrate ion ( $\text{NO}_3^-$ ) vibration is observed at wavenumber  $1037 \text{ cm}^{-1}$  in Raman spectra, and in the FTIR spectra, the  $\text{NO}_3^-$  vibration is seen at the wavenumber equal to  $1380 \text{ cm}^{-1}$ .



### Article History

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### Keywords:

Lead Nitrate,  
PVA -PVP blend,  
Doping,  
Raman shift,  
FTIR assignments,  
UV-Visible spectroscopy,  
Indirect allowed,  
transition,  
Direct allowed,  
transition.

### Introduction

Polymer composites have drawn the attention of researchers due to their potential applications in different areas<sup>1</sup>. Polymer composites having lead (Pb) salts as a component are important for

photons and X-rays, when a shielding material is required to prevent the effect of harmful radiation on personnel, as well as other users and materials (or equipment)<sup>2,3</sup>. Research investigations reveal that polymer composites are dual purpose shielding





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RESEARCH ARTICLE | APRIL 10 2018

## Optical, structural and thermal properties of bismuth nitrate doped polycarbonate composite

Rajestwari Mirji, Blaise Lobo



+ Author & Article Information

AIP Conf. Proc. 1942, 070019 (2018)

<https://doi.org/10.1063/1.5028817>




Bismuth nitrate ( $\text{Bi}(\text{NO}_3)_3$ ) doped polycarbonate (PC) films were prepared by solution casting method, in the doping range varying from 0.1 wt% to 5 wt%. The prepared samples were characterized using UV-Visible spectroscopy, X-Ray Diffraction (XRD) and Differential Scanning Calorimetry (DSC). Optical band gap was calculated by analyzing the UV-Visible spectra of pure as well as doped PC. Optical band gap is found to decrease from 4.38 eV to 4.33 eV as the  $\text{Bi}(\text{NO}_3)_3$  content within PC increases. XRD patterns showed an increase in the degree of crystallinity of  $\text{Bi}(\text{NO}_3)_3$  doped PC, especially at 3.5 wt% and 5 wt%. DSC study showed an increase in the degradation temperature, as the doping level is increased from 0 wt% up to 0.3 wt%. A decrease in  $T_g$  is observed as the doping level of these samples increases from 0 wt% up to 5 wt%.

Topics

[Crystal structure](#), [Doping](#), [Band gap](#), [Thermodynamic states and processes](#), [Visible spectra](#)

# Conductivity and free volume studies on bismuth sulfide/PVA:polypyrrole nanocomposites

Original Paper | [Published: 22 August 2018](#)Volume 93, pages 147–158, (2019) [Cite this article](#)[V Hebbar](#), [HB Ravikumar](#), [M Nandimath](#), [S Masti](#), [LM Munirathnamma](#), [J Naik](#) & [R F Bhajantri](#)  404 Accesses  6 Citations [Explore all metrics](#) →

## Abstract

The polymer composite films of polyvinylalcohol:polypyrrole blend containing different wt% of bismuth sulfide ( $\text{Bi}_2\text{S}_3$ ) particles are prepared through in situ oxidation followed by solution casting method, where the particles are coated with blend matrix. The XRD studies affirm the enhanced crystallinity of the composites. The variation of crystallite size is measured with the Debye–Scherrer method. The DSC studies are used to investigate the glass transition that occurred in the  $\text{Bi}_2\text{S}_3$  particles-filled polymer blend matrix. The AFM and SEM studies illustrated the effect of insertion of metallic sulfide particles on the surface morphology. The addition of bismuth sulfide particles results in the increased mechanical properties of the composite matrix. The electrical conductivity is determined by the Cole–Cole plot fitted using equivalent circuit model, and the conductivity is





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January 31, 2020  
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Full Paper

## Synthesis and Molecular Modelling Studies of Coumarin and 1-Aza-Coumarin Linked Miconazole Analogues and Their Antimicrobial Properties

Uraj M. Sutar, Hemantkumar M. Savanur, Shruti S. Malunavar, Geeta M. Pawashe, R. Gopalakrishnan Aridoss, Dr. Kang Min Kim ✉, Jin Young Lee, Dr. Rajesh G. Kalkhambkar ✉

First published: 30 January 2020 | <https://doi.org/10.1002/slct.201903572> | Citations: 8

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### Graphical Abstract

A series of coumarin, 1-Azocoumarin, Imidazole and benzimidazole linked miconazole analogue of compounds were synthesized by modification in the readily available miconazole moiety to screen it towards its antimicrobial properties. Molecular modelling studies found to be effective with excellent binding affinity results. Further, some of the synthesized compounds exhibited excellent antibacterial and antifungal activity compared to that of standard. Further,



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Positron annihilation studies of free volume changes accompanying the incorporation of lead nitrate in PVA-PVP polymeric blend	Prof. Blaise Lobo	Radiation Physics and Chemistry	<b>Print ISSN: 0969-806X, Online ISSN: 1879-0895</b>	<a href="https://doi.org/10.1016/j.radphyschem.2019.02.001">https://doi.org/10.1016/j.radphyschem.2019.02.001</a>
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Dielectric relaxation in a cadmium chloride-doped polymeric blend	Prof. Blaise Lobo	Indian Academy of Sciences		<a href="http://dx.doi.org/10.1007/s12034-018-1690-3">http://dx.doi.org/10.1007/s12034-018-1690-3</a>
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Unique oleochemical data source: Deployed for the optimization of fatty acids of seed oils for production of liquid fuel	Dr. Kariyappa Katagi	Chemical Data Collections (CDC)	<b>Online ISSN: 2405-8300</b>	<a href="https://doi.org/10.1016/j.cdc.2019.100324">https://doi.org/10.1016/j.cdc.2019.100324</a>
Facile one-pot synthetic access to libraries of diversely substituted 3-aryl (Alkyl)-coumarins using ionic liquid (IL) or conventional base/solvent, and an IL-mediated approach to novel coumarin-bearing diarylethynes	Dr. Rajesh G. Kalkhambar	Tetrahedron Letters	<b>Print ISSN: 0040-4039, Online ISSN: 1873-3581</b>	<a href="https://doi.org/10.1016/j.tetlet.2020.151854">https://doi.org/10.1016/j.tetlet.2020.151854</a>

1-Aryltriazenes in the Suzuki, Heck, and Sonogashira Reactions in Imidazolium-ILs, with [BMIM(SO <sub>3</sub> H)][OTf] or Sc(OTf) <sub>3</sub> as Promoter, and Pd(OAc) <sub>2</sub> or NiCl <sub>2</sub> ·glyme as Catalyst	Dr. Rajesh G. Kalkham bkar	EurJOC ( <i>European Journal of Organic Chemistry</i> )	<b>Online ISSN:1099-0690,Print ISSN:1434-193X</b>	<a href="https://doi.org/10.1002/ejoc.201901070">https://doi.org/10.1002/ejoc.201901070</a>
Synthesis of diverse libraries of carboxamides via chemoselective <i>N</i> -acylation of amines by carboxylic acids employing Brønsted acidic IL [BMIM(SO <sub>3</sub> H)][OTf]	Dr. Rajesh G. Kalkham bkar	Tetrahedron Letters	<b>Print ISSN: 0040-4039,Online ISSN: 1873-3581</b>	<a href="https://doi.org/10.1016/j.tetlet.2019.151159">https://doi.org/10.1016/j.tetlet.2019.151159</a>
Facile Access to Diverse Libraries of Internal Alkynes via Sequential Iododediazotiation/Decarboxylative Sonogashira Reaction in Imidazolium ILs without Ligand or Additive	Dr. Rajesh G. Kalkham bkar	EurJOC ( <i>European Journal of Organic Chemistry</i> )	<b>Online ISSN:1099-0690,Print ISSN:1434-193X</b>	<a href="https://doi.org/10.1002/ejoc.201900093">https://doi.org/10.1002/ejoc.201900093</a>
Ionic liquid-mediated benzoyl transfer-coupling in the Suzuki and Sonogashira reactions and aryl transfer-coupling by decarbonylative Heck reaction, using <i>N</i> -Benzoyl-saccharin (NBSac) as reagent	Dr. Rajesh G. Kalkham bkar	Tetrahedron Letters	<b>Print ISSN: 0040-4039,Online ISSN: 1873-3581</b>	<a href="https://doi.org/10.1016/j.tetlet.2020.151987">https://doi.org/10.1016/j.tetlet.2020.151987</a>
Indigenous knowledge of Kappath hills, Medicinal Plants, Gadag district, Karnataka	Prof.Kotr esha K		<b>0976-5255</b>	-
Subaerial nonheterocytous and heterocytous cyanobacteria from Sirsi taluk, Uttara Kannada, Karnataka, India.	Prof.Doris Singh	International Journal of Scientific Research and Reviews	<b>: 2279–0543</b>	<a href="http://www.ijssr.org/">http://www.ijssr.org/</a>
A comment on $g\alpha$ -closed sets in topological spaces	Dr. J.B. Torangatti	International Journal of Scientific Research in	<b>2348-4519</b>	-

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seasonal variation of zooplankton abundance in belur pond of Dharwad	Dr. S.S.Mangalwede	International Journal of Scientific Research and Reviews	<b>2279--543X</b>	<a href="http://www.dynamicpublisher.org">www.dynamicpublisher.org</a>
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On Selecting the Best Population among Increasing Failure Rate Average Populations	Dr. Keerthi Astagimath	TEST Engineering and management	<b>0193-4120</b>	-
optimal control analysis for stochastic unemployment model	Prof. Shankreva Gani	International journal of mathematics and	<b>0974-7117</b>	-



		statistics		
Particle Swarm Optimization and Texture Analysis Image Processing Techniques using MRI Images to Detect Brain Tumor in Human	Smt. Lalitha R. Naik		ISSN:2278-3075(Online)	<a href="http://dx.doi.org/10.35940/ijitee.E2750.039520">http://dx.doi.org/10.35940/ijitee.E2750.039520</a>
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A GIS based assessment of Morphometric analysis of Lingasugur Taluk in Raichur District, Karnataka, India	Prof. S.Manjunatha	Journal of Engineering Sciences	ISSN NO: 0377-9254	-
Impact of precipitation, temperature and humidity on groundwater fluctuation in shalmala river sub-basin Dharwad District	Prof. S.Manjunatha	Journal of Engineering Sciences	0377-9254	<a href="http://www.jespublication.com">www.jespublication.com</a>
Morphometric analysis of Shalmala riversub-basin Dharwad District using Rs and GIS Techniques	Prof. S.Manjunatha	Journal of Engineering Sciences	0377-9254	<a href="http://www.jespublication.com">www.jespublication.com</a>
Taxonomic identity, occurrence of six species of salacia and first report on chromosome numbers of the Salacia Chinesis L. and Salacia oblonga wall ex Wight and Ern Var. from Western Ghats of Karnataka (India)	Dr. Chandrashekar G. Patil	Springer	00820-7	<a href="https://doi.org/10.1007/s10722-019-00820-7">https://doi.org/10.1007/s10722-019-00820-7</a>
Genetic Structure and Diversity among Species of Salacia: An Endangered Medical Herb of Western Ghats, India	Dr. Chandrashekar G. Patil	South Asian J Exp Biol	2230-9799	<a href="http://dx.doi.org/10.38150/sajeb.9(1).p23-33">http://dx.doi.org/10.38150/sajeb.9(1).p23-33</a>

Studies on Toxicological Endpoints of Henoxaprop- p-Ethyl on Behavioural Changes in Freshwater Exotic Carp Cyprinus Caprpio (linnaeus)	Srinivas R. Negulr	Journal of advance Scientific Research	<b>0976-9595</b>	<b><a href="http://www.sciensage.info/jasr">http://www.sciensage.info/jasr</a></b>
Molecular interaction of the triazole fungicide propiconazole with homology modelled dismutase and catalase	Dr. Rajeshwari D. Sanakal	Enviourn mental Sustainbil ity	<b>019-00083</b>	<b><a href="http://dx.doi.org/10.1007/s42398-019-00083-z">http://dx.doi.org/10.1007/s42398-019-00083-z</a></b>

# Studies on the effect of temperature on dielectric relaxation, activation energy ( $\Delta G^*$ ), enthalpy ( $\Delta H^*$ ), entropy ( $\Delta S^*$ ) and molecular interactions of some anilines, phenol and their binary mixtures using X-band microwave bench

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## Highlights

- Variation of relaxation time with temperature is in agreement with Debye's theory.
- Results suggest relaxation process as rate process according to Eyring's theory.
- Positive values of  $\Delta S^*$  indicates that environment of the system is non-cooperative.
- Molecular radii estimated from SED theory, Edward & DFT methods are in agreement.
- (4-Chloroaniline+4-Chlorophenol) is more disordered than (2-Nitroaniline+4-Bromoaniline).

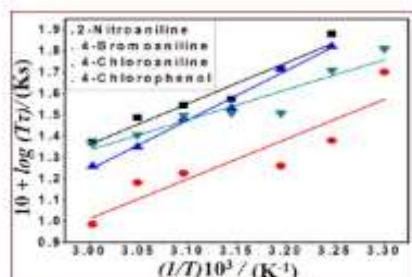
## Abstract

In the present study, the variation of dielectric relaxation time ( $\tau$ ) with temperature is carried out on four polar molecules viz., 2-Nitroaniline, 4-Bromoaniline, 4-Chloroaniline and 4-Chlorophenol and also on the binary mixtures (1:1) viz., (2-Nitroaniline+4-Bromoaniline) and (4-Chloroaniline+4-Chlorophenol) in benzene and results are analysed using Whiffen and Thompson model in order to understand the nature of the relaxation process involved. Microwave bench operating at a frequency of 9.59GHz is used for this purpose. It is observed that, relaxation time ( $\tau$ ) decreases with increase in temperature for all the systems studied and the results are in agreement with Debye's theory. The linearity in the  $\log(\tau T)$  versus  $1/T$  plots for all the cases indicates that, relaxation process can be treated as rate process according to Eyring's theory. Further,



thermodynamic parameters like change in activation energy ( $\Delta G^\ddagger$ ), enthalpy of activation ( $\Delta H^\ddagger$ ) and entropy of activation ( $\Delta S^\ddagger$ ) have been determined for all the cases. It is observed that, values of  $\Delta H^\ddagger$  are higher than the values of  $\Delta G^\ddagger$ , thus leading to the positive values of  $\Delta S^\ddagger$ . The positive values of  $\Delta S^\ddagger$  indicates that, the environment of the system is non-cooperative for the activated process and the activated state is less stable and disordered than the normal state for all the cases studied. The molecular radii estimated from SED theory, Edward's atomic increment method and from DFT computations using Gaussian 09W are found to be in good agreement with each other and suggest that, the molecular dynamics follows SED theory.

## Graphical abstract



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Research paper

# Electronic excitation energy transfer studies in binary mixtures of novel optoelectronically active 1,3,4-oxadiazoles and coumarin derivatives

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## Highlights



- Studies on electronic excitation energy transfer between derivatives of 1,3,4-Oxadiazole and Coumarin-334.
- Energy transfer take places between D-A is due to FRET.
- Enhancement of energy transfer efficiency is found in PMMA.
- Present systems can be used as luminescent solar concentrator (LSC) and Energy Transfer Dye Lasers.

## Abstract

The mechanisms of excitation energy transfer are studied using systems consisting of blue light emitting novel thiophene substituted 1,3,4-oxadiazole derivatives as donors and green light emitting laser dye coumarin-334 (C-334) as an acceptor in ethanol and poly(methyl methacrylate) [PMMA] media from steady-state and time-resolved methods. Experimental observations like bimolecular quenching constant ( $k_q$ ) greater than translation diffusion rate parameter ( $k_d$ ), critical transfer distance ( $R_0$ ) greater than diffusion length ( $D_f$ ), donor-acceptor interaction strength ( $\alpha$ ) greater than donor-donor interaction strength ( $\beta$ ) and biexponential decay of the donor in the presence of the acceptor confirms that the overall energy transfer from donor to acceptor is due to Förster resonance energy transfer (FRET). Furthermore, enhancement of energy transfer efficiency and fluorescence intensity in polymer media suggests that these donor-acceptor doped PMMA matrixes may have potential applications such as luminescent solar concentrator (LSC), energy transfer dye lasers (ETDL) and chemical sensors.

Data Article

# Synthesis, photophysical, DFT and solvent effect studies on biologically active benzofuran derivative: (5-methyl-benzofuran-3-yl)-acetic acid hydrazide

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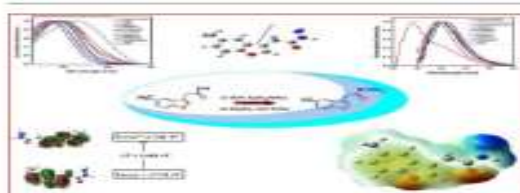
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Received 13 January 2019, Revised 11 April 2019, Accepted 25 April 2019, Available online 26 April 2019, Version of Record 3 May 2019.

## Abstract

The synthesis, photophysical, DFT and solvent effect studies on novel benzofuran derivative namely, (5-methyl-benzofuran-3-yl)-acetic acid hydrazide [**5MLBH**] are reported. The probe is characterized by <sup>1</sup>H NMR, <sup>13</sup>C NMR, IR and mass spectral methods. Absorption and fluorescence maxima of 5MLBH are determined for different solvents of varying polarity and solvatochromic behavior and dipole moments are investigated. Results indicate that, excited state dipole moment ( $\mu_e$ ) values are higher than ground state dipole moment ( $\mu_g$ ) values and suggest that, probe molecule 5MLBH is more polar in excited state than ground state. Energy band gap is determined from HOMO-LUMO and absorption threshold wavelengths. Using HOMO-LUMO energies, chemical hardness of probe molecule is estimated. From DFT molecular electrostatic potential (MESP) plots, electrophilic site and nucleophilic site were identified. Using Catalan parameters, solute-solvent interactions were analyzed. Preliminary investigations suggest, probe 5MLBH may be considered as potential candidate for luminescence materials, fluorescent probes and for designing non-linear optical materials in future.

## Graphical abstract





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# Synthesis, characterization and photophysical studies on novel benzofuran-3-acetic acid hydrazide derivatives by solvatochromic and computational methods

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Received 29 December 2018, Revised 12 March 2019, Accepted 18 March 2019, Available online 21 March 2019, Version of Record 6 April 2019.

## Highlights

- Synthesis & characterization of two novel benzofuran derivatives are reported.
- Probes 6MLBH & 6MOBH are more polar in the excited state than the ground state.
- Nucleophilic and electrophilic sites are identified using MESP plots.
- HOMO-LUMO & Chemical hardness studies suggest soft nature of molecules.
- Stoke's shifts are more controlled by SP than SA, SB and SdP.

## Abstract

In the present studies, synthesis of two novel benzofuran-3-acetic acid hydrazide derivatives namely, (6-methyl-benzofuran-3-yl)-acetic acid hydrazide [6MLBH] and (6-methoxy-benzofuran-3-yl)-acetic acid hydrazide [6MOBH] are reported. The probes are characterized by IR, <sup>1</sup>H-NMR, <sup>13</sup>C-NMR and mass spectral methods. The absorption and fluorescence maxima of novel derivatives 6MLBH and 6MOBH are determined for different solvents of varying polarity and the solvatochromic behavior and dipole moments are investigated. Stoke's shift exhibits a red shift with increase in solvent polarity for both the probe molecules indicating a  $\pi \rightarrow \pi^*$  transition. The ground state dipole moment ( $\mu_g$ ) of both the molecules in gaseous phase is estimated from *ab initio* computations by using Gaussian 09W software and also from solvatochromic method and the results are compared. Further, the ground state dipole moments of the probe molecules in different solvents were also estimated theoretically by using the integral equation formalism of polarizable continuum model (IEF-PCM). By using solvatochromic correlations like Lippert's, Bakhshiev's, Kawski-Chamma-Viallet's and solvent polarity

parameter ( $E_{T}^N$ ), the excited state dipole moments ( $\mu_e$ ) are determined. Results show that, the excited state dipole moments ( $\mu_e$ ) are higher than the ground state dipole moments ( $\mu_g$ ) and suggest that, the probe molecules 6MLBH and 6MOBH are more polar in the excited state. The HOMO-LUMO energy gaps computed from density functional theory (DFT) and from absorption threshold wavelengths are found to be in agreement and also support intramolecular charge transfer (ICT). Using HOMO-LUMO energies, the chemical hardness ( $\eta$ ) of the molecules are determined and the chemical stability is discussed. Further, using DFT molecular electrostatic potential (MESP) plots, the electrophilic site and nucleophilic site which are useful in photochemical reactions were identified. The various types of interactions present between the solute-solvent were analyzed by multiple linear regression analysis using Catalan parameters. The preliminary observations and results suggest that, the probe molecules 6MLBH and 6MOBH can be considered as potential candidates for luminescence materials, fluorescent probes and for designing non-linear optical materials in future.

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# Positron annihilation studies of free volume changes accompanying the incorporation of lead nitrate in PVA-PVP polymeric blend

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Received 24 April 2018, Revised 23 January 2019, Accepted 1 February 2019, Available online 2 February 2019, Version of Record 8 February 2019.



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## Highlights

- Lead nitrate filled PVA-PVP composite films are studied using PALS and
- Significant changes are observed in positron parameters due to filler loading.
- Intensity of *o*-Ps component decreases from 18% to 2%, at higher filler levels (FL).
- Inhibition of positronium (Ps) formation is observed for FL beyond 19.8 wt%.
- Ps trapping rate in the composite decreased significantly at moderate and high FL.

## Abstract

Lead nitrate ( $\text{Pb}(\text{NO}_3)_2$ ) – filled polyvinyl alcohol (PVA) – polyvinyl pyrrolidone (PVP) composite films were prepared by solution casting method, with filler levels (FL) varying from 2.7 wt% up to 42.7 wt%. Positron annihilation lifetime spectroscopy and measurements of Doppler broadening of annihilation radiation (DBAR) were carried out to monitor the changes in polymer microstructure due to the filler loading. The lineshape parameter, *S*, increased at lower doping levels, followed by a decrease at higher FL due to the effects of the filler ( $\text{Pb}(\text{NO}_3)_2$ ) on the microstructure of PVA-PVP composite films. A significant drop in the intensity ( $I_3$ ) of the ortho-positronium (*o*-Ps) component, from 18% down to approximately 2%, is observed on increasing the FL from 16.2 up to 26.7 wt%. This is accompanied by a decrease in the intensity ( $I_1$ ) of the shortest lifetime component and a compensating increase in intensity ( $I_2$ ) of the intermediate lifetime component. It indicated the inhibition of positronium (Ps) formation in  $\text{Pb}(\text{NO}_3)_2$ -filled PVA-PVP composites.



# Structural, Optical and Electrical Studies on Hybrid Material of In Situ Formed Silver sulfide in Polymer Blend Matrix

Published: 12 March 2019

Volume 29, pages 1466–1475, (2019) [Cite this article](#)

Shruti S. Devangamath & Blaise Lobo 

 229 Accesses  8 Citations [Explore all metrics](#) →

## Abstract



Organic–inorganic polymer hybrid films were prepared, using polyvinyl alcohol–polyethylene glycol blend as the organic host matrix. Silver sulfide ( $\text{Ag}_2\text{S}$ ) semiconductor particles have been synthesized in polymer blend matrix, by in-situ method. Polymer hybrid films, with various amounts of  $\text{Ag}_2\text{S}$  were prepared and characterized structurally, optically and electronically by using various characterization techniques, such as Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), Scanning electron microscopy (SEM), UV–Vis absorption spectroscopy, temperature and time dependent DC electrical studies. Hydrogen bonding interactions take place between hydroxyl groups (OH) and carbonyl groups (C=O) of polymer blend molecules with  $\text{Ag}^+$  ion of  $\text{Ag}_2\text{S}$  filler, indicating complex formation between polymer matrix and filler, which is confirmed by FTIR technique. XRD results showed presence of additional multiple peaks (compared to pure blend film) corresponding to  $\alpha'$ - $\text{Ag}_2\text{S}$  monoclinic crystal system. Changes in degree of crystallinity (%C) are observed for hybrid films with various amounts of  $\text{Ag}_2\text{S}$ , showing a highest value of 18.2% for the film containing 0.372 g of  $\text{Ag}_2\text{S}$ , when compared to 13.45% (%C) for pure blend film. Uniform distribution of  $\text{Ag}_2\text{S}$  nanoparticles in polymer blend matrix is revealed by SEM analysis for hybrid film containing 0.372 g of  $\text{Ag}_2\text{S}$ . UV–Vis absorption studies showed multiple absorption peaks due to added filler. Highest value of room temperature conductivity of  $9.40 \times 10^{-7}$  S/cm was obtained for the hybrid film containing 0.372 g of  $\text{Ag}_2\text{S}$ . Values of transference numbers ( $t_{\text{ion}}$  and  $t_{\text{ele}}$ ) in time dependent electrical studies indicated that the electrical conductivity in pure blend film as well as hybrid films is mainly due to ions.

# Dielectric relaxation in a cadmium chloride-doped polymeric blend

Published: 18 January 2019

Volume 42, article number 18, (2019) [Cite this article](#)

Basavarajeshwari M Baraker & Blaise Lobo 

 266 Accesses  19 Citations [Explore all metrics](#) →

## Abstract

The temperature- and frequency-dependent relaxation processes in films of a polymeric blend comprising a polyvinyl alcohol (PVA)/polyvinyl acetate (PVAc) co-polymer blended with polyvinyl pyrrolidone (PVP) in equal proportion by weight, and doped with an inorganic metallic salt, cadmium chloride [*Math Processing Error*], at 0.0 wt% and 10.2 wt% doping levels (DLs), have been studied using dielectric relaxation spectroscopy (DRS). The frequency response of dielectric parameters for these samples has been studied with variation in temperature, from 303 up to 373 K, at different fixed frequencies (from 12 Hz up to 200 kHz). Study of Cole–Cole plots reveals a decrease in bulk resistivity of the samples with increase in temperature, which is attributed to thermally induced increase in the mobility of polymer chains. A 10-fold increase in bulk conductivity is observed for doped films with a DL of 10.2 wt%, when compared with the bulk conductivity of the undoped (0.0 wt% DL) sample. The temperature dependence of dielectric parameters at different frequencies has been studied and the activation energy has been calculated. The relaxation time is found to be of the order of a few milliseconds, which implies that electrical conduction in [*Math Processing Error*]-doped PVA/PVAc–PVP blend films is predominantly due to the migration of ions. The variation of AC conductivity with frequency is in agreement with Jonscher's universal power law. AC conductivity of the sample is found to increase significantly with an increase in temperature of the sample. Frequency-dependent dielectric properties of [*Math Processing Error*]-doped PVA/PVAc–PVP blend films, for various DLs, are also studied at room temperature.





# Study of polycarbonate–bismuth nitrate composite for shielding against gamma radiation

Published: 13 February 2020

Volume 324, pages 7–19, (2020) [Cite this article](#)

Rajeshwari Mirji & Blaise Lobo 

 719 Accesses  23 Citations [Explore all metrics](#) →

## Abstract

Polycarbonate (PC) loaded with different filler levels equal to 0.1, 0.2, 0.3, 0.5, 0.75, 1.0, 2.5, 3.5 and 5.0 wt% (weight percent) of bismuth nitrate pentahydrate ( $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$  or BNP) were prepared by dispersion of filler in PC solution, followed by casting. The values of mass attenuation coefficient ( $\mu_m$ ), effective atomic number ( $Z_{eff}$ ), effective electron density ( $N_{el}$ ), half value layer (HVL) thickness, tenth value layer (TVL) thickness and photon mean free path (MFP or  $\lambda$ ) were determined for specific gamma photon energies

ranging from 303 up to 1332 keV, both computationally and experimentally. Considerable variation in the radiation attenuation parameters was observed, which is mainly dependent on the energy of incident gamma ray photon and the concentration of BNP incorporated as filler within the PC matrix. Values of the experimentally determined parameters like  $\mu_m$ ,  $Z_{eff}$  and  $N_{el}$  were compared with the computationally estimated values, and they are found to be in good agreement. The results are discussed, taking into consideration our understanding of the interaction of gamma radiation with matter.



PAPER

## AC and DC electrical transport properties of potassium permanganate doped PVA-PVP solid polymer electrolyte

G Veena<sup>1</sup> and Blaise Lobo<sup>1</sup> 

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[Materials Research Express](#), Volume 6, Number 3

Citation G Veena and Blaise Lobo 2019 *Mater. Res. Express* 6 035315

DOI 10.1088/2053-1591/aaf7ac

### Abstract

PVA-PVP based polymer electrolyte doped with potassium permanganate ( $\text{KMnO}_4$ ) from 0.0 wt% up to 4.7 wt% were prepared by solution casting technique. Electrical transport properties of the prepared films were studied by DC electrical measurements, DC polarization technique, frequency and temperature dependent AC measurements. From DC electrical measurements, the activation energy was determined using Arrhenius equation. The data was found to obey three dimensional VRH model. DC polarization technique revealed that the majority of charge carriers are ions. AC impedance study was carried out in the frequency range starting from 12 Hz up to 200 kHz, at various set temperatures, from 303 K up to 363 K. Pure PVA-PVP blend (0.0 wt%/DL), 0.07 wt% and 4.7 wt% (DL)  $\text{KMnO}_4$  doped samples were considered for detailed electrical study. The bulk conductivity was found to increase with temperature, implying the process to be a thermally activated one, a result of thermally induced increase in mobility of polymer chains. An equivalent circuit was formulated for the samples under study. The study of dielectric parameters such as  $\epsilon'$  and  $\epsilon''$  revealed the orientation of dipoles on application of the AC field. Temperature dependent study at various fixed frequencies was carried out in order to determine the activation energy for mobility of charge carriers. The study revealed an enhancement in ionic conductivity, due to the contribution of dopant ions. An increase in bulk conductivity was observed with increase in DL.





# Effect of stereo electronic factors of coumarin derivatives during their interaction with TiO<sub>2</sub> nanoparticles

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## Highlights

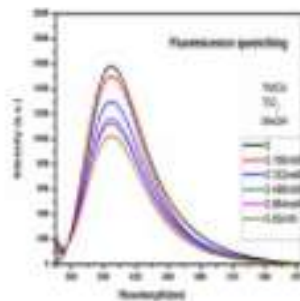
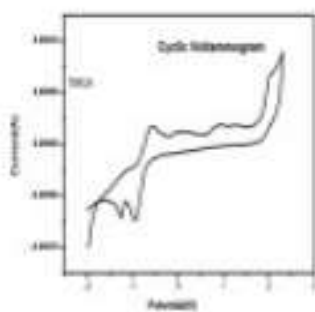
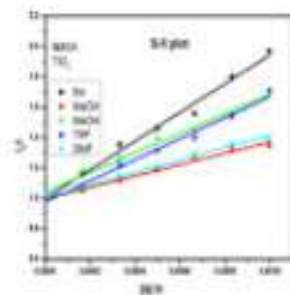
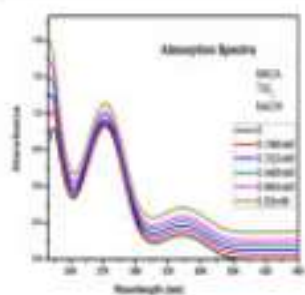
- Benesi-Hildebrand plots indicate that interaction between coumarin derivative and TiO<sub>2</sub> NPs are dependent on solvent polarity.
- The steady state and time resolved Stern-Volmer plots are linear for 6MCA and 7MCA systems.

- Fluorescence quenching study and FRET study confirm that interaction between these two systems is different.
- Electrochemical analysis shows that azido group ( $-N_3$ ) of coumarin derivatives are responsible for electron transfer process.

## Abstract

The effect of stereo electronic factors of coumarin derivatives, 6-methoxy-4-azido methyl coumarin (6MCA) and 7-methoxy-4-azido methyl coumarin (7MCA) during their interaction with the TiO<sub>2</sub> nanoparticles in ethyl acetate, tetrahydrofuran, methanol, dimethyl formamide and acetonitrile solvents has been studied using uv-vis absorption spectroscopy, fluorescence quenching, FRET and electrochemical analysis. Benesi-Hildebrand plots confirm that interaction between 6MCA and TiO<sub>2</sub> is stronger in solvents with low dielectric constant whereas for 7MCA and TiO<sub>2</sub> system, interaction is stronger in solvents with high dielectric constant. The steady state and time resolved S-V plots are linear for both the systems. For 6MCA system, quenching rate parameter is decreasing with increasing dielectric constant of the solvent and for 7MCA system these values are in increasing order with increasing dielectric constant of the solvents. FRET study also confirms that nature of interaction between these two systems is different. Electrochemical analysis reveals the role of electron transfer from coumarin derivative to TiO<sub>2</sub> nanoparticles and shows that azido group ( $-N_3$ ) of 7MCA and 6MCA are responsible for electron transfer. The magnitude of free energy change for electron transfer confirms that quenching is more efficient for 7MCA system. The higher magnitude of quenching rate parameter of 7MCA compared to 6MCA is due to its stable and polar structure.

# Graphical abstract





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Volume 25, February 2020, 100324



Data Article

# Unique oleochemical data source: Deployed for the optimization of fatty acids of seed oils for production of liquid fuel

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Received 28 May 2019, Revised 18 November 2019, Accepted 10 December 2019, Available online 12

<https://doi.org/10.1016/j.cdc.2019.100324>





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## Abstract

Underutilized seeds species like *Caryocar villosum*, *Dacryodes rostrata*, *Erismacalcaratum* and *Irvingia gabonensis* yield 72%, 32%, 53% and 61% seed oils respectively. The physicochemical / oleochemical data of seed oils, such as Saponification Value, Iodine Value, Acid value, Component fatty acids in the seed oils is extracted from the literature. Thus obtained physicochemical data and fatty acids profile of selected seed oils is utilized for the assessment of liquid fuel /biodiesel property. The research data obtained from this work is compared with biodiesel properties of existing biodiesels and also with petro-diesel. Hence, these selected minor seed oils are suitable candidates for the production of biodiesel after optimizing percent saturated and unsaturated fatty acid content by mixed oils strategy. After thorough investigation, the bio-diesel properties obtained from *Caryocar villosum* seed oil, *Dacryodes rostrata* seed oil, *Erismacalcaratum* seed oil and *Irvingia gabonensis* seed oils satisfy the major specifications of biodiesel standards.

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# Facile one-pot synthetic access to libraries of diversely substituted 3-aryl (Alkyl)-coumarins using ionic liquid (IL) or conventional base/solvent, and an IL-mediated approach to novel coumarin-bearing diaryl-ethynes


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## Highlights

- Libraries of diversely substituted 3-aryl-coumarins via *in-situ* formed carbonylimidazole derivatives of Ar(alkyl)-CH<sub>2</sub>COOH.
- IL-mediated synthesis of coumarin-bearing diaryl-ethynes by the Sonogashira reaction.
- One-pot sequential process.
- [BMIM][X] as solvent and [PAIM][NTf<sub>2</sub>] as base.
- Potential for recycling/reuse of the IL solvent.

## Abstract

The *in-situ* formed carbonylimidazole derivatives of Ar(alkyl)-CH<sub>2</sub>COOH react at r.t. with substituted salicylaldehydes in [BMIM][PF<sub>6</sub>] or [BMIM][BF<sub>4</sub>] as solvent, and [PAIM][NTf<sub>2</sub>] as basic-IL, to produce libraries of 3-aryl(alkyl)coumarins. Whereas these reactions can also be performed with similar efficiency in THF by employing DBU, the IL approach offers easier work-up and recycling of the IL solvent. An IL-mediated approach to the synthesis of novel coumarin-bearing diaryl-ethynes by the Sonogashira reaction is also

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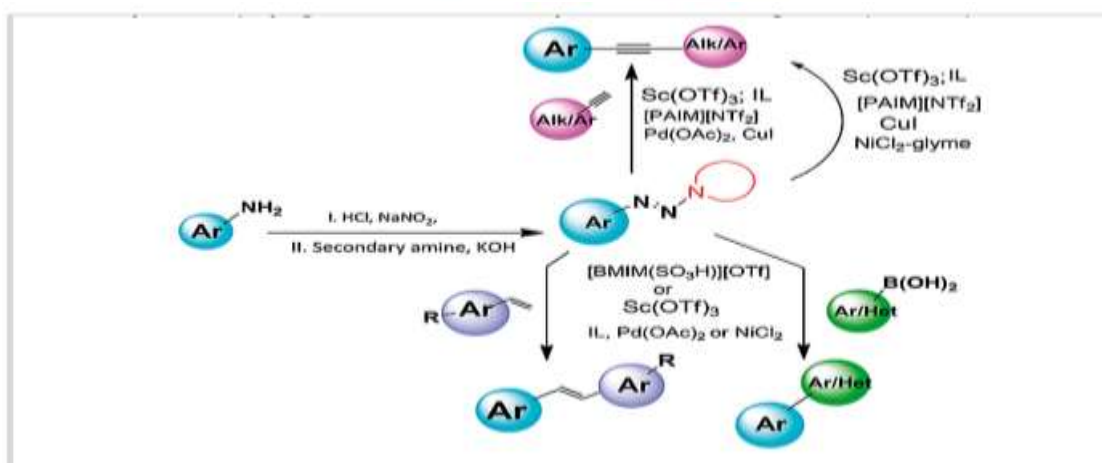


Communication

# 1-Aryltriazenes in the Suzuki, Heck, and Sonogashira Reactions in Imidazolium-ILs, with [BMIM(SO<sub>3</sub>H)][OTf] or Sc(OTf)<sub>3</sub> as Promoter, and Pd(OAc)<sub>2</sub> or NiCl<sub>2</sub>·glyme as Catalyst

Suraj M. Sutar, Hemantkumar M. Savanur, Shruti S. Malunavar, Pavankumar Prabhala, Rajesh G. Kalkhambkar ✉, Kenneth K. Laali ✉

First published: 26 August 2019 | <https://doi.org/10.1002/ejoc.201901070> | Citations: 34



reported, and the potential for recycling/reuse of the IL solvent is shown.

## Graphical abstract



## Abstract

1-Aryltriazenes, the protected and more stable form of aryl-diazonium species, can be conveniently unmasked with Brønsted acidic-IL or Sc(OTf)<sub>3</sub> and coupled with a host of aryl/heteroaryl boronic acids, styrenes, and aryl/alkyl acetylenes in the Suzuki, Heck and Sonogashira reactions in one-pot and in respectable isolated yields, by using palladium or nickel catalyst in readily available imidazolium ILs as solvent, under mild conditions. The scope of these reactions are explored, and the potential for recovery/reuse of the IL solvent is also addressed.

# Synthesis of diverse libraries of carboxamides via chemoselective *N*-acylation of amines by carboxylic acids employing Brønsted acidic IL [BMIM(SO<sub>3</sub>H)][OTf]

Hemantkumar M. Savanur<sup>a</sup>, Shruti S. Malunavar<sup>a</sup>, Pavankumar Prabhala<sup>a</sup>, Suraj M. Sutar<sup>a</sup>, Rajesh G. Kalkhambkar<sup>a</sup>, Kenneth K. Laali<sup>b</sup>

<sup>a</sup> Department of Chemistry, Karnatak University's Karnatak Science College, Dharwad, Karnataka 580001, India

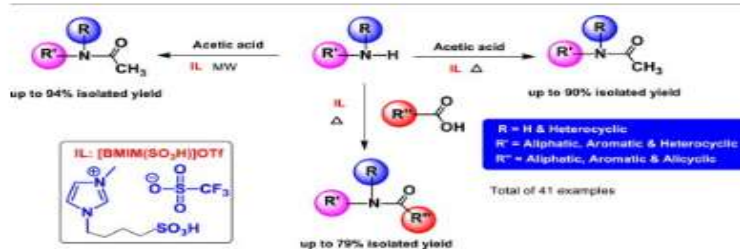
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Received 4 July 2019, Revised 11 September 2019, Accepted 15 September 2019, Available online 17 September 2019, Version of Record 30 September 2019.

## Abstract

Chemoselective *N*-acylation of amines with carboxylic acids as acyl electrophiles and Brønsted acidic IL [BMIM(SO<sub>3</sub>H)][OTf] as promoter is reported under both thermal and microwave irradiation to produce libraries of carboxamides in good to excellent yields after a simple workup. The protocol is compatible with structurally diverse 1° and 2° amines and works in the presence of sensitive functional groups such as thiols and phenols. The potential for recycling and reuse of the IL is also demonstrated.

## Graphical abstract



## Highlights

- Chemoselective method for the preparation of carboxamide libraries.
- Uses readily available carboxylic acids as acyl electrophiles instead of acid chlorides and anhydrides.
- Compatible with structurally diverse 1° and 2° amines.
- Works in the presence of sensitive functional groups such as thiols and phenols.
- Uses the Brønsted acidic IL [BMIM(SO<sub>3</sub>H)][OTf] as promoter instead of corrosive protic acid/metal catalyst combinations.

Communication

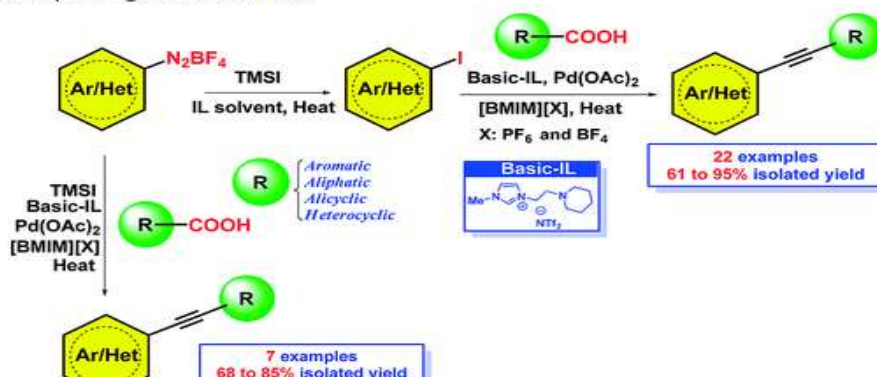
# Facile Access to Diverse Libraries of Internal Alkynes via Sequential Iododediazotiation/Decarboxylative Sonogashira Reaction in Imidazolium ILs without Ligand or Additive

Pavankumar Prabhala, Hemantkumar M. Savanur, Rajesh G. Kalkhambkar ✉, Kenneth K. Laali ✉

 First published: 15 February 2019 | <https://doi.org/10.1002/ejoc.201900093> | Citations: 24

## Graphical Abstract

A facile one-pot method comprising sequential iododediazotiation/Sonogashira reaction is used to prepare diverse libraries of internal alkynes. The method uses imidazolium-ILs as base and solvent and does not require ligand or additive.



## Abstract

Convenient access to diverse libraries of internal alkynes via decarboxylative Sonogashira reaction of alkynyl-carboxylic acids with iodoarenes, employing imidazolium-ILs as solvent, along with piperidine-appended imidazolium [PAIM][NTf<sub>2</sub>] as task-specific basic IL is demonstrated, without the need for any ligand or additive. The feasibility to perform these reactions by sequential one-pot iododediazotiation/decarboxylative Sonogashira reaction is also shown, and the scope of the methods is underscored by providing 29 examples. The potential for recycling and reuse of the IL solvent is also examined.



## INDIGENOUS KNOWLEDGE OF KAPPATH HILLS MEDICINAL PLANTS, GADAG DISTRICT, KARNATAKA

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Karnatak University's, Karnatak Science College, Dharwad -580 001

### Abstract

Kappath hill is blessed with rich diversity of medicinal plants, which were used by medicine men to treat local population for effective control of many ailments. Traditional medicine based on herbal remedies has always played a key role in maintaining the health of the village population in India. In an ethnobotanical exploration of the Kappath Hills, Gadag district area, the method/s of herbal preparation prescribed by the local traditional healers from 65 species belonging to 59 genera and 36 families were documented. In most of the cases single plant was useful in curing two to three diseases such as leucorrhoea, fever, rheumatic pains, menstrual disorders, cuts and wounds. A good number of claims have also been recorded. The parts used and the method of preparation was discussed along with the local names.

**Key words:** Indigenous Knowledge, Medicinal Plants, Gadag

### Introduction

Indigenous knowledge or Ethno-botany deals with the direct relationship of plants with man. The importance of traditional and folk medicine in the treatment of various human ailments is well known since olden days. India has kept alive number of traditional medicines like, Ayurveda, Sida, Yoga, and Unani etc. Among them oldest is Ayurveda, it has a lot of information on Indian medicinal plants. Plants have been one of the important sources of medicines ever since the dawn of human civilization. Over 60% of all pharmaceuticals are plant based<sup>1</sup>. Plants still remains one of the major sources of drug in modern as well as traditional systems of medicines all over the world.

### Materials and Methods

The study area is located between 15° 16' & 16° 55' North latitude and 75° 10' & 75° 55' East longitude. Extensive survey was conducted in and around the villages of Kappath hills, namely Doni, Hire Vaddati, Shingatalur, Murū Tanda, Goulgerimath, Harogeri, Kapateshwar temple area etc. The information about medicinal plants and medicine-men around the Kappath hills was gathered during the field visits. Information on indigenous knowledge was recorded through oral interviews and discussion with medicine-men. While recording ethno-botanical information, every care was taken to record, local names of the plants, parts used, uses, method of drug preparation and mode of administration. The collected specimens were identified with the help of floras and specimens were deposited in the Herbarium of Department of Botany, Karnatak Science College, Dharwad.

### Result and Discussion

The present investigation on enumeration of wild medicinal plants in and around Kappath hills resulted about 65 species belonging to 59 genera and 36 families have been documented as potential medicinal plants. Species names are arranged in alphabetically, followed by the family name, parts used, uses and method of preparations have been given. These plants are helpful to treat approximately 33 types of ailments.

\*Corresponding Author: Dr. S. V. Kambhar

## International Journal of Scientific Research and Reviews

### Subaerial nonheterocytous and heterocytous cyanobacteria from Sirsi taluk, Uttara Kannada, Karnataka, India.

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#### ABSTRACT

The present study focuses on the diversity of subaerial filamentous cyanobacteria including both nonheterocytous (order Oscillatoriales) and heterocytous forms (Nostocales and Stigonematales). Subaerial algal samples were collected from Sirsi taluk, Karnataka, India and a total of 59 subaerial cyanobacteria were documented. Out of 59 subaerial cyanobacteria, maximum taxa belonged to the family Scytonemataceae (19 taxa) and minimum taxa belonged the families Rivulariaceae, Microchaetaceae and Hapalosiphonaceae (2 taxa each). Among heterocytous cyanoabcteria, *Scytonema hofmannii* and *S. varium* were the most frequently occurring taxa while among nonheterocytous cyanobacteria *i.e.* Oscillatoriales members *Leptolyngbya cataractarum* and *L. valderiana* were the dominant subaerial cyanobacteria in Sirsi taluk. Shannon-Wiener diversity index was used to calculate the diversity of these subaerial cyanobacteria in the study area. Camera lucida drawings have been given in support of the description of the taxa.

**KEYWORDS:** Cyanobacteria, Western Ghats, tropical climate, taxonomy.



## A Comment on $g\alpha$ -Closed Sets in Topological Spaces

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Available online at: [www.isroset.org](http://www.isroset.org)

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**Abstract**— In this paper, we will show that the notations of generalized pre  $\alpha$ -closed( $g\alpha$ -closed) set and pre-closed set are equivalent.

**Keywords**—pre-closed sets, aspg-closed sets, gab-closed sets,  $g\alpha$ -closed sets.

### I. INTRODUCTION

In 1970, N. Levin[9] initiated the study of generalized closed(briefly g-closed) sets in topological spaces. This concept was found to be useful and many results in general topology were improved. As a modification of g-closed sets,  $gp$ -closed sets are introduced and investigated by H. Maki et al.[10] Also, P. H. Patil and P. G. Patil[13] discussed and established the concept of generalised pre  $\alpha$ -closed sets as a generalization of pre-closed sets. We will show that the concept of pre-closed set and a generalization of pre  $\alpha$ -closed sets are same. Moreover, we have established that the notations of  $gab$ -closed[15] set and  $aspg$ -closed[14] set do not give rise to any notations in topological spaces.

### II. PRELIMINARIES

- E. Definition[10] Let  $(X, \tau)$  be a topological space. A subset  $A$  of  $X$  is said to be a  $gp$ -closed set if  $pCl(A) \subseteq G$  whenever  $A \subseteq U$  and  $U$  is open in  $X$ .
- F. Definition[13] Let  $(X, \tau)$  be a topological space. A subset  $A$  of  $X$  is said to be a  $g\alpha$ -closed set if  $pCl(A) \subseteq G$  whenever  $A \subseteq U$  and  $U$  is a  $\alpha$ -open in  $X$ .
- G. Definition[15] Let  $(X, \tau)$  be a topological space. A subset  $A$  of  $X$  is said to be a  $gab$ -closed set if  $bCl(A) \subseteq G$  whenever  $A \subseteq U$  and  $U$  is a  $\alpha$ -open in  $X$ .
- H. Definition [14] Let  $(X, \tau)$  be a topological space. A subset  $A$  of  $X$  is said to be a  $aspg$ -closed set if  $spCl(A) \subseteq G$  whenever  $A \subseteq U$  and  $U$  is a  $\alpha$ -open in  $X$ .
- I. Lemma [7] In every topological space  $(X, \tau)$ , each singleton is pre-open or nowhere dense.
- J. Lemma[4] Let  $(X, \tau)$  be a topological space,  $A \subseteq X$  and  $x \in X$ . If  $\{x\}$  is nowhere dense, then  $\{x\}$  is  $\alpha$ -closed and





B Parvathalu

## Construction of distance equienergetic graphs through generalized composition

Authors [HS Ramane](#), [D Patil](#), [B Parvathalu](#), [K Ashoka](#)

Publication date 2020

Journal [Journal of Advanced Mathematical Studies](#)

Volume 13

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Scholar articles [Construction of distance equienergetic graphs through generalized composition](#)  
[HS Ramane, D Patil, B Parvathalu, K Ashoka - J. Adv. Math. Stud, 2020](#)  
[Cited by 2](#) [Related articles](#)



B Parvathalu

## Harary spectrum of generalized composition of graphs and Harary equienergetic graphs

Authors H Ramane, D Patil, K Ashoka, B Parvathalu

Publication date 2019/12/1

Journal Journal of Algebra and Related Topics

Volume 7

Issue 2

Pages 31-45





Publisher University of Guilan

Description The Harary spectrum of a connected graph  $G$  is the collection of the eigenvalues of its Harary matrix. The Harary energy of a graph  $G$  is the sum of absolute values of its Harary eigenvalues. Harary equitable partition is defined and is used to obtain Harary spectrum of generalized composition of graphs. Harary equienergetic graphs have been constructed with the help of generalized composition through Harary equitable partition.

Total citations Cited by 2



# Ionic liquid-mediated benzoyl transfer-coupling in the Suzuki and Sonogashira reactions and aryl transfer-coupling by decarbonylative Heck reaction, using *N*-Benzoyl-saccharin (NBSac) as reagent

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Received 19 March 2020, Revised 14 April 2020, Accepted 27 April 2020, Available online 30 April 2020, Version of Record 27 May 2020.

## Highlights

- Facile access to diverse libraries of diarylketones, keto-ethynes and diaryl-ethenes.
- *N*-Benzoylsaccharin for transfer-benzoylation in Suzuki and Sonogashira reactions.
- *N*-Benzoylsaccharin for decarbonylative arylation in Heck coupling.
- Catalysis by either Pd or Ni.
- [BMIM][X] as solvent, [PAIM][NTf<sub>2</sub>] as base, guanidinium-IL as acidic/basic IL.
- Potential for recycling/reuse of the IL solvent.

## Abstract

The efficacy of *N*-benzoyl-saccharin (NBSac) as reagent for selective benzoyl transfer-coupling in the Suzuki reaction in BMIM-IL/[PAIM][NTf<sub>2</sub>] as solvent/base, and in the Sonogashira reaction employing guanidinium-IL (GIL) as solvent, are demonstrated. Decarbonylative aryl transfer-coupling occurs in the Heck reaction employing GIL as solvent. The reactions are catalyzed by Pd(OAc)<sub>2</sub> or NiCl<sub>2</sub>(dppp), are performed under mild conditions in good yields, and have the potential for recycling/reuse of the IL solvent. Collectively, these methods provide facile access to diverse libraries of diarylketones, keto-ethynes and diaryl-ethenes.



# Molecular interaction of the triazole fungicide propiconazole with homology modelled superoxide dismutase and catalase

Original Article | Published: 12 August 2019

Volume 2, pages 429–439, (2019) [Cite this article](#)

[Praveen Satapute](#) , [Rajeshwari D. Sanakal](#), [Sikandar I. Mulla](#) & [Basappa Kaliwal](#)

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## Abstract

To understand the plasmid mediated biodegradation of propiconazole and enzymatic antioxidant activity, the plasmid cured PS-4C strain was utilized against the propiconazole for its dissolution in the liquid medium, further, the molecular docking studies against the *Pseudomonas aeruginosa* superoxide dismutase (SOD) as well as catalase (CAT) was undertaken. An acridine orange based LD<sub>50</sub> concentration of the propiconazole was found at 50 µg ml<sup>-1</sup> and hence the plasmid of PS-4C strain was cured at this dose. Homology modeling using Swiss modeler was applied to generate 3D structure of both SOD and CAT. Active sites were predicted using CastP server and molecular docking was performed by AutodockVina program and thereby calculated binding free energy. Ligand docked against the SOD and CAT enzymes was found to bind with strong hydrophobic interaction. Propiconazole showed strong binding affinity with CAT compared to SOD. Thus, propiconazole resistant plasmid degenerated bacterium PS-4C strain can be a potent

candidate for the safer remediation of pollutants and the conformation of propiconazole exploits the interactive geometry along with the molecule size sufficient for spanning the two enzymes to which they will bind making it a good starting point for designing library of antioxidants.

**Juni Khyat**  
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**ISSN: 2278-4632**  
**Vol-10 Issue-5 No. 18 May 2020**

**MUNICIPAL SOLID WASTE GENERATION, PROCESS AND PRESENT ASSOCIATE  
PROBLEMS IN THE URBAN CENTERS OF GADA DISTRICT, KARNATAKA**

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**ABSTRACT**

*Rapid growth of urbanization, standard of living and per capita income lead to high rate of municipal solid waste generation, and unscientific handling of MSW degrades the urban environment and causes health hazards. In recent times E-waste and plastic waste also contributing remarkably to waste stream due to utilization of electric and other items. In this paper an attempt is made to examine major parameters of MSWM like trends of population, solid waste per capita generation, growth and associate problems of urban centers in Gadag district, in addition to this its process, management and present problems and characteristics of MSWM are also examined. The present study is based on secondary data gathered from Urban Development Authority (UDA), city municipal council, town municipal councils and town panchayats of the urban local bodies of the respective urban centers. The urban population has increased from 2, 97,957 in 1991 to 3, 79,309 in 2011, at the same time the generation of solid waste has also increased to 14,972 kg per day in 2011 from 10,674 kg. per day in 1991. During 1991, the average per capita waste generation was 35.82 grams per person/day, whereas in 2011 it has increased to 39.47 grams. It is noticed that the solid waste generation is growing with the rapid growth of urban population. In fact, the study area per capita generation of waste is significantly lower than the India's average i.e., 400g per capita.*

**Key Words:** Solid waste, Management, MSW, Per capita, urbanization, biodegradable, population, MSWM.



# On Selecting the Best Population among Increasing Failure Rate Average Populations

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## Abstract

One of the important areas of research in Statistical Inference, namely, the selection and ranking of populations is well attended by many researchers. Here, a selection procedure is developed to select the population possessing stronger increasing failure rate average (IFRA) property among the several IFRA populations. A selection procedure is developed using a measure of departure from exponentiality towards IFRA. The strength of IFRA property of populations is determined by considering the measure given by Keerthi and Pandit [8]. The statistic proposed by Keerthi and Pandit [8] to test exponentiality against IFRA alternatives is based on a U-statistic with a kernel of degree four. Keerthi and Pandit [8] established the large sample properties of the statistic which is the basis for selection procedure. Also the performance of the selection procedure is evaluated using probability of correct selection.

**Keywords:** Increasing Failure Rate Average (IFRA) class, Selection and ranking, U-statistic, Probability of correct selection.





Shankreeva Gani

## optimal control analysis for stochastic unemployment model

Authors S. B. Munoli shankeevva Gani, s Gani

Publication date 2019

Journal International journal of mathematics and statistics

Volume 20

Issue 2

Pages 61-75

# Particle Swarm Optimization and Texture Analysis Image Processing Techniques using MRI Images to Detect Brain Tumor in Human

Lalitha R Naik



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**Abstract:** Cosmetics and classification findings are the most difficult and powerful task of preparing. MRI (Magnetic Resonance Imaging) is a treatment, which is often used by the radio translator to represent the appearance of a person with no surgery. MRI provides much information on the human body's body, which helps to control the brain's brain. MRI is used for research on high resolution, speed of availability, and high profile profile for patients [19]. The deep part of the MRI shape is primarily responsible for the termination of the brain's brain from the computer that supports medical devices. This book focuses on planning the best way and the best way to diagnose MRI's brain detection if it supports brain arrest if its focus is on surveillance its vision is: benign or operated by using the SVM configuration process. The method we recommend is to create a configuration using the history and management of the process that will create a split by using a test feature (PSO), extracting compression using GLCM, reducing PCA features, to reduce the feature is also used by ICA (Self-Exam) to provide free access for the GLCM and for SVM format. The result is MATLAB2015.

**Keywords:** SVM, Performance Matrices, Accuracy, PCA, ICA, Feature Reduction, GLCM

**Scope of the Article:** Swarm intelligence

# Physico-Chemical Characteristics of Shalmala River Sub-Basin, Dharwad District, Karnataka

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**Abstract :** A hydro chemical study has been carried out to assess the groundwater quality in Shalmala river sub-basin Dharwad district, Karnataka. About 45 groundwater samples from different locations in study area are collected. The aim of the study is to determine the suitability of water for drinking and domestic purposes. The physico-chemical parameter such as hydrogen ion concentration (pH), Total dissolved solids (TDS), Electrical conductivity (EC), Total hardness (TH), Cations like Calcium ( $\text{Ca}^{++}$ ), Magnesium ( $\text{Mg}^{++}$ ), Sodium ( $\text{Na}^+$ ), Potassium ( $\text{K}^+$ ) and Anions like Carbonate ( $\text{CO}_3^{--}$ ), Bi-carbonates ( $\text{HCO}_3^-$ ), Chloride ( $\text{Cl}^-$ ), Sulphate ( $\text{SO}_4^{--}$ ) and Nitrate ( $\text{NO}_3^-$ ). The pH value ranges from 7.13 to 8.12 and average is 7.59. Therefore, all the groundwater samples are indicating faintly alkaline in nature and are suitable for drinking and domestic purposes. 96% of total hardness (TH) in the study area showing hard category consequently softening of water is recommended. The piper diagram illustrates that the 96% of groundwater samples in the study area are belonging to area I suggesting that water samples are alkaline earths exceeds alkalis. According to Gibbs (1970) classification it is illustrated that all the groundwater samples in the study area are representing rock dominance. All the groundwater samples are within the permissible limits as per WHO (2017).

**IndexTerms -** Hydrochemical, Groundwater, Shalamla river sub-basin, Karnataka.

## I. INTRODUCTION

Water is a colourless, odourless and tasteless natural resources and that is essential for the survival of the living things. About 71% of earth's surface is covered with water. The sources of water have been characterized into two categories – Surface water and Ground water. The surface water means the water that collects on the surface of the earth such as rivers, lakes, reservoirs etc. The Ground water found beneath the land that is surface water seeps into the cracks or crevices of rocks and reaches the ground.

The physio chemical analysis of water plays a vital role to determine the quality of water whether it is good for drinking or agricultural purposes. The Ground water contains dissolved mineral ions which may results on the quality of water. If the dissolved mineral ions content is above the permissible standard limits, then it hazards to human health. Therefore, an attempt made to evaluate the various hydro chemical parameters of ground water of Shalmala river sub-basin Dharwad district, Karnataka.

## II. STUDY AREA

The Shalmala river sub-basin is situated at Survey of India toposheet no. D43D3 and D43D4 lies in between North latitudes  $15^{\circ} 06' 21.6''$  to  $15^{\circ} 24' 50.4''$  and East longitudes  $75^{\circ} 00' 3.6''$  to  $75^{\circ} 11' 49.2''$ . The total geographical area is 363.39  $\text{km}^2$ . Geologically, the study area is covered by quartz-mica schist of Chitradurga group of Archean age, greywacke and argillites. And also, the study area consists of intrusions of dolerite dyke and banded ferruginous quartzite. The elevation ranges from 498 to 772 above mean sea level (MSL). The study area receives 772mm of average annual rainfall and annual average temperature is around  $24.3^{\circ}\text{C}$ .



## A GIS based assessment of Morphometric analysis of Lingasugur Taluk in Raichur District, Karnataka, India

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**Abstract**— In the present paper, an attempt has been made to study drainage morphometric of Lingasugur Taluk, Karnataka, India. It lies of Latitude 16°03' 50" to 16°21' 35" and Longitude 76° 20' 30" to 76°45'50". The total study area consists of 1965.75Sq.Km. Geologically, the area is situated in the northern part of Hutti Schist Belt with some metavolcanics and metasediments of Eastern Dharwar Craton. For the present study we used ASTER-DEM data for the understanding and preparation of essential maps for the analysis. The Arc GIS software (Version: 10.4.1) is used. The present evaluation consist of linear, areal and relief aspects of morphometric analysis. The analysis has revealed that, Drainage Pattern is Dendritic to Sub-dendritic in nature. Mean Bifurcation ratio suggests that the drainage pattern is not much influenced by geological structure. Drainage density (Average value -1.66) indicated clearly that the subsurface is permeable. The length of overland flow indicates low relief. Calculated Circulatory ratio (0.15 to 0.29) and elongation ratio (0.006 to 0.013) suggest that the sub-basins are in elongated shape within the boundary. Relief Ratio (0.0037 to 0.0056) shows major portion of the area is having gentle slope.

There are basically three vital aspects as linear aspect, areal aspect and relief aspect used for the analysis of the morphometric characteristics of the basin. Linear aspect is the single dimensional parameters gives information about parameters like stream order, stream number and bifurcation ratio. Areal aspect deals with parameters like: drainage density, drainage texture, stream frequency, circularity ratio and form factor which are two dimensional parameters. Relief aspect is the three dimensional aspect which deals with the parameter like total relief, relief ratio and slope. The drainage pattern characteristics of various basins have been studied using conventional methods in earlier times [9], [14], [21], [23], [25].

In the recent years, the analysis of morphometric parameters has gained increasing attention after the advent of tools such as Remote Sensing and Geographical Information System (GIS) [10], [13], [16], [15], [18], [19], [22], [24] [29], [30]. The GIS tools helps in various manners as to identify the drainage network with the help of Digital elevation model (DEM), also can give quantitative description of geometric characteristics which includes topology of stream network, computation of relief characteristics, drainage

Hence the groundwater recharge scheme is recommended for proper management of water resources. The overall analysis depicts extraction of river basins in the administrative boundary of Lingasugur Taluk, Karnataka, India.

**Keywords**— GIS, Lingasugur Taluk, Morphometry, etc

### 1. INTRODUCTION

Morphometric analysis represents the topographical expression of the basin geometry to understand its slope, area, shape, length, or inequalities in the rock hardness, structural controls, recent diastrophism, geological and geomorphic history of the drainage basin [28].

pattern and drainage texture. Therefore, morphometric analysis has concluded that, remote sensing has emerged as a powerful tool in analyzing the drainage morphometry [15][19]. There is no published literature available on the morphometric analysis of Lingasugur taluk, Karnatak State using RS and GIS techniques. Hence, the present study has been undertaken.

### 1.1. STUDY AREA

The study area comprises of administrative boundary of Lingasugur Taluk of Raichur District, Karnataka state, India and it lies in between North Latitude 16°03' 50" and 16°21' 35" and East Longitude 76° 20' 30" and 76°45' 50" which fall in the Survey of India Toposheet- 56D/7, 56D/8,

## IMPACT OF PRECIPITATION, TEMPERATURE AND HUMIDITY ON GROUNDWATER FLUCTUATION IN SHALMALA RIVER SUB-BASIN DHARWAD DISTRICT, KARNATAKA, INDIA

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**Abstract**— A study has been carried to determine the fluctuations of groundwater in Shalmala river sub-basin. To achieve this goal, two years data of rainfall, temperature, humidity and depth of groundwater (2017, 2018) have been collected from Shalmala river sub-basin and recorded manually for pre-monsoon season as well as post-monsoon season. The average rainfall of the area is 664.9mm, temperature and humidity are 25.81°C, 65.36% respectively. The highest groundwater fluctuation is recorded at Tabkadhonalli village whereas least is recorded at Hubballi in the year 2017. Hence the study concludes that there is need for watershed development program in the area of Hubballi and Devaragudihal village taking into consideration of the site factors

**Keywords**— Below ground level (bgl), Shalmala sub-basin, Hubballi, Karnataka

### 1. INTRODUCTION

Groundwater is one of the most important renewable resources which play a vital role into livelihood and is primary source of fresh water in the many parts of the world. Decline in ground water levels were reported in many parts of the

world [1],[2],[3]. Compared to other countries, India is the largest user of ground water for irrigated agriculture [4]. The farmers are mainly depending on ground water for irrigation in non-monsoon period. Hence, it is important to know how much precipitation is required to recharge the groundwater table [5],[6]. Groundwater recharge mainly occurs through the infiltration of rainwater and surface water. On the other hand, groundwater can also play an important role in sustaining the stream flow [7]. Groundwater fluctuation level mainly depends on the drainage, topography of the area, soil, vegetation and specific yield of the

particular area [8]. However, human is also a main reason for depletion of groundwater by over exploitation and excessive groundwater pumping [9]. It is described that the water table fluctuation (WTF) method is based on the rise or fall in groundwater levels due to the recharge and discharge of groundwater [10],[11],[12]. Rainfall Infiltration Factor (RIF) is also the indirect method for estimating the groundwater recharge [13],[14]. The soil-moisture balance study indicated that the groundwater recharge is more dependent on the continuous rainfall of the total annual volume of rainfall [15].

### 2. METHODOLOGY

#### 2.1. STUDY AREA

The Shalmala river sub-basin, Dharwad district, Karnataka is located between latitudes 15° 06' 21.6" to 15° 24' 50.4"; longitudes 75° 00' 3.6" to 75° 11' 49.2" and fall in parts of Survey of India toposheet numbers 48M/3 and 48M/4 (1:50,000 Scale). The sub-basin covers an area of 363.39Km<sup>2</sup> (Fig. 1). The elevation ranges from 498m to 772m above mean sea level (MSL) and receives 772mm of average annual rainfall and annual average temperature is around 24.3°C.

Geologically, the study area is covered by Sedimentary rocks such as greywacke, argillites and banded ferruginous quartzite. The study area comprises metamorphic formation like Quartz mica-schist of Chitradurga group of Archean age. At some places, dolerite dyke cuts across the bedding planes.

#### 2.2. DATA COLLECTION AND ANALYSIS

07 locations within Shalmala river sub-basin have been selected, measured and estimated the fluctuation level of groundwater. Out of 07 stations, 06 are belonging to hand pump borewells



## MORPHOMETRIC ANALYSIS OF SHALMALA RIVER SUB-BASIN DHARWAD DISTRICT, KARNATAKA, USING RS AND GIS TECHNIQUES

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**Abstract**— In the present study an attempt has been made to evaluate the morphometric analysis of the Shalmala river sub-basin by using Remote Sensing (RS) and Geographic Information System (GIS) techniques. The study area is delineated by Arc GIS v10.4 software as per ASTER-DEM. Morphometric parameters like linear, areal and relief aspects of the basin have been evaluated. The study revealed that, the drainage pattern of the study area is sub-dendritic to dendritic. The highest stream order is fifth order. The drainage density (Dd) of the area is 1.583 Km<sup>-1</sup> indicates the area comprises of highly permeable subsurface material. The mean bifurcation ratio of the present area is 4.69, suggests that the area is not affected by structural disturbances. The relief ratio of the study area is 0.00786 which indicates gentle slope and comparatively higher infiltration. The Shalmala river sub-basin comprises sufficient number of lineaments for the groundwater recharge.

**Keywords**— Dharwad, Digital Elevation Model, GIS, Karnataka, Morphometric analysis, Remote sensing, Shalmala River

### 1. INTRODUCTION

Morphometry is the operation of measurement and mathematical analysis of the configuration of the earth's surface, shape and dimensions of the landforms [1], [2], [3], [4] and [5]. The study helps to understand channel network, ground slope, structural control, geologic and geomorphic of a drainage basin [6]. Remote sensing and geographical information system (RS-GIS) techniques are in trend for assessing various morphometric and hypsometric parameters of the drainage basin/watershed [7], [8], [9], [10], [11], [12] and [13]. Recently, researchers carried out morphometric analysis using RS and GIS techniques [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26]. Hence, the present study is carried out on morphometric

characteristics of the Shalmala river sub-basin, Karnataka, which is located between latitudes 15° 06' 21.6" to 15° 24' 50.4" and longitudes 75° 00' 3.6" to 75° 11' 49.2" and fall in parts of Survey of India toposheet numbers 48M/3 and 48M/4 (1:50,000 scale). The sub-basin covers an area of 363.39Km<sup>2</sup> (Figure 1). The elevation ranges from 498m to 772m above mean sea level (MSL) and receives 772mm of an average annual rainfall and annual average temperature is around 24.3°C.

Geologically, the Shalmala river sub-basin is covered by Sedimentary rocks such as greywacke, argillites and banded ferruginous quartzite. The present study constitutes metamorphic formation like Quartz mica-schist of Chitradurga group of Archean age. At some places, dolerite dyke cuts across the bedding planes.

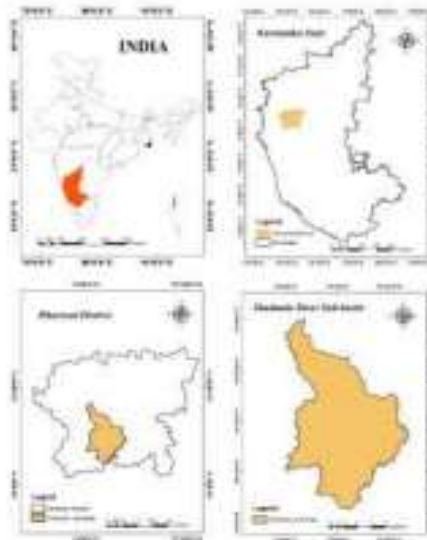



Fig. 1 Location map of the Shalmala river sub-basin

### 2. METHODOLOGY

The morphometry analysis of Shalmala river sub-basin has been carried out by using Arc-GIS



# Taxonomic identity, occurrence of six species of *Salacia* and first report on chromosome numbers of the *Salacia chinensis* L. and *Salacia oblonga* Wall ex Wight and Ern Var. from Western Ghats of Karnataka (India)

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**Abstract** The genus *Salacia* is an important element of the forest flora of the Western Ghats of Karnataka and is well known for its anti-diabetic properties. The region hosts a wide diversity with several taxa. The genus is considered as a taxonomically difficult one due to the complexity and diversity in floral characteristics. The species is still poorly understood with respect to its cytological characteristics. The present study explicates the diversity and distribution of *Salacia* species in the Western Ghats of Karnataka. Here, we also present the first report of the chromosome numbers of the species *Salacia chinensis* L. and *Salacia oblonga* Wall ex Wight and Ern Var. and is different from those of other previously reported *Celastraceae* genera. Conservation status of *Salacia* species of the Western Ghats of Karnataka has also been revised in this study. The diversity of floral morphology, leaf morphology, fruit and seed morphology, stem and root morphology were

elaborated along with a dichotomous key to the Western Ghats species. Morphological study in *S. chinensis* L., *S. malabarica* Gamble, *S. oblonga* Wall ex Wight and Ern Var, *S. macrosperma* Wight, *S. reticulata* Wight and *S. gambleana* Whiting and Kaul is done for the first time using descriptor analysis. The paper describes 73 morphological traits that appear to be at least partly genetically controlled and can be used as descriptors of *Salacia* species.

**Keywords** *Salacia* · Descriptors · Diversity · Conservation · Somatic chromosomes

## Introduction

Many drugs listed as traditional medicines were primarily derived from plants. Diverse wild medicinal plants including herbs, lianas and trees or their related parts like leaves, stems, roots, fruits and flowers are used in traditional medicinal systems (Marshall 2011). Although there is no record for exact total number of medicinal plants around the world, about half million

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Article

## Genetic Structure and Diversity among Species of Salacia: An Endangered Medicinal Herb of Western Ghats, India

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### Abstract

Salacia is one of the medicinally valuable genus, distributed throughout tropical areas which include India, Sri Lanka, Southern China and other Southern Asian Countries. The genus Salacia is represented by 21 species in India, among them eight species are recorded from the state of Karnataka in the Southern part of India. Despite its pharmaceutical importance, very little information exists about the genetic diversity of Salacia at molecular level. Hence the present study was carried out to evaluate the genetic among six species of Salacia namely *S. chinensis*, *S. malabarica*, *S. oblonga*, *S. macrosperma*, *S. reticulata* and *S. gambleana* with the help of ISSR marker analysis. Dendrogram and genetic distance were generated adopting Unweighted Paired Group Method with Arithmetic mean (UPGMA) in the NTSYS-pc software. Basic genetic parameters were calculated by analysing the genetic data with Pop gene 1.32 and GenAIEx 6.2 software. The overall polymorphism across the ten primers screened revealed 26 % polymorphism. A 60% polymorphism was scored for the primer UBC 841, whereas, no polymorphism was observed for primer UBC 840 and ISSR 6. The average observed heterozygosity was more than expected heterozygosity. Observed heterozygosity ( $H_o$ ) ranged from 0.15 (UBC 841) to 0.38 (ISSR 6) with an average of 0.25, whereas expected heterozygosity ( $H_e$ ) ranged from 0.10 (UBC 843) to 0.35 (ISSR 6) with an average of 0.23 for Salacia species. The higher heterozygosity pointed towards increased genetic diversity amongst the species. ISSR marker analysis showed high level of inter and intra population genetic differentiation.

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## STUDIES ON TOXICOLOGICAL ENDPOINTS OF FENOXAPROP-P-ETHYL ON BEHAVIORAL CHANGES IN FRESHWATER EXOTIC CARP *CYPRINUS CARPIO* (LINNAEUS)

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### ABSTRACT

The present study was undertaken to determine the acute toxicity of the herbicide Fenoxaprop-P-ethyl (FPE) and the resulting behavioral alterations in the exotic freshwater carp *Cyprinus carpio*. The experimental fish were divided into groups of 10 ( $n=10$ ) and exposed to different concentrations of the test pesticide for 24, 48, 72, and 96 hours. The 96-hour  $LC_{50}$  was found to be 300  $\mu\text{g/l}$ . Sub-lethal concentration was fixed based on  $LC_{50}$  value is 37.5  $\mu\text{g/l}$  ( $1/8^{\text{th}}$  of  $LC_{50}$ ) of the herbicide FPE for a period of 45 days. Regular observation was made throughout the exposure period to determine the long-term behavioral changes in the test fish. The fish displayed erratic swimming behavior that increased over the days of exposure. Behavioral anomalies such as whirling cork movement, altered opercular movement, altered fin movement and physiological changes such as dyspigmentation and altered mucus secretion were observed.

**Keywords:** *Cyprinus carpio*, Fenoxaprop-P-ethyl, Herbicide, Freshwater fish, Fenoxaprop acid

### 1. INTRODUCTION

Toxic chemicals have changed the quality of water that affects the well-being of fishes and other aquatic organisms. Increased use of chemical pesticides for agricultural purpose has resulted in the excess inflow of toxic chemicals into the environment, mainly into the aquatic ecosystems [1]. Herbicides are one among the more frequently used category of pesticides, because of their high herbicidal property, low mammalian toxicity,

systems such as aquatic environments, and there is a need to consider the toxicity of degradation products.

Fishes are ideal sentinels to study the impact of exposure to various stressors and toxic chemicals on behavioral aspects of animals due to the following factors: 1) direct and constant contact with the aquatic environment where chemical exposure occurs over the entire body surface, 2) ecological relevance in many natural systems 3) ease of culture and maintenance, 4)





# Molecular interaction of the triazole fungicide propiconazole with homology modelled superoxide dismutase and catalase

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## Abstract

To understand the plasmid mediated biodegradation of propiconazole and enzymatic antioxidant activity, the plasmid cured PS-4C strain was utilized against the propiconazole for its dissolution in the liquid medium, further, the molecular docking studies against the *Pseudomonas aeruginosa* superoxide dismutase (SOD) as well as catalase (CAT) was undertaken. An acridine orange based LD<sub>50</sub> concentration of the propiconazole was found at 50 µg ml<sup>-1</sup> and hence the plasmid of PS-4C strain was cured at this dose. Homology modeling using Swiss modeler was applied to generate 3D structure of both SOD and CAT. Active sites were predicted using CastP server and molecular docking was performed by AutodockVina program and thereby calculated binding free energy. Ligand docked against the SOD and CAT enzymes was found to bind with strong hydrophobic interaction. Propiconazole showed strong binding affinity with CAT compared to SOD. Thus, propiconazole resistant plasmid degenerated bacterium PS-4C strain can be a potent candidate for the safer remediation of pollutants and the conformation of propiconazole exploits the interactive geometry along with the molecule size sufficient for spanning the two enzymes to which they will bind making it a good starting point for designing library of antioxidants.

**Keywords** Propiconazole · Catalase · Superoxide dismutase · Homology modeling · Docking

## Introduction

Propiconazole is a triazole foliar antimycotic agent, employed in the agriculture fields. The annual intake of this antimycotic agent is 7373 g a.i./ha. It's amongst the leading triazole antimycotic agent within the agriculture field (Satapute and Kaliwal 2016a; Satapute et al. 2019a). On the other hand, microorganisms are the potent biological candidates which are easily available and were used for the bio-transformation/degradation of pesticides (Mulla et al. 2017).

Soil borne microorganisms are most promising biological agents; they themselves adapt to adverse stress conditions and gain the capability of survivability under many contaminated sites (Satapute and Kaliwal 2018; Satapute et al. 2019b). The application of pesticides can provide the sufficient amount of carbon sources for the growth of adapted and resistant soil microorganisms (Araya and Lakhi 2004), and thus establishing the healthy way for the degradation of these harmful chemicals (Satapute and Kaliwal 2016a). Generally, during degradation process, the microorganisms and their enzymes can play a vital role in the breakdown of environmental contaminants (toxic/hazardous) into non-

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Title of paper	Name of the author/s	Name of journal	ISSN number	Link to the recognition in UGC enlistment of the Journal /Digital Object Identifier (doi) number
				Link to website of the Journal
<b><u>2020-21</u></b>				
Role of botanical essential oils as a therapy for controlling coronavirus (SARS-CoV-2) disease (Covid-19)	Prof.Kiran P. Kolkar	International Journal of Innovation Scientific Research and Review	ISSN 2321–2705	<a href="https://dx.doi.org/10.51244/IJRSI.2021.8407">https://dx.doi.org/10.51244/IJRSI.2021.8407</a>
Role of substituent position in Coumarin Derivatives during their interaction with TiO <sub>2</sub> Nano particles.	Dr. Nirupama M. Jagadeshwar	Journal of Fluorescence	10895-021-02706-3	<a href="https://doi.org/10.1007/s10895-021-02706-3">https://doi.org/10.1007/s10895-021-02706-3</a>
Ionic liquid catalyzed Ritter reaction/PD-Catalyzed directed Ortho-arylation ; facile access to diverse libraries of biaryl-amides from Aryl-nitriles.	Dr. Rajesh C. Kalkhambkar	Tetrahedron letters	ISSN 00404039 E-ISSN 18733581	<a href="https://doi.org/10.1016/j.tetlet.2020.152553">https://doi.org/10.1016/j.tetlet.2020.152553</a>
Synthesis ,characterization photo physical and DFD Studies of bicoumarin and 3-(3-benzofuranyl)coumarin derivatives.	Prof. G.H.Malimath	Chemical data collections	12-Jul-05	<a href="https://doi.org/10.1016/j.cdc.2020.100537">DOI:10.1016/j.cdc.2020.100537</a>
Influence of furfuraldehyde derivatives as corrosion inhibition of mild steel in hydrochloric acid solution	Dr. S.K.Rajappa	journal of materials and environment science	ISSN : 2028-2508	<a href="http://www.jmaterenvironsci.com/">http://www.jmaterenvironsci.com/</a>
Investigation of Dolichandra Unguis -cati leaves extract as a corrosion inhibitor for mild steel in acid medium	Dr. S.K.Rajappa	Current research in green and sustainable chemistry	13-Jul-05	<a href="https://dx.doi.org/10.1016/j.crgsc.2021.100113">https://dx.doi.org/10.1016/j.crgsc.2021.100113</a>
Corrosion protection of soft -cast steel pin 1 M HCl with Araucaria	Dr. S.K.Rajappa	Electrochemical science advances	##### #####	<a href="https://doi.org/10.1002/elsa.202100080">https://doi.org/10.1002/elsa.202100080</a>



heterophylla leaves extract				
Corrosion inhibition effect of Cycas revoluta leaves extract on corrosion of soft - cast steel in hydrochloric acid medium	Dr. S.K.Rajappa	Electrochemical science advances	##### #####	<a href="https://doi.org/10.1002/elsa.202100059">https://doi.org/10.1002/elsa.202100059</a>
Synthesis ,spectroscopic propertise and DFD correlative Studies .3 3-carbonyl biscoumarin derivatives	Prof. G.H.Malimath	Journal od molecular structure	<b>13-Jul-05</b>	<a href="https://doi.org/10.1016/j.molstruc.2021.130781">DOI:10.1016/j.molstruc.2021.130781</a>
Miscibility and thermal study of 4-Hydroxycoumarin Doped Chitosan Films	Dr. Saraswati P. Masti	Journal Home page	<b>11-Jul-05</b>	<a href="https://doi.org/10.1016/j.cdc.2019.100257">https://doi.org/10.1016/j.cdc.2019.100257</a>
Synthesis and molecular modelling studies of coumarin abd 1-aza - coumarin linked miconazole analogues and their antimicrobial properties	Dr. Rajesh G. Kalkhambkar	Biological Chemistry & Chemical Biology	##### #####	<a href="https://doi.org/10.1002/slct.201801408">https://doi.org/10.1002/slct.201801408</a>
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synthesis, molecular modelling studies and antimicrobial activity of coumarin and 1-azacoumarin linked 1,2,3-Triazole	Dr. Rajesh C. Kalkhambkar	Chemical data collections	<b>12-Jul-05</b>	<a href="https://doi.org/10.1016/j.cdc.2020.100480">https://doi.org/10.1016/j.cdc.2020.100480</a>
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# Role of botanical essential oils as a therapy for controlling coronavirus (SARS-CoV-2) disease (Covid-19)

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**Abstract:** - This review paper presented on the basis of extensive literature survey updated the importance of plant essential oils in controlling many diseases, particularly coronavirus (SARS-CoV-2) disease outbreak. Plant essential oils are valuable natural products, and used as a raw materials in aromatherapy, phytotherapy, perfumery, cosmetics, spices and nutrition. Aromatic plants produced a diversity of chemical constituents with the potential to inhibit viral replication. Essential oils have several biological properties such as antibacterial, antifungal, antiviral, antioxidant, anti-inflammatory, wound-healing and anti-cancer effects in *in vitro* and *in vivo*. Therefore, essential oils have been analyzed and described as good antiviral agents against respiratory tract viral infections, hence are excellent prospective candidate against coronavirus. Thus, essential oils and their constituents can hopefully be considered in near future for more clinical assessment and possible applications in controlling the coronavirus pandemic. However, some of the plant essential oils are very toxic and poisonous and therefore, oral consumption should be avoided. Further detailed clinical trial experiments should be conducted for the scientific validation.

**Key words:** Antiviral, aromatherapy, coronavirus, essential oils, herbal medicine, oil therapy, toxicity,

## I. INTRODUCTION

The global outbreak of severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) disease (covid-19) is an ongoing pandemic and a public gravest health emergency (Malabadi et al., 2021a, 2021b). The SARS-CoV-2 is a new strain of coronavirus that appeared in China in December 2019, and the viral disease is named as covid-19 (Zhang et al., 2020a, 2020b, 2020c; Zheng et al., 2009; Zhou et al., 2020a, 2020b; Zhu et al., 2020). SARS-CoV-2 is a beta-coronavirus responsible for the COVID-19 pandemic (Shin et al., 2020; Yang, 2021; Xu et al., 2020; Malabadi et al., 2021a, 2021b). Symptoms of COVID-19 can be relatively non-specific and infected people may be asymptomatic (Shin et al., 2020; Yang, 2021). The coronavirus can infect cells of the lungs, kidneys, heart and intestine, resulting in the organ damage leading to the multiple organ dysfunction syndrome (Shin et al., 2020; Yang, 2021; Wu et al., 2020a, 2020b). Infection

with these highly pathogenic coronaviruses (SARS-CoV-2) could result in the acute respiratory distress syndrome (ARDS) and acute lung injury (ALI) followed by the failure of the lungs function and death (Shin et al., 2020; Yang, 2021; Wu et al., 2020a, 2020b). Therefore, interaction between coronavirus, SARS-CoV-2 and the host may be responsible for its unusual high morbidity and mortality (Zhang et al., 2020a, 2020b, 2020c; Zheng et al., 2009; Zhou et al., 2020a, 2020b; Zhu et al., 2020). People infected with COVID-19 generally develop signs and symptoms including mild respiratory symptoms, fever, common cold, running nose, severe headache, dry cough, fatigue, shortness of breath, and loss of smell on an average of 5–6 days after infection but may ranges from two to fourteen days (Shereen et al., 2020; Wu et al., 2020a, 2020b; Wang et al., 2020; V'kovski et al., 2020). Furthermore, coronavirus-2 (SARS-CoV-2) is zoonotic infecting both animal and human (Shereen et al., 2020; Shin et al., 2020; Wu et al., 2020a, 2020b; Wang et al., 2020). Airborne transmission, particularly *via* nascent aerosols from human atomization, is highly virulent and represents the dominant route for the transmission of covid-19 disease (Shin et al., 2020; Yang, 2021; Malabadi et al., 2021a). Coronaviruses have been identified in human and several avian hosts as well as in various mammals, including pigs, chicken, camels, bats, Himalayan palm civets, mice, dogs, and cats (Wu et al., 2020a, 2020b; Wang et al., 2020; Shin et al., 2020; Malabadi et al., 2021a, 2021b). SARS-CoV-2 is a RNA enveloped coronavirus responsible for the pandemic of the Severe Acute Respiratory Syndrome. RNA viruses are characterized by a high mutation rate, up to a million times higher than that of their hosts (Zhu et al., 2020; Shin et al., 2020; Yang, 2021). The pathogen, severe acute respiratory syndrome coronavirus (SARS-CoV-2) shared a phylogenetic similarity to SARS-CoV (about 79%) and Middle East respiratory syndrome (MERS-CoV) (about 50%) (Zhang et al., 2020a, 2020b, 2020c; Zheng et al., 2009; Zhou et al., 2020a, 2020b; Zhu et al., 2020). Furthermore, the genome sequence of coronavirus (SARS-CoV-2) also showed phylogenetic similarity to one of the species of bats (80%)





## Role of Substituent Position in Coumarin Derivatives during their Interaction with TiO<sub>2</sub> Nano Particles

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### Abstract

The effect of position of benzo group in coumarin derivatives, 5,6 benzo-4-azidomethyl coumarin (5BAMC) and 7,8 benzo-4-azidomethyl coumarin (7BAMC) during their interaction with TiO<sub>2</sub> nanoparticles in ethyl acetate, tetrahydrofuran, butan-1-ol and acetonitrile solvents has been studied using different spectroscopic methods and electrochemical analysis. Benesi-Hildebrand plots indicate that nature of interaction between 7BAMC and TiO<sub>2</sub> is 1:2 in solvent with low dielectric constant whereas for 5BAMC and TiO<sub>2</sub>, it is 1:1 in all the solvents. From the fluorescence quenching study and binding equilibria analysis, it is observed that interaction between 5BAMC and TiO<sub>2</sub> depends on the dielectric constant of the solvent. Time resolved quenching study reveals that quenching is dynamic for 5BAMC in solvent with high dielectric constant. Whereas for 7BAMC, it is dynamic in solvent with low dielectric constant. Hence the nature of interaction of these two coumarin derivatives with TiO<sub>2</sub> NPs is different. From electrochemical analysis, it is observed that, free energy change for electron transfer is more negative for 5BAMC-TiO<sub>2</sub> compared to 7BAMC-TiO<sub>2</sub> therefore quenching is more efficient for 5BAMC-TiO<sub>2</sub> compared to 7BAMC-TiO<sub>2</sub> system, which is also confirmed from fluorescence quenching studies. Non-radiative energy transfer rate is more than radiative energy transfer rate for both the systems according to FRET study.

**Keywords** Interaction · Binding equilibria · Electron transfer · Substituent · Aprotic solvent

### Introduction

Titanium dioxide (TiO<sub>2</sub>) nanoparticles (NPs) are highly stable, anticorrosive and possess physicochemical properties. They are extensively used in industries because of their catalytic activity. TiO<sub>2</sub>NP is a wide band gap semiconductor and shows significant alteration in its properties with band gap tuning. Hence TiO<sub>2</sub> NPs are used in photo optics, solar cells and electronic devices. When TiO<sub>2</sub> NPs are exposed to UV

in photodynamic therapy (PDT) for the treatment of a wide range of diseases, from psoriasis to cancer. These NPs are used in all the branches of medicine because of their ability to deliver drugs at specific sites in optimum dosage range with weakened side effects [1–3]. Many researchers have studied the interaction of TiO<sub>2</sub> NPs with bio macromolecules since TiO<sub>2</sub> NPs are biologically active and biocompatible. Such studies throw more light on interaction mechanisms between inorganic materials and bio macromolecules which is im-



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## UNF FACULTY RESEARCH AND SCHOLARSHIP

### Ionic liquid catalyzed Ritter reaction/Pd-catalyzed directed Ortho-arylation; facile access to diverse libraries of biaryl-amides from Aryl-nitriles

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**Abstract**

Diverse libraries of biaryl-amides bearing N-t-butyl and N-adamantyl groups were synthesized in two steps by the Ritter reaction of aryl-nitriles, using tBuOH and AdaOH as carbocation precursors, and employing [BMM](SO<sub>3</sub>H)[[OTf] (neat or with [BMIM][PF<sub>6</sub>] as co-solvent) or tetramethyl guanidinium-ILs [TMG][X] (X = CF<sub>3</sub>COO, EtOSO<sub>3</sub>) as dual catalyst/solvent, followed by a Pd-catalyzed directed regioselective ortho-arylation of the Ritter amides with Ar-X (X = I, Cl). The feasibility to perform the two-steps in sequence is also demonstrated, and potential for recycling/reuse of the ILs is also shown. Preference for [Pd] coordination to the amide carbonyl versus amide nitrogen is borne out by DFT computations.



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Article

## Synthesis, characterization, photo physical and DFT studies of bicoumarin and 3-(3-benzofuranyl)coumarin derivatives

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### Abstract

A series of novel bicoumarin and 3-(3-benzofuranyl) coumarin derivatives were synthesized by the reaction of salicylaldehyde and substituted coumarin 4-acetic acid/benzofuran-3-acetic acid using cyanuric chloride. The scaffolds were characterized by spectral analysis. The significant photophysical fundamentals for organic electronic applications such as thermal stability, strong and broad optical absorption were investigated for the synthesized compounds. Optical properties are studied in detail by UV-Vis absorption and fluorescence spectroscopy. Optical band gaps of the bicoumarin and 3-(3-benzofuranyl)coumarin derivatives were found to be 2.00–3.07 eV as calculated from their onset absorption edge. The bicoumarin and 3-(3-benzofuranyl)coumarin derivatives exhibit high thermal stability up to 239–367 °C. Density functional theory computation was performed to understand intramolecular charge transfer property. Photophysical studies designate that, the synthesized materials are potential candidates and play an important role in organic electronic applications.



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## Influence of furfuraldehyde derivatives as corrosion inhibition of mild steel in hydrochloric acid solution

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### Keywords

1. Corrosion of metals,
2. Corrosion inhibitors,
3. Furfuraldehyde derivatives,
4. Inhibition efficiency,
5. Adsorption isotherm.

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### Abstract

Furfuraldehyde derivatives have been prepared by the condensation reaction between furfuraldehyde with urea (CFU) & furfuraldehyde with thiourea (CFTU). The products were subjected to corrosion inhibition studies on mild steel in hydrochloric acid solution using chemical and electrochemical methods. The maximum inhibition efficiency of 88.09 in case of CFU and 90.47 in case of (CFTU) were observed in optimum  $5 \times 10^{-3}$  M/L concentration inhibitor. Results also showed that the prepared compounds control the corrosion of mild steel in hydrochloric acid solution. The CFTU showed better corrosion inhibition than CFU. Nevertheless, both these compounds possessed good interaction with the metal surface and formed a barrier between metal and solution interface. Various parameters such as, activation energy, enthalpy of activation, free energy of activation and entropy of activation were calculated and interpreted. The negative values of  $\Delta G_{ads}$  showed the spontaneous adsorption of the inhibitor on the metal surface. The products control both anodic and cathodic reactions and acts as mixed type of inhibitors. The calculated percentage inhibition efficiency obtained from both the methods nearly same. The mode of corrosion inhibition was explained on the basis of adsorption of the inhibitor on metal surface. Interaction of the inhibitors with the metal surface was assessed by FTIR technique and change of surface morphology was characterized by SEM technique.

### 1. Introduction

Mild steel is one of the most promising materials for the fabrication of various industrial equipment's. But it undergoes corrosion when exposed to corrosive environment and is the major drawback to use for a long period of time. However, when the material is in contact with the chloride ions in the corrosive medium, these ions induced the metals and alloys to undergo different forms of corrosion. Hydrochloric acid is the most commonly preferred acid for descaling, acid pickling and other industrial cleaning purpose [1-3]. Extreme care is taken to handle such an acid even at dilute concentration is also high



Article

## Investigation of Dolichandra unguis-cati leaves extract as a corrosion inhibitor for mild steel in acid medium

May 2021 · Current Research in Green and Sustainable Chemistry 4(10):100113

DOI: [10.1016/j.crgsc.2021.100113](https://doi.org/10.1016/j.crgsc.2021.100113)

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### Abstract

Electroactive compounds extracted by the leaves of *Dolichandra unguis-cati* (DUCLE) have been utilized for corrosion studies on mild steel in HCl solution. Mass-loss, Potentiodynamic Polarization, and Electrochemical impedance measurements were applied in the evaluation. The DUCLE forms a light coating on the surface of the metal, which helps in controlling the corrosion. The percentage inhibition performance, cathodic Tafel slopes, anodic Tafel slopes, and corrosion current density were evaluated. The maximum  $\% \eta_w$  observed was 93.61 in 1 M HCl at 0.76 (g/L) concentration of DUCLE inhibitor after 3 h of immersion at  $300 \pm 1K$ . DUCLE functions as a mix type inhibitor and, DUCLE adsorption on the mild steel fits the Langmuir isotherm. The inhibitor potential for mild steel was acquired by various concentrations of inhibitor. Thermodynamic specifications disclose the corrosion inhibition process was spontaneous and exothermic. The values of  $\Delta G_{adso}$  lie between  $-31.585$  and  $-32.45$   $\text{kJ mol}^{-1}$  for 1 M HCl. FT-IR, AFM, SEM, and contact angle techniques were used to characterize the DUCLE inhibitor's relationship on the surface of mild steel.



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# Corrosion protection of soft-cast steel in 1 M HCl with *Araucaria heterophylla* leaves extract

WILEY

July 2021 | *Electrochemical Science Advances*

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## Abstract and Figures

The mass-loss, polarization tests, and electrochemical impedance spectroscopic strategies were applied to assess the inhibition performance of the environmentally friendly inhibitor *Araucaria heterophylla* leaves extract (AHLE) for soft-cast steel corrosion safety in 1 M HCl at  $300 \pm 1$  K. The environmentally friendly inhibitor creates a protective coat on soft-cast steel that decelerates the corrosion process in acidic environments. The percentage inhibition effectiveness, corrosion current density, corrosion potential, cathodic and anodic Tafel slopes are being assessed. The outcomes of chemical and electrochemical research are almost similar. The inhibitor's inhibition activity was well illustrated by the AHLE adsorption on soft-cast steel follows the Langmuir adsorption isotherm. According to the study, AHLE is a mixed kind of inhibitor. Experiments were conducted with varying inhibitor amounts and temperatures. The calculated  $\Delta G_{\text{ads}}$  values were in the range of  $-33.75$  to  $-34.40$  kJ/mol, which discloses the corrosion inhibitory action is exothermic and spontaneous. Scanning electron microscopy, Fourier transform infrared spectroscopy, and contact angle techniques were used to determine the association of the AHLE on the metal surface.



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## Corrosion inhibition effect of *Cycas revoluta* leaves extract on corrosion of soft-cast steel in hydrochloric acid medium

Manohar R. Rathod, S. K. Rajappa

First published: 19 May 2021 | <https://doi.org/10.1002/elsa.202100059> | Citations: 6

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### Abstract

The inhibition action of environmentally sustainable inhibitor *Cycas revoluta* leaves extract (CRLE) for corrosion protection of soft-cast steel in a solution of HCl was assessed with electrochemical and chemical methods. The eco-friendly inhibitor forms a thin coating on soft-cast steel and slows the corrosion in acid media. The percent inhibition performance, corrosion current density, corrosion potential, and both anodic and cathodic slopes for Tafel were calculated. The results for electrochemical and chemical research are in beneficial correlation with each other. The inhibitor's inhibitory ability was well illustrated by the CRLE adsorption on soft-cast steel followed the Langmuir isotherm. The investigations reveal that CRLE is a mixed form of inhibitor. Studies were performed with varying inhibitor amounts and temperatures. Thermodynamic parameters were calculated, and it shows that the corrosion inhibition effect is spontaneous and exothermic. The interaction of the plant extract was characterized by SEM, FTIR, contact angle measurements, and AFM techniques.

### Abbreviations

CRLE

*Cycas revoluta* leaves extract

## 1 INTRODUCTION

Soft-cast steel is commonly used for mass production for its cheap rate, mechanical strength, and deformability, and plenty of other features.<sup>[1]</sup> Industries heavily depend on the metal and their alloys, and during this process, they are exposed to corrosive media to form a stable compound and during this process mass loss of the metal occurs, and the external metal surface corrodes and termed as corrosion. Acid treatments for industrial applications

Figures References Related Information

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## Synthesis, spectroscopic properties, and DFT correlative studies of 3,3'- carbonyl biscoumarin derivatives

May 2021 - Journal of Molecular Structure 1243(16):130781

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### Abstract

A facile and simple method for the synthesis of a library of 3,3'- Carbonyl biscoumarin derivatives via a one-pot chemical reaction is reported. The synthesized fluorescent dyes were purified and characterized by analytical methods. The IR, <sup>1</sup>H-NMR, and MS results confirmed the corresponding structure of the fluorescent dyes. The absorption and fluorescence spectra of fluorescent dyes were recorded in different solvents of varying polarity to understand the solvatochromic behaviour and dipole moments. Stoke's shift exhibits a redshift with an increase in solvent polarity for all molecules indicating a  $\pi-\pi^*$  transition. The ground state dipole moments of all fluorescent dyes are estimated theoretically from ab initio computations (integral equation formalism of polarizable continuum model) and experimentally from the solvatochromic method and the results are compared. Further, using solvatochromic correlations like Lippert's, Bakhshiev's, Kawski-Chamma-Viallet's, and solvent polarity parameter the excited state dipole moments are determined. Results show that the excited state dipole moments are higher than the ground state dipole moments which suggests that, all fluorescent dyes are more polar in the excited state. The HOMO-LUMO energy gaps computed from density functional theory and absorption threshold wavelengths are found to be in good agreement and also support intramolecular charge transfer (ICT). Using HOMO-LUMO energies, the chemical hardness ( $\eta$ ) of the molecules is determined and the chemical stability is discussed. Further, using DFT molecular electrostatic potential (MESP) plots, the electrophilic site and nucleophilic site which are useful in photochemical reactions were identified. The preliminary observations and results suggest that the fluorescent dyes can be considered as potential candidates for fluorescent probes and construction of dye-sensitized solar cell in future.



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Data Article

# Thermal and tensile properties study of 4-Hydroxycoumarin doped Polyvinyl alcohol/Chitosan blend films

Vinayak N. Vanjeri <sup>a</sup>, Naganagouda Goudar <sup>a</sup>, Deepak Kasai <sup>b</sup>, Saraswati P. Masti <sup>c</sup>,  
Ravindra B. Chougale <sup>a</sup>  

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## Abstract

In this study, we have prepared 4-Hydroxycoumarin (4HC) doped Polyvinyl alcohol/Chitosan (PC4HC) blend films by solution casting technique. The Differential Scanning Calorimetry (DSC) and Fourier Transform Infrared (FT-IR) Spectroscopic analysis confirm that prepared blend films were interactive and miscible. To check the thermal stability, Thermogravimetric Analysis (TGA) was performed and obtained results show that all the PC4HC blend films were stable as much as Polyvinyl alcohol/Chitosan (PC) blend film. The tensile properties revealed that the addition of 4HC slightly altered the properties of the PC4HC blend films. The surface wettability (or hydrophilicity) was studied by the drop method using a contact angle meter. Although pure Polyvinyl alcohol (PVA), Chitosan (CS) and PC films were hydrophilic by nature, after the addition of 4HC, hydrophilic nature of the PC films changes to hydrophobic.

## Graphical abstract

# Synthesis and Molecular Modeling Studies of Coumarin- and 1-Aza-Coumarin-Linked Miconazole Analogues and Their Antifungal Activity

Hemantkumar M. Savanur, Geeta M. Pawashe, Dr. Kang Min Kim✉, Dr. Rajesh G. Kalkhambkar✉

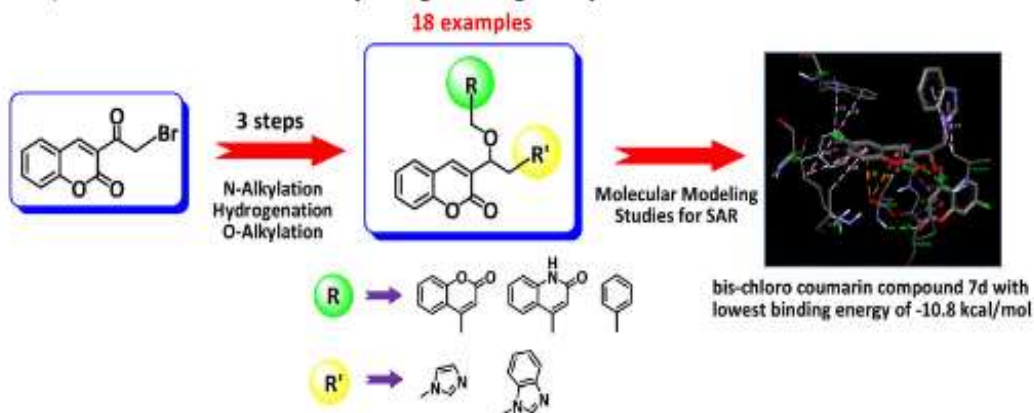
First published: 05 September 2018 | <https://doi.org/10.1002/slct.201801408> | Citations: 10

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## Graphical Abstract

A series of new coumarin and 1-aza coumarin analogues of miconazole (6 a-j) were synthesized from 3-bromoacetyl coumarins. Further diversification was achieved by synthesizing coumarin-benzimidazole hybrids of miconazole (7 a-j) and evaluated for *in-vitro* anti-microbial activities. The present investigation has shown that the introduction of benzimidazole in coumarin analogues of miconazole instead of imidazole (7 d) has marked effect on its anti-fungal activity, i.e the presence of chloro and benzimidazole further enhances its activity, which is not only evident from MIC values comparable to standard but also by its high binding affinity value at  $-10.8 \text{ kcal/mol}$ .



## Abstract

A series of new coumarin and 1-aza coumarin analogues of miconazole (6 a-j) were synthesized from 3-bromoacetyl coumarins. Further diversification was achieved by synthesizing coumarin-benzimidazole hybrids of miconazole (7 a-j) and evaluated for *in-vitro* anti-microbial activities. Amongst the tested compounds, 7 d was found to be particularly effective as anti-fungal agents against *C. albicans* and *C. krusei*, with activity comparable to that of the standard. Comparative Docking studies with mevalonate-5-diphosphatedecarboxylase shows better binding affinity than imidazole counterparts which is primarily attributed to extended  $\pi$ -alkyl interactions facilitated by benzimidazole.



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ZnO NPs Doped PVA/Spathodea campanulata Thin Films for Food Packaging.

**Authors**

Goudar, Naganagouda; Vanjeri, Vinayak N.; Kasal, Deepak; Gouripur, Gangadhar; Malabadi, Ravindra B.; Masti, Saraswati P.; Chougale, Ravindra B.

**Abstract**

The present study aims to investigate the influence of Zinc Oxide nanoparticles (ZnO NPs) on the physicochemical properties of poly(vinyl alcohol)/Spathodea campanulata bud fluid (PSC) matrix. The FTIR study assured the physical interaction between ZnO NPs and the PSC matrix. Tensile strength was enhanced by 18% with the incorporation of ZnO NPs into the PSC matrix. The DSC measurements depicted an increased glass transition temperature than PSC matrix at lower content of ZnO NPs. The thermal stability of nanocomposite films was remarkably improved (about 50 °C). The XRD results depicted the homogeneous distribution of ZnO NPs in the PSC matrix. The morphology studies revealed the homogeneity due to good dispersion of ZnO NPs. The water contact angle findings shown the nanocomposite films were hydrophilic. The nanocomposites have shown only 2.8% solubility in water. The WVTR of nanocomposite films was improved by 56%. The bionanocomposite films exhibited good antibacterial activity and excellent preservation capacity and could be a potent alternative to the nonbiodegradable packaging material.

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**DOI**

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Article

# Hydroxy citric acid cross-linked chitosan/guar gum/poly(vinyl alcohol) active films for food packaging applications

February 2021 · International Journal of Biological Macromolecules 177(36)

DOI: [10.1016/j.ijbiomac.2021.02.109](https://doi.org/10.1016/j.ijbiomac.2021.02.109)

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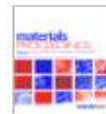
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## Abstract

The present work aims to prepare Chitosan (CS)/Guar gum (GG)/Poly(vinyl alcohol) (PVA) cross-linked with Hydroxy citric acid (HCA) (CGPH active film) by solvent casting technique. The influence of HCA on different CS/PVA ratio (1:3, 1:1, 3:1) in presence of the fixed amount of GG (0.2%) was investigated. The analysis of the results showed that the addition of HCA to the different ratio of CS/PVA increased the degradation temperature and improved the mechanical properties of CGPH active films. FTIR spectra and XRD analysis revealed strong interactions among the components of CGPH active films. The analysis of SEM images and water contact angle suggested a compact, dense film surface with hydrophobic nature. Further, all the active films have shown a decrease in water vapour permeability (WVP) and acted as a barrier to UV-light. CGPH active films effectively inhibited the growth of *S. aureus* and *E. coli* bacteria. With all these features the CGPH active films can find application in food packaging.



# Garcinia livingstonei leaves extract influenced as a mild steel efficient green corrosion inhibitor in 1 M HCl solution

Manohar R. Rathod<sup>a</sup>, S.K. Rajappa<sup>a</sup>  , A.A. Kittur<sup>b</sup>

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<https://doi.org/10.1016/j.matpr.2021.11.084>

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## Abstract

Garcinia livingstonei leaves extract (GLE) comprises several bioactive components. The environmentally sustainable inhibitor GLE was evaluated for mild steel (MS) corrosion control in 1 M HCl solution, employing mass loss, electrochemical impedance spectroscopy, and Tafel polarization methods. The GLE adsorption showed the ability of inhibitor on MS. GLE appears to be a mixed inhibitor. The rate of corrosion, inhibitor performance and effect of temperature were studied. Adsorption thermodynamic parameters were computed and interpreted. FT-IR spectra indicated GLE adsorption on the MS surface. SEM, AFM, and contact angle investigations revealed the modification of MS surface morphology in presence of GLE.

## Introduction

Metals and their alloys have many engineering applications because they are low-cost materials and have high mechanical properties [1]. They are extensively used for the industrial process where they undergo frightful corrosion. HCl and H<sub>2</sub>SO<sub>4</sub> are often used for cleaning, pickling, etching, descaling, acidizing oil wells [2], [3]. The consumption of acid and mass loss of the metal can be reduced by adding the corrosion inhibitor [4]. Due to the destructive effect of acids in industries, several metal parts get corroded and cause economic loss. To control the rate of corrosion, many inhibitors are synthesized in the laboratory. Most organic inhibitors comprise heteroatoms like O, N, S, etc., that create a thin layer on the metal surface and inhibit corrosion [5], [6]. Despite of many benefits,





Data Article

# UV screening, swelling and in-vitro cytotoxicity study of novel chitosan/poly (1-vinylpyrrolidone-co-vinyl acetate) blend films

Tilak Gosti <sup>a</sup>, Vishram D. Hiremani <sup>a</sup>, Sarala P. Satoraddi <sup>a</sup>, Vinayak N. Varjeri <sup>a</sup>,  
Naqanagouda Gaudar <sup>a</sup>, Saraswati P. Mochi <sup>a</sup>, Ravindra B. Chauale <sup>a</sup>,  
Ravindra B. Malabadi <sup>a</sup>

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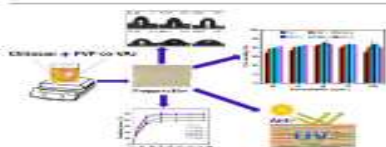
## Highlights

- Novel CS/PVP-co-VAc blend films were prepared via solvent casting technique.
- CSP blend films showed enhanced UV screening property.
- Swelling index of CSP films increased about ≈91.5% than pure CS.
- In-vitro cytotoxicity of the CSP blend films had MMT (%) assay > 90% against HEK296 cell line.

## Abstract

The novel Chitosan (CS)/ Poly (1-vinylpyrrolidone-co-vinyl acetate) (PVP-co-VAc) blend films (CSP) were prepared by solvent casting method. The film properties were studied by FT-IR spectroscopy, UV-visible spectroscopy, Thermal analysis, and Water contact angle. The light transmittance and UV screening rate of CSP films remarkably increased (85.22%) than CS film. The CSP blend films attained high thermal stability as well as glass transition temperature ( $T_g$ ) than CS. The surface roughness and hydrophilicity of the CSP films significantly enhanced by the influence of PVP-co-VAc that leads to increase in the swelling property of the CSP films about ≈91% than CS film. In addition, in-vitro cytotoxicity of the CSP films showed cell viability (%) > 90% against human embryonic kidney cell line. These results suggest that the prepared CSP blend films have the potential to be implemented in the field of UV screening barriers, drug delivery and wound dressing material.

## Graphical abstract



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# Physicochemical and Antibacterial Evaluation of Poly (Vinyl Alcohol)/Guar Gum/Silver Nanocomposite Films for Food Packaging Applications

Original Paper | Published: 25 March 2021

Volume 29, pages 3347–3363, (2021) [Cite this article](#)

[Tilak Gasti](#), [Vishram D. Hiremani](#), [Sheetal Suresh Kesti](#), [Vinayak N. Vanjeri](#), [Naganagouda Goudar](#), [Saraswati P. Masti](#), [Shivasharana Chandrabanda Thimmappa](#) & [Ravindra B. Chougale](#) 

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## Abstract

In this study, we prepared Poly (vinyl alcohol) (PVA)/Guar gum (GG) based nanocomposite films with a different weight ratio of silver nanoparticles (AgNPs) via in situ approach using GG itself as a reducing agent and PVA as a capping as well as stabilizing agent at room temperature. The in situ synthesized AgNPs in the PVA/GG matrix was confirmed by surface plasmon resonance (420–450 nm) and SEM-EDAX analysis. The average size of AgNPs was found to be 10 nm determined by XRD. The light transmittance is greatly influenced by the AgNPs. At an optimal concentration of AgNPs (6.8 mg), PVA/GG/Ag nanocomposite films showed improved tensile properties ( $T_s$ —23.93 MPa) and the water vapor transmission rate. The incorporation of AgNPs has significantly enhanced the hydrophobicity (~ 77%) as well as the thermal stability (~ 61.39%) of the PVA/GG film. The overall migration rate of the nanocomposite films with the three food simulants was shown significantly below the permitted limit of 10 mg/dm<sup>2</sup>. Further PVA/GG/Ag nanocomposite films showed a lower soil burial degradation rate than PVA/GG film and good antibacterial properties against environmental microorganisms such as *S. aureus* and *E. coli* bacteria. The results suggest that the prepared films can be used as promising food packaging materials.

# Dielectric relaxations and ion transport study of NaCMC:NaNO<sub>3</sub> solid polymer electrolyte films

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## Abstract

Na<sup>+</sup> ion-conducting solid polymer electrolyte (SPE) of sodium salt of carboxymethyl cellulose (NaCMC) doped with sodium nitrate (NaNO<sub>3</sub>) was developed by solution casting method. FTIR technique confirmed the formation of hydrogen bonding between NO<sub>3</sub><sup>-</sup> anion and functional groups of NaCMC. XRD study revealed the low degree of crystallinity that reduced upon doping. Impedance spectroscopy was adapted in order to analyze the conductivity and dielectric relaxation phenomena of the polymer-salt complex. FTIR deconvolution technique was employed to understand the factor that influences the ionic conductivity in SPE; concentration of mobile ions and ionic mobility both play a vital role. Ion transference number has been found out to be > 0.97 for all samples indicating that the conducting species are primarily ions. The highest ionic conductivity of  $3 \times 10^{-3} \text{ Scm}^{-1}$  with the mechanical strength of 30.12 MPa was achieved for a host containing 30 wt. % NaNO<sub>3</sub> at ambient temperature.

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**Sections** **Figures** **References**

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[Ethics declarations](#)

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## ***In-vitro* antibacterial activity of neem, clove, and cinnamon against *Actinobacillus* sp., isolated from chronic periodontitis patients**

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(Received: October 2019    Revised: April 2020    Accepted: May 2020)

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### **ABSTRACT**

**Introduction and Aim:** Periodontal diseases represent possible reservoirs of opportunistic bacteria in the oral cavity, which display important evidence properties and cause a wide range of human systematic diseases including pneumonia, septicemia, and endocarditis. The aim of the study is to isolate, identify, and characterize the periodontal pathogens from infected patients and to check the antimicrobial activity of the isolated pathogen against neem, clove, and cinnamon on extracts.

**Materials and Methods:** In the present study, the five clinical samples were collected from patients suffering from chronic periodontitis in the age group ranging from 16-30 years. Dental pathogen *Actinobacillus* sp. were isolated from clinical samples. The antimicrobial assay was carried by agar well diffusion method at 2%, 4%, 6%, 8%, and 10% concentration of neem, clove, and cinnamon in aqueous and acetone solvents. The standard antibiotics tetracycline and azithromycin (30mcg/ml) were used as a positive control.

**Results:** The results of the antimicrobial assay of aqueous extracts of clove and neem were showed an effective zone of inhibition (24 and 22 mm) against *Actinobacillus* sp. at 10% concentration, while cinnamon aqueous extracts exhibited a moderate zone of inhibition (16 mm) at the same concentration. The acetone extracts of neem and clove exhibited effective inhibitory action (20 and 18 mm) against *Actinobacillus* sp. compare to cinnamon, which showed a moderate zone of inhibition (14 mm).

**Conclusion:** It can be concluded from the study that neem, clove, and cinnamon extracts can be explored as an

Article

## Recent Advances in the Synthesis of Diverse Libraries of Small-Molecule Building Blocks in Ionic Liquids (ILs)

November 2021 | Synlett 33(07)

DOI: 10.1055/s-0049-1719852

Authors:



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University of North Florida



**Rajesh Kalkhambkar**



**Suresh M. Sutar**



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Citations (2)

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### Abstract

The Account describes recent advances, from the authors' laboratories, in the synthesis of diverse libraries of small-molecule building blocks employing ionic liquids (ILs). The ability of ILs to act as catalysts/promoters/solvents for electrophilic and onium ion chemistry, as well as in metal-mediated cross-coupling reactions, and the potential to sequence/hyphenate these methods, have opened up new opportunities for facile assembly of functional small molecules with increased complexity from readily available precursors. While Brønsted acidic IL/IL solvent mixtures are suitable media for carbocation and onium ion chemistry, piperidine-appended IL/IL solvent mixtures can successfully catalyze a variety of base-catalyzed reactions. Several widely practiced transformations including 'name reactions' were adapted and performed efficiently in ILs. 1 Introduction 2 Aryliodonium Salts and Aryltriazenes as Coupling Partners in Metal-Mediated C–C Cross-Coupling Reactions in ILs 3 Expanding the Scope of Metal-Mediated Cross-Coupling Reactions in ILs 4 Application of ILs in Synthesis and Functionalization of Heterocycles 5 Expanding the Scope of Amide Synthesis in ILs 6 Generation and Chemistry of 'Tamed' Propargylic Cations in ILs 7 Newer Nitration Methods for Arenes and Heteroarenes in ILs 8 Halofunctionalization in ILs 9 'Name Reactions' and Other Widely Practiced Synthetic Transformations in ILs 9.1 The Bignelli Reaction 9.2 Nitrile Synthesis by the Schmidt Reaction 9.3 Rupe Rearrangement 9.4 Synthesis of 1,3-Dioxanes via Prins Reaction in [BMIM][SO<sub>3</sub>H][OTf] 9.5 Synthesis of Cyclopropanes and Oxiranes by the Corey–Chaykovsky (CC) Reaction 10 Conclusions and Closing Remarks

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# Ultrasonic Assisted Facile Synthesis of *N*-Arylamides Using Nitriles and 1-Aryltriazenes Precursors Promoted by Brønsted Acidic Ionic Liquid under Metal-Free Conditions

Suraj M. Sutar, Dr. Rajesh G. Kalkhambkar ✉

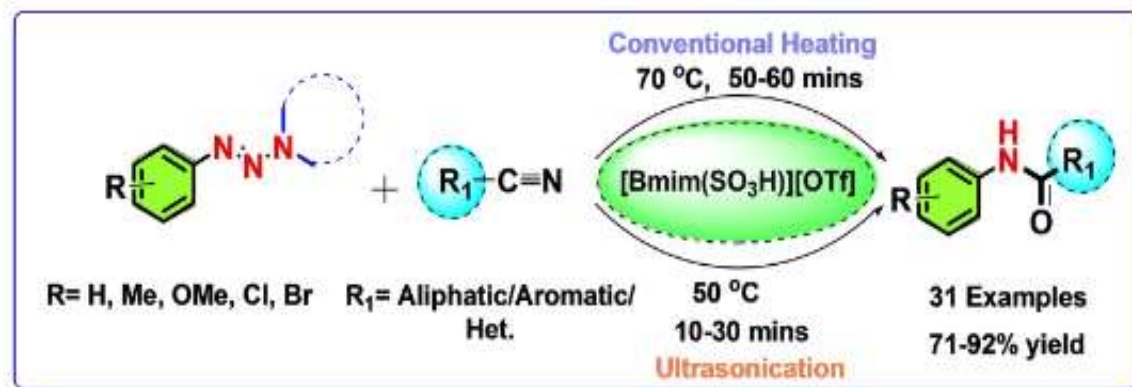
First published: 01 July 2021 | <https://doi.org/10.1002/slct.202101855> | Citations: 4

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## Graphical Abstract

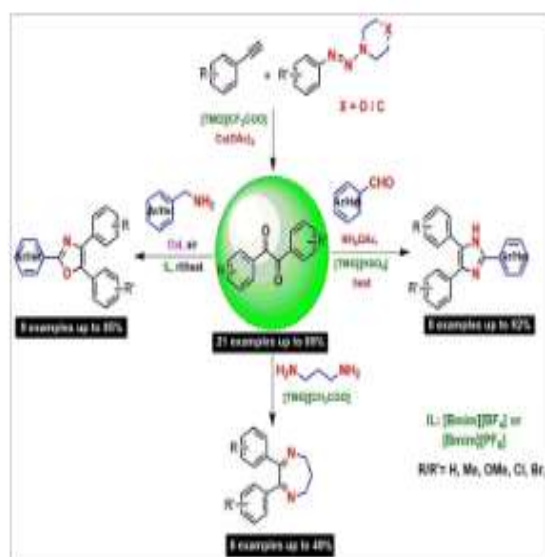
Synthetically important *N*-arylamides were synthesized using 1-aryltriazenes and Brønsted acidic ionic liquid as a promoter via metal-free amination pathway that take place by cleavage of C–N bond by conventional heating as well as under ultrasonication. Various derivatives of nitriles were used to build a range of compounds. A combined green approach is used over traditional methodology to synthesize these compounds in good to better yields. The recycling and re-usability of ionic liquid is advantageous in obtaining the greater yields of products.





3 years ago

## Copper-Catalyzed Coupling of Arylethynes and Aryltriazenes to Access Libraries of 1,2-Diketones and Their Efficacy in Synthesis of Triaryloxazoles, Imidazoles and Diaryl-Diazepines



Suraj M. Sutar, Pavanikumar Prabhala, Hemantkumar M. Savanur, Rajesh G. Kalkhambkar, Gopalakrishnan Aridoss, Kenneth K. Laali

Libraries of diaryl-1,2-diketones were synthesized by oxidative coupling of 1-aryl-ethynes with 1-aryl-triazenes, employing tetramethylguanidium ionic liquid  $[\text{TMG}][\text{CF}_3\text{COO}]$  and  $\text{Cu}(\text{OAc})_2$ . The synthesized compounds served as scaffolds for facile one-pot synthesis of diverse libraries of pharmaceutically important heterocycles in ionic liquid solvents. Thus BMIM-ionic liquid/ $\text{CuI}$  was utilized for the synthesis of triaryl-oxazoles,  $[\text{TMG}][\text{HSO}_4]/\text{NH}_4\text{OAc}$  was used to prepare triaryl-imidazoles, and  $[\text{TMG}][\text{OAc}]$  was employed for the synthesis of diaryl-diazepines. Reactions were performed in fresh as well as in recycled ionic liquids. The reported methods expand the available protocols for the synthesis of diaryl-1,2-diketones, and enable facile access to pharmaceutically important nitrogen heterocycles.

Full Paper

## Palladium Catalyzed Electrophilic C2-Arylation of Azoles by Aryltriazenes in Ionic Liquid Promoted by Acidic Ionic Liquid

Suraj M. Sutar, Dr. Hemantkumar M. Savanur, Dr. Chidanand Patil, Pavankumar Prabhala,  
Dr. Gopalakrishnan Aridoss ✉, Dr. Rajesh G. Kalkhambkar ✉

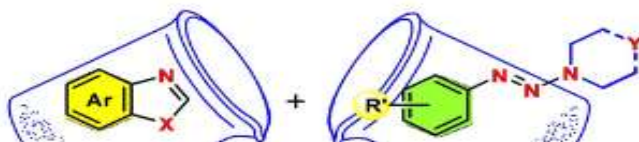
First published: 20 October 2020 | <https://doi.org/10.1002/slct.202002854> | Citations: 12

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### Graphical Abstract







Biologically important aromatic compounds such as benzoxazole, benzothiazole, benzimidazole derivatives were synthesized using 1-aryltriazenes as a coupling source at C-2 position in azole rings using ionic liquid as solvent and acid promoter. A green approach is used over traditional methodology to synthesize these compounds in better yields. The recycling and re-usability of ionic liquid is advantageous in obtaining the greater yields of products.




X = O, S, NH, N-Me  
Y = O / CH<sub>2</sub>



# “Synthesis, molecular modelling studies and antimicrobial activity of Coumarin and 1-Azacoumarin linked 1,2,3- Triazole”

[Suraj M. Sutar](#)<sup>a</sup>, [Hemantkumar M. Savanur](#)<sup>b</sup>, [Chidanand Patil](#)<sup>c</sup>, [Geeta M. Pawashe](#)<sup>a</sup>,  
[Gopalakrishnan Aridoss](#)<sup>d,e</sup>  , [Kang Min Kim](#)<sup>f</sup>  , [Rajesh G. Kalkhambkar](#)<sup>a</sup>  

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<https://doi.org/10.1016/j.cdc.2020.100480> 

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## Abstract

Diversely substituted Coumarin/1-Azacoumarin and 1,2,3-triazole appended Miconazole analogues were synthesized in moderate to good yield and evaluated for their possible antimicrobial potencies along with molecular docking studies. This revealed that compounds **5b/6b** and **6f/6g** emerged as promising leads towards the antibacterial and antifungal agents respectively with comparable inhibitory potencies to that of the standard drugs.

## Graphical abstract



# Liquid fuel synthesis from *Leonotis nepetifolia* seeds through in-situ transesterification method

Sangeeta D Benni, Ravindra S Munnolli, Kariyappa S Katagi ✉, Nikhil S Kadam & Mahesh C Akki

Received 06 Feb 2020, Accepted 24 Jun 2020, Published online: 07 Aug 2020

“ Cite this article <https://doi.org/10.1080/15567036.2020.1790697>



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## ABSTRACT

In the present research work, biodiesel is produced by in-situ technique using directly the dried seeds of *Leonotis nepetifolia*. Herein, methanol plays a dual role, as solvent for extraction of oil from the seeds of *Leonotis nepetifolia* and as a reactant in the process of alcoholysis in presence of KOH catalyst. The influence of seed to methanol molar ratio, reaction time, temperature and catalyst loading is investigated. The result showed that the maximum yield of about 96% is obtained with 1: 393 molar ratios of seed oil to methanol at 60°C, using 3.0% (w/w) KOH catalyst for 100 min. Biodiesel parameters are experimentally evaluated and calculated by using various mathematical models. The experimentally determined and empirically calculated fuel properties of *Leonotis nepetifolia* methyl esters are found comparable with the existing biodiesels and

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## Ervatamia Coronaria Seed Oil for Biodiesel Production: An Investigative Approach Via Fatty Acid Chemistry

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\*\*\*

**Abstract**— The use of non-edible seed oils for biodiesel production is gaining much attention due to the great demand of edible oils in food industries. The present research work deals with the optimization of transesterification of *Ervatamia coronaria* seed oil (ECSO) with varying methanol to oil molar ratio in the range from 4:1 to 8:1, using various alkaline catalysts such as NaOH, KOH, NaOCH<sub>3</sub>, KOCH<sub>3</sub> in the concentration range of 0.50-1.50% by weight, reaction temperature from 50–70°C and stirring rate from 350-800 rpm keeping fixed reaction time of 100 min. The optimum set of transesterification reaction conditions of 0.90% NaOCH<sub>3</sub> as catalyst, methanol to oil molar ratio of 6:1, reaction temperature of 65°C and stirring rate of 650 rpm yielded 98.3% fatty acid methyl esters (FAMEs) of *Ervatamia coronaria* seed oil (ECME). The biodiesel properties satisfy ASTM and EN standards.

**Keywords**- Fatty acid methyl ester, *Ervatamia coronaria*, non-edible seed oil, biodiesel, transesterification.

### 1. Introduction

Around the year 1900 the mechanical engineer Rudolf Diesel proposed an idea of using vegetable oil as a substitute for

# Understanding the binding interaction between phenyl boronic acid P1 and sugars: determination of association and dissociation constants using S-V plots, steady-state spectroscopic methods and molecular docking

Raveendra Melavanki<sup>1 2</sup>, Kalpana Sharma<sup>1 2</sup>, Basappa Chanabasapa Yallur<sup>2 3</sup>, Raviraj Kusanur<sup>2 4</sup>, Kishor Kumar Sadasivuni<sup>5</sup>, Diksha Singh<sup>6</sup>, Smita Mane<sup>7</sup>, Kariyappa Katagi<sup>7</sup>, Shridhar V Pattar<sup>8</sup>

Affiliations [+](#) expand

PMID: 32790047 DOI: [10.1002/bio.3931](https://doi.org/10.1002/bio.3931)

## Abstract

Continuous monitoring of glucose and sugar sensing plays a vital role in diabetes control. The drawbacks of the present enzyme-based sugar sensors have encouraged the investigation into alternate approaches to design new sensors. The popularity of fluorescence sensors is due to their ability to bind reversibly to compounds containing diol. In this study we investigated the binding ability of phenyl boronic acid P1 for monosaccharides and disaccharides (sugars) in aqueous medium at physiological pH 7.4 using steady state fluorescence and absorbance. P1 fluorescence was





# Investigation on Fatty Acid Chemistry and Fuel properties of *Cannarium vulgar* and *Haemostaphis baterii* seed oils: An approach for the production of Clean Fuel

Nikhil S Kadam, Kariyappa S Katagi\*

Department of Chemistry, Karnatak Science College, Dharwad, India.

Corresponding author E-mail: kskatagi69@gmail.com

**Abstract:** *Cannarium vulgar* and *Haemostaphis* seeds yields 63 and 54.5 % of seed oil content respectively. The Fatty acid profile of the seed oils is obtained from the literature. The fatty acid profile of selected seed oils is utilized for the evaluation of various fuel properties by using standard mathematical models. The physicochemical properties like Saponification Value, Iodine Value, Molecular weight and Fuel properties like Cetane Number, Cloud point, Flash point Higher heating value, Lower heating value are evaluated. The results obtained are compared with biodiesel properties with the biodiesels in practice and with petro-diesel. The biodiesel properties investigation on *Cannarium vulgar* and *Haemostaphis baterii* seeds, satisfy the major specifications of biodiesel standards. The fuel properties of seed oils under study shown comparable results. These resulted Cetane Numbers (CN) 59.05 and 43.64, Cloud points (CP) 14.8 0C and -4.23 0C, Flash points (FP) 137 0C and 214 0C, Higher Heating Values (HHV) 40.33 MJ/Kg and 39.02 MJ/Kg, Lower Heating Values (LHV) 38.68 MJ/Kg and 37.7 MJ/Kg, Kinematic viscosities (KV) 3.6 mm<sup>2</sup>/sec and 3.8 mm<sup>2</sup>/sec and Pour points (PP) 8.76 0C and -10.2 0C investigated for *Cannarium vulgar* Seed Oil Methyl Esters (CVSOMEs) and *Haemostaphis baterii* Seed Oil Methyl Esters (HBSOMEs).

**Key Words:** *Cannarium vulgar*, Clean Fuel, Fatty Acid Chemistry, Fuel properties, *Haemostaphis baterii*.

# Design, synthesis, molecular docking, anti-proliferative and anti-TB studies of 2H-chromen-8-azaspiro[4.5]decane-7,9-dione conjugates

October 2020 - Journal of Molecular Structure 1227:129530

DOI:10.1016/j.molstruc.2020.129530

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## Abstract

In this work, a series of new 8-[(substituted 2-oxo-2H-chromen-4-yl)methyl]-8-azaspiro[4.5]decane-7,9-dione derivatives (1a - 1l) is synthesized and characterized by <sup>1</sup>H NMR, <sup>13</sup>C NMR, FT-IR, GC-MS and elemental analysis. In addition, the structure of compound 1k has been elucidated using single crystal X-ray diffraction techniques. The synthesized compounds are screened for their anticancer and anti-TB activity. Preliminary anticancer results showed that compounds (1a- 1l) exhibit moderate to potent activity against MDA-MB-231, A549, HT-29 and HeLa cancer cell lines. Compound 1f exhibited the most potent activity against MDA-MB-231 cell line with IC<sub>50</sub> value of 9.05 μM concentration, compound 1g and 1h



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Article

# Liquid fuel production from *Cassia spectabilis* seed oil by one step Transesterification and evaluation of its Fuel properties based on fatty acid composition

December 2020 · Chemical Data Collections 31(19):100635

DOI:10.1016/j.cdc.2020.100635

Authors:



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**Mahesh Akki**

Centre for Nano and Material Science, J...



**Smita G Mane**



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## Abstract

In this work biodiesel is synthesized using low cost feedstock *Cassia spectabilis* seed oil. The *Cassia spectabilis* seeds yield 25% oil. Various physicochemical properties of seed oil have been determined according to AOCS methods. The Acid value of seed oil is 1.8 mg KOH/gm oil and is directly subjected for single step base catalyzed transesterification process under optimized condition. The synthesized biodiesel is characterized using FT-IR, <sup>1</sup>H-NMR and <sup>13</sup>C-NMR spectroscopic methods for the confirmation of fatty acid methyl esters. The biodiesel is subject for GC-FID analysis to quantify its component fatty acids. Various fuel fuel properties relevant to biodiesel are evaluated computationally and substantiated with



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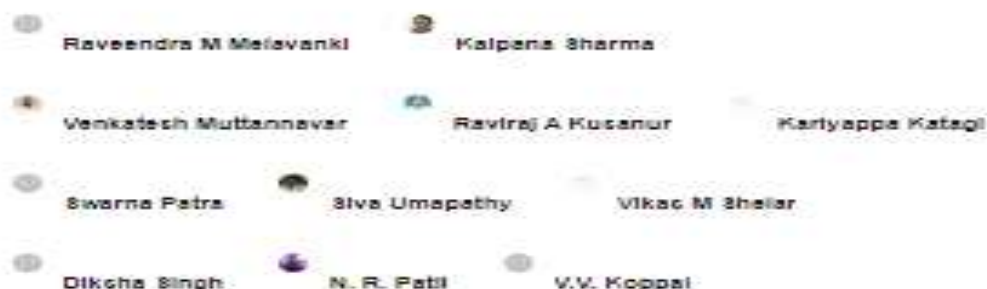
# Quantum chemical computations, fluorescence spectral features and molecular docking of two biologically active heterocyclic class of compounds

## Quantum chemical computations, Fluorescence spectral features and molecular docking of two biologically active heterocyclic class of compounds

January 2021 - Journal of Photochemistry and Photobiology A: Chemistry 404(1):112956

DOI: [10.1016/j.jphtchem.2020.112956](https://doi.org/10.1016/j.jphtchem.2020.112956)

Authors:



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### Abstract

This work is an effort for determination of excited and ground state values of dipole moments and also for quantum chemical computation of two biologically active heterocyclic class of compounds namely of 3-[2-Oxo-2-(2-oxo-2H-chromen-3-yl)-ethylidene]-1,3-dihydro-indol-2-one (3OCE) and 3-[2-Oxo-2-(3-oxo-3H-benzo[*f*]chromen-2-yl)-ethylidene]-1,3-dihydro-indol-2-one (3OBC). Redshift is displayed by both the compounds with some enhancement in polarity of solvent. The selected molecules show comparatively more polar nature in excited state than in ground state, and this is indicated by large dipole moment in the excited state. DFT calculations with B3LYP/6-311+G (d, p) basis sets using compound's quantum chemical property such as analysis of frontier molecular orbital were used for studying chemical reactivity and kinetic stability of selected compounds. MEP, NBO and Mulliken charges are further studied. The compounds exhibit great amount of energy for stabilization, which is depicted as transfer of proton showed by natural bond orbital (NBO) analysis within the selected donor-acceptor. The indices of electrophilicity and local softness of solute

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## Recent updates on the role of herbal medicine for Alzheimer's disease (Dementia)

January 2021

DOI: [10.20548/ijorbp.2021.801.002](https://doi.org/10.20548/ijorbp.2021.801.002)

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Bharati Vidyapeeth Deemed University



**Raju Krishna Chalannavar**  
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### Abstract

This review paper highlights the use of medicinal plants in the management of Alzheimer's disease and memory deficit. Alzheimer's disease is the most common form of dementia, a serious brain disorder that impacts daily living through memory loss and cognitive changes. Alzheimer's disease is also age-related neurodegenerative disorders caused by progressive loss of structure or function of neurons, resulting in neuronal cell death. Alzheimer's patients have an acetylcholine deficiency. Stressful conditions, free radicle scavenging and oxidation are often associated with loss of memory and cognitive functions, which may lead to threats of

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# Camphor tree, *Cinnamomum camphora* (L.); Ethnobotany and pharmacological updates

Ravindra B. Malabadi

Kiran P. Kolkar

Neelambika T. Meti

Raju K. Chalannavar

DOI: <https://doi.org/10.51248/v4i12.779>

**Keywords:** Antiviral, camphor, herbal medicine, skin disease, poisonous tree, traditional medicine

## ABSTRACT

This review paper highlights the recent updates of the fragrant camphor tree (*Cinnamomum camphora*) and camphor oil is used as a medicine for controlling many human diseases, relief of pain, inflammation and irritation in the body and skin. It can also be very effective in treating and preventing some serious, life threatening diseases. Recently medicinal plants (sweet worm wood; *Artemisia annua*) containing camphor essential oil has been tested against corona virus (SARS-CoV-2) disease (Covid-19)



PDF

PUBLISHED

2021-07-07

HOW TO CITE



# Melatonin: One molecule one-medicine for many diseases, coronavirus (SARS-CoV-2) disease (Covid- 19); Function in plants

March 2021

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## Abstract

This review paper highlights the role of melatonin in many diseases, coronavirus (SARS-CoV-2) disease (covid-19) and multi-physiological functions in plants. Based on its ubiquitous distribution (animal, human, plant, fungi, bacteria, algae), and multi-directional activity, melatonin is recommended as one of the most versatile biological signal of nature. Melatonin, so called a Hormone of darkness, has a high safety profile and potential to be used as COVID-19 therapy. Melatonin is a light sensitive molecule used in the therapy of sleeping disorders-insomnia, glaucoma, stroke, cancers, puberty, Alzheimers disease, Parkinson

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# Vaccine Development for Coronavirus (SARS-CoV2) Disease (Covid-19); Lipid Nanoparticles

January 2021

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## Abstract

This review aims to highlight the rationale for the development of mRNA-lipid nanoparticle based SARS-CoV-2 vaccines. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is a novel coronavirus, a major threat to human population and declared as global pandemic viral disease (COVID-19). The detection of double mutation (the mutation sites E484Q and L452R) in a new variant, called B.1.617 in India is very dangerous coronavirus strain is the major concern. India's double mutant strain (B.1.617) could be considered as a variant of concern responsible for the second wave. There are many efforts to develop

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## 60.1-Supplementary 1278 File-8492-8596-10-20210909

September 2021

DOI: [10.14719/pst.2021.8.4.1278-](https://doi.org/10.14719/pst.2021.8.4.1278-1278)

Authors:



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Karnatak Science College, Dharwad

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### Abstract

**ABSTRACT** Yadahalli Chinkara Wildlife Sanctuary is located in semi-arid zone of north Karnataka with heterogeneous vegetation types within it. The forest has variable geographical features such as rocky slopes, open grass lands, scrub forest, seasonal minor waterfalls and lakes. The present paper provides a checklist of tree species of Yadahalli Chinkara Wildlife Sanctuary, Bagalkot, which spreads over the Bilagi and Mudhol taluka. The list comprises of 80 tree species belonging to 67 genera of 34 families. The family Fabaceae contributes 23 species followed by Moraceae, Rubiaceae and Rutaceae 4 species each. Out of 80 species, three species are endemic to Peninsular India, four species are Vulnerable (VU), and one species is Near Threatened (NT) at global level. The present work is an inventory of tree species of Yadahalli Chinkara Wildlife Sanctuary, Bagalkot, in view to create awareness among the local people and to support the conservation activities in the forest.

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**International Journal of Trend in Scientific Research and Development (IJTSRD)**  
 Volume 5 Issue 1, November-December 2020 Available Online: [www.ijtsrd.com](http://www.ijtsrd.com) e-ISSN: 2456 - 6470

## Alien Flora of Ballari District, Karnataka, India

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### ABSTRACT

The present study deals with comprehensive list of invasive alien species in the flora of Ballari district with background information on family, habit and nativity. Total 215 invasive alien species belonging to 168 genera under 68 families were documented. It was prepared based on history, species origin, species behavior and field observations. Literature and websites were consulted extensively for relevant publications. Almost 54% are native to Tropical America contribute maximum proportion to the invasive alien flora of Ballari district. Habit wise analysis shows herbaceous species share 119(56%) species, followed by shrubs 35 (16%), climbers 20(9%) and trees 42(19%). Among 68 families, Asteraceae is the most dominant family with 27 species (25%) followed by Ceasalpinaceae with 14 species(13%). There is an imperative need to listing regional data on exotic species in order to study the impact on local vegetation and survey the worldwide pattern of species invasion.

**Keywords:** Alien species, biodiversity, plant invasion, biogeography, taxonomy, Ballari district

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(ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-1, December 2020, pp.167-174, URL: [www.ijtsrd.com/papers/ijtsrd35850.pdf](http://www.ijtsrd.com/papers/ijtsrd35850.pdf)



IJTSRD35850

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# STUDIES ON TOXICOLOGICAL ENDPOINTS OF FENOXAPROP-P-ETHYL ON BEHAVIORAL CHANGES IN FRESHWATER EXOTIC CARP CYPRINUS CARPIO (LINNAEUS)

October 2020 · JOURNAL OF ADVANCED APPLIED SCIENTIFIC RESEARCH

Authors:



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**Muniswamy David**

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[References \(16\)](#)

[Figures \(1\)](#)

## Abstract and Figures

14 The present study was undertaken to determine the acute toxicity of the herbicide Fenoxaprop-P-ethyl (FPE) and the 15 resulting behavioral alterations in the exotic freshwater carp *Cyprinus carpio*. The experimental fish were divided into 16 groups of 10 ( $n=10$ ) and exposed to different concentrations of the test pesticide for 24, 48, 72, and 96 hours. The 96-17 hour LC 50 was found to be 300  $\mu\text{g/l}$ . Sub-lethal concentration was fixed based on LC 50 value is 37.5  $\mu\text{g/l}$  (1/8 th of LC 50) 18 of the herbicide FPE for a period of 45 days. Regular observation was made throughout the exposure period to determine 19 the long-term behavioral changes in the test fish. The fish displayed erratic swimming behavior that increased over the 20 days of exposure. Behavioral anomalies such as whirling cork

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## STUDIES ON TOXICOLOGICAL ENDPOINTS OF FENOXAPROP-P-ETHYL ON BEHAVIORAL CHANGES IN FRESHWATER EXOTIC CARP CYPRINUS CARPIO (LINNAEUS)

[View Abstract](#)[PDF](#)[Download PDF](#)

Published Nov 22, 2022

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### Abstract

The present study was undertaken to determine the acute toxicity of the herbicide Fenoxaprop-P-ethyl (FPE) and the resulting behavioral alterations in the exotic freshwater carp *Cyprinus carpio*. The experimental fish were divided into groups of 10 ( $n=10$ ) and exposed to different concentrations of the test pesticide for 24, 48, 72, and 96 hours. The 96-hour  $LC_{50}$  was found to be 100  $\mu$ g/l. Sub-lethal concentration was fixed based on 1/10th of the

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Article

# Optimal control analysis for Stochastic Unemployment Model

April 2019

Authors:



**Shankrevva R Gani**  
BLDEA's College of jamkhandl



**Shrishail Ramappa Gani**  
Karnatak University, Dharwad



**Surekha B. Munoli**  
Karnatak University, Dharwad

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[References \(10\)](#)

## Abstract

This paper endeavors to propose stochastic model for unemployment. An optimal control policy for the proposed model is derived using implemented policies of government to provide employment to unemployed persons and to create new vacancies. Numerical simulations are carried out to validate the derived results. **Keywords:** unemployment, stochastic model, Hamilton-Jacobi-Bellman equation, quadratic cost function, adjoint variables, stochastic dynamic programming



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# Environmental Impact of Iron ore Mining in Bellary District, Karnataka: Using Geo-Spatial Techniques

**L.T. Nayak**

Department of Geography, Karnatak Science College, Dharwad, Karnataka

**Keywords:** EIA, Satellite images, Excavation, Spatial techniques, FCC, Mining leases, exploration

## Abstract

Accurate and reliable information on the distribution of various earth resources, urbanization, industrialization etc., form the backbone of Environmental Impact Assessment study. Environmental Impact assessment (EIA) is a process, used to identify the environmental, social and economic impacts of proposed and completed project. Environmental Impact Assessment in the wake of iron ore mining of Bellary district has been


 PDF

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Section

Geo-Eye

DOI: [10.53989/bu.ge.v9i2.7](https://doi.org/10.53989/bu.ge.v9i2.7)

Year: 2020, Volume: 9, Issue: 2, Pages: 36-46

Original Article

## RURAL DEVELOPMENT AND POVERTY ALLEVIATION PROGRAMMES: A CASE STUDY OF NIGADI GRAM PANCHAYAT, DHARWAD DISTRICT

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Received Date:02 August 2020, Accepted Date:11 December 2020, Published Date:21 December 2020



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### ABSTRACT

NA



**Title**

A CONTROL THEORY BASED ANALYSIS OF REPAIRABLE SYSTEM.

**Authors**

Bhat, Suhas; Munoli, S. B.; Gani, S. R.

**Abstract**

The paper studies a repairable system using control theory approach. A simple repairable model is proposed using Ordinary Differential Equations defined in terms of numbers of functioning and failed components at time  $t$ , failure rate, repair rate and time dependent controls. The objective of the analysis is to determine control trajectories that minimize the number of non-functioning components of the system and the cost of applying control. The optimality conditions of the proposed repair strategies are also investigated using Pontryagin's maximum principle. The model and its optimal control analysis for various parameter combinations are validated through simulation study.

**Publication**

International Journal of Agricultural & Statistical Sciences, 2021, Vol 17, p957



**A TEST FOR COMPARING TWO POPULATIONS HAVING  
MORE INCREASING FAILURE RATE AVERAGE  
PROPERTY**

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**Abstract**

In this paper, a test based on  $U$ -statistic for comparing two distributions possessing 'more increasing failure rate (IFRA)-ness' property of life distributions is proposed. The proposed test procedure rejects the hypothesis of one has more IFRA ness property than the other for large values of the statistic proposed. The distributional properties of the proposed test statistic are studied. The asymptotic relative efficiencies (ARE) of the proposed procedure are evaluated with respect to the tests available in the literature for this problem. It is observed that the members of proposed class perform well.

# **A new class of continuous functions via $\delta$ gp-open sets in topological spaces**

**J. B. Toranagatti**

Department of Mathematics

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Email: jagadeeshbt@gmail.com

*(Received September 06, 2020)*

## **Abstract**

In this paper, a new class of almost continuity called almost  $\delta$  gp-continuity is presented. Characterizations and properties of almost  $\delta$  gp-continuous functions are discussed.

## **1 Introduction**

The notion of continuity on topological spaces, as significant and fundamental sub-

# On a class of sets between $\alpha$ -open sets and $g\delta$ -open sets

[Toranagatti, Jagadeesh B.](#) [Ratio Mathematica; Pescara](#) Vol. 39, (2020); 237-252. DOI:10.23755/rm.v39i0.535

## Abstract (summary)

In this paper, a new class of sets called  $D_\alpha$ -open sets are introduced and investigated with the help of  $g\delta$ -open and  $\delta$ -closed sets. Relationships between this new class and other related classes of sets are established and as an application  $D_\alpha$ -continuous functions have been defined to study its properties in terms of  $D_\alpha$ -open sets. Finally, some properties of  $D_\alpha$ -closed graph and  $(D_\alpha)$ -closed graphs are investigated.

## Indexing (details)

Title	On a class of sets between $\alpha$ -open sets and $g\delta$ -open sets
Author	Toranagatti, Jagadeesh B
Publication title	Ratio Mathematica; Pescara
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# On almost contra $\delta gp$ -continuous functions in topological spaces

J.B.Toranagatti

## Abstract

The aim of this paper is to introduce a new class of almost contra continuity. The notion of almost contra  $\delta gp$ -continuous functions is introduced and studied.

## Keywords

$\delta gp$ -open set,  $\delta gp$ -closed set, almost contra pre-continuous function, almost contra  $\delta gp$ -continuous function.

## AMS Subject Classification

54C08, 54C10.

Department of Mathematics, Karnatak University's Karnatak College,  
Dharwad-580 001, India.

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## Contents

1	Introduction .....	1213
2	Preliminaries .....	1213
3	Almost contra $\delta gp$ -continuous functions .....	1214
	References .....	1217

## 1. Introduction

Recently, Baker (resp. Ekici, Balasubramanian and Laxmi) introduced and investigated the notions of almost contra continuity [3] (resp. almost contra pre-continuity [10]) and almost contra  $gp$ -continuity [4] as a continuation of research done

open, regular closed,  $\delta$ -preopen,  $\delta$ -semiopen,  $e^*$ -open, pre-open, semiopen,  $\beta$ -open and clopen) sets of  $(U, \tau)$  is denoted by  $\delta GPO(U)$  (resp.  $\delta GPC(U)$ ,  $O(U)$ ,  $C(U)$ ,  $RO(U)$ ,  $RC(U)$ ,  $\delta PO(U)$ ,  $\delta SO(U)$ ,  $e^*O(U)$ ,  $PO(U)$ ,  $SO(U)$ ,  $\beta O(U)$  and  $CO(U)$ ).

## 2. Preliminaries

**Definition 2.1.** A set  $M \subseteq U$  is called  $\delta$ -closed [36] if  $M = cl_{\delta}(M)$  where  $cl_{\delta}(M) = \{ p \in U : int(cl(G)) \cap M \neq \emptyset, G \in \tau \text{ and } p \in G \}$ . The complement of a  $\delta$ -closed set is called  $\delta$ -open.

**Definition 2.2.** A set  $M \subseteq U$  is called pre-closed [21] (resp.  $b$ -closed [1], regular-closed [33], semi-closed [19] and  $\alpha$ -



## A note on pre generalized b-closed set

J.B. Toranagatti\*

### Abstract

In this paper, we show that some results obtained in [S. Sekar and R. Brindha, On Pre Generalized B-Closed Set In Topological Spaces, Int. J. Pure Appl. Math., 111(4)(2016),577-586] are incorrect in general, by giving counter examples. Also, we illustrate that Example 3.5, Example 3.13, Example 3.15 and Example 3.17 are incorrect. Moreover, the correction form of the incorrect results of [13] is presented. Finally, we established that the concepts of b-closed sets and pgb-closed sets are same.

### Keywords

pg-closed sets,  $g\alpha$ b-closed sets, pgb-closed sets, rgb-closed sets, b-closed sets.

### AMS Subject Classification

54A05.

\*Department of Mathematics, Karnatak University's Karnatak College, Dharwad-580001, India.

\*Corresponding author: jagadeeshbt2000@gmail.com

Article History: Received 24 March 2020; Accepted 12 July 2020

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Article PDF Available

## Reciprocal Complementary Distance Energy of Complement of Line Graphs of Regular Graphs

March 2021 · Mathematical Sciences and Applications E-Notes 9(1):36-41

DOI:10.36753/mathenot.641660

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Authors:



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**B. Parvathalu**  
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#### Abstract

The reciprocal complementary distance (RCD) matrix of a graph  $G$  is defined as  $SRCD(G) = [r_{ij}]$ , where  $r_{ij} = \frac{1+D-d_{ij}}{2}$  if  $i \neq j$  and  $r_{ij} = 0$ , otherwise, where  $D$  is the diameter of  $G$  and  $d_{ij}$  is the distance between the vertices  $v_i$  and  $v_j$  in  $G$ . The RCD-energy of  $G$  is defined as the sum of the absolute values of the eigenvalues of RCD-matrix. Two graphs are said to be RCD-equienergetic if they have same RCD-energy. In this paper, the RCD-energy of the complement of line graphs of certain regular graphs in terms of the order and degree is obtained and as a consequence, pairs of RCD-equienergetic graphs of same order and having different RCD-eigenvalues are constructed.

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Article

## On the Seidel Laplacian and Seidel signless Laplacian polynomials of graphs

March 2021 · Kyungpook mathematical journal 61(1):155-168

Authors:



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**B. Parvathalu**  
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### Abstract

The Seidel Laplacian polynomial and Seidel signless Laplacian polynomial of a graph are expressed in terms of the Seidel polynomial of induced subgraphs. Further the Seidel Laplacian polynomial and Seidel signless Laplacian polynomial of the join of regular graphs are obtained.



## On complementary equienergetic strongly regular graphs

Harishchandra S. Ramane<sup>1</sup>, K. Ashoka<sup>1</sup>, Bolle Parvathalu<sup>2</sup>, Daneshwari Patil<sup>1</sup>, Ivan Gutman<sup>3,\*</sup>

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(Received: 13 July 2020. Received in revised form: 18 August 2020. Accepted: 20 August 2020. Published online: 22 August 2020.)

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### Abstract

The energy of a graph is the sum of absolute values of the eigenvalues of its adjacency matrix. Two graphs are said to be equienergetic if they have same energy. A graph is said to be complementary equienergetic if it is equienergetic with its complement. In this paper, we characterize the strongly regular graphs, which are complementary equienergetic. In addition, by means of Cartesian and strong graph products, we construct equienergetic graphs using complementary equienergetic graphs.

**Keywords:** energy of a graph; equienergetic graphs; complementary equienergetic graphs; strongly regular graphs.

**2020 Mathematics Subject Classification:** 05C50.

## 1. Introduction

The energy of a graph is the sum of absolute values of the eigenvalues of its  $(0, 1)$ -adjacency matrix [10, 17]. It is clearly

# Multimodal Biometric System using Texture Features

Publisher: IEEE

[Cite This](#)[PDF](#)Shivashankar S ; Rajashekhar V Baraker ; Prakash S. Hiremath [All Authors](#)

56

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## Abstract

### Document Sections

1. Introduction
2. Related work
3. Proposed Method
4. Experimental Setup
5. Conclusion and Future Scope

### Authors

### Figures

### References

### Keywords

### Metrics

## Abstract:

In this paper a divided image based Local Gabor Binary Patterns is proposed for image description in multimodal biometrics. The combination of Gabor transform and Local Binary Pattern provides the robustness to variations in the input image. Two well known and widely used biometric traits viz. Face and Finger print are considered. Firstly the images are divided into non overlapping blocks, each of the blocks are treated separately and LGBP is applied over each block. The normalized histogram bin values of each block forms the image descriptor. Feature level fusion of the biometric traits is employed and the classification is carried out using KNN classifier. The modal was trained and tested on SDUMLA-HMT, a homogeneous multimodal biometrics database. The results are compared with multimodal biometric system using LBP and Multimodal Biometric system using Galois operator. The results indicate significant improvement in the recognition ratio of the proposed method.

**Notes:** This article was mistakenly omitted from the original submission to IEEE Xplore. It is now included as part of the conference record.

**Published in:** 2021 International Conference on Computer Communication and Informatics (ICCCI)

**Date of Conference:** 27-29 January 2021

**DOI:** 10.1109/ICCCI50826.2021.9457022

**Date Added to IEEE Xplore:** 21 June 2021

**Publisher:** IEEE

**ISBN Information:**

**Conference Location:** Coimbatore, India

**Print on Demand(PoD) ISSN:** 2329-7190

## 1. Introduction

Biometrics is a way of identifying and authenticating an individual using one of the traits, either physiological or behavioural traits. Physiological traits can be looked up as what an individual has viz., finger print, face, iris, retina, palm print and finger vein. Behavioural traits are those which are procured by an individual over the years, for example signature, walking style (Gait), Voice etc[1]. Unimodal biometrics can be used effectively for authentication. However, multimodal biometrics has gained the popularity over unimodal systems because of the robustness of it. Multimodal biometrics systems uses more than one traits for authentication.

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Article

## Adjacency and Seidel polynomials of splice and links of certain graphs

December 2020

Authors:



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Karnatak University, Dharwad



**Ashoka K ..**  
Christ University, Bangalore



**B. Parvathalu**  
Karnatak University's Karnatak Arts Colle...



**Daneshwari D. Patil**  
Karnatak University, Dharwad

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### Abstract

The adjacency and the Seidel polynomial of a graph are respectively the characteristic polynomial of adjacency and Seidel matrix associated to that graph. The adjacency polynomial of splice and link graphs of some well-known graph classes have been obtained recently in the literature. The equitable partition of a graph plays an important role in finding partial spectrum of a graph. In this article we study the adjacency polynomial of complement of splice and link graphs of certain graphs and also the Seidel polynomial by using the concept of equitable partition.

Conference Paper

## Multimodal Biometric System using Texture Features

January 2021

DOI:10.1109/ICCCI50826.2021.9457022

Conference: 2021 International Conference on Computer Communication and Informatics (ICCCI)

Authors:



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## Senna italica subsp italica; Overlooked species from Karnataka State

June 2020 · Indian Forester 146(5):461-462

DOI: [10.36808/iff/2020/v146i5/147952](https://doi.org/10.36808/iff/2020/v146i5/147952)

Authors:



**Sidanand Vitthal Kambhar**  
Department of Botany Government First ...



**Kotresha Sekharappa Katrahalli**  
Karnatak Science College, Dharwad

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### Abstract

*Senna italica* Mill. subsp. *italica* (Fabaceae; Caesalpinioideae): An Overlooked species from Karnataka State, India The *Senna* is one of the most diverse genera within the family Fabaceae (under subfamily Caesalpinioideae) with approximately 350 species of trees, shrubs and sub-shrubs distributed throughout the American, African, and Australian continents, with occurrences also in Asia and on Pacific islands (Marazzi et al., 2006). The genus extends in all terrestrial habitats from the equator to the edges of dry and cold deserts, but much of its diversity is centered in areas of varied topography with seasonal climates (Irwin and Barneby, 1982).

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## Alien Flora of Ballari District, Karnataka, India of the Creative Commons Attribution License (CC BY 4.0)

December 2020

Authors:



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Karnatak Science College, Dharwad



**M. Siddeshwari**  
Vijayanagara Sri Krishnadevaraya Univer...

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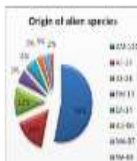
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### Abstract and Figures

The present study deals with comprehensive list of invasive alien species in the flora of Ballari district with background information on family, habit and nativity. **Total 215 invasive alien species belonging to 168 genera under 68 families were documented. It was prepared based on history, species origin, species behavior and field observations. Literature and websites were consulted extensively for relevant publications.** Almost 54% are native to Tropical America contribute maximum proportion to the invasive alien flora of Ballari district. Habit wise analysis shows herbaceous species share 119(56%) species, followed by shrubs 35 (16%), climbers 20(9%) and trees 42(19%). Among 68 families, Asteraceae is the most dominant family with 27 species (25%) followed by Ceasalpinaceae with 14 species(13%). There is an imperative need to listing regional data on exotic species in order to study the impact on local vegetation and survey the worldwide pattern of species invasion.



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Short communication

# Investigation of African mangosteen leaves extract as an environment-friendly inhibitor for low carbon steel in 0.5 M H<sub>2</sub>SO<sub>4</sub>

Manohar R. Rathod<sup>a</sup>, S.K. Rajappa<sup>a</sup>, Raqini L. Minagalavar<sup>a</sup>, B.M. Praveen<sup>b</sup>, Bharath K. Devendra<sup>b,d</sup>, A.A. Kittur<sup>c</sup>

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<https://doi.org/10.1016/j.inoche.2022.105488>

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## Abstract

The African mangosteen plant species comprises a variety of bioactive molecules. In the following research, phytochemicals have been screened with Shinoda test, Benedict's test, etc., for ethanolic African mangosteen leaves extract (AMLE). The inhibition efficacy of AMLE for low carbon steel corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> was assessed by mass-loss, polarization, and electrochemical impedance spectroscopic (EIS) approach. Corrosion studies were performed for various inhibitor concentrations and differing temperatures. The inhibition performance of AMLE on low carbon steel rises with concentration rise. Potentiodynamic polarization results revealed that AMLE bind to the surface of low carbon steel, as they hinder corrosion spots from the bulk media, and the maximum inhibition performance ( $\eta_w$ ) was 96.14% for 1.5 g/L concentration. Electrochemical impedance spectroscopy (EIS), the maximum inhibition performance ( $\eta_w$ ) was 95.57% attributed to AMLE adsorption on the low carbon steel surface. Findings reported from electrochemical and chemical research are well in agreement. The AMLE inhibition activity is stated by the adsorption process on low carbon steel and complies with Langmuir isotherm. The values of  $\Delta G_{ads}^{\circ}$  were estimated to be between  $-30.27$  to  $-33.06$  kJ mol<sup>-1</sup>, indicating that the inhibition effect is exothermic and spontaneous. Furthermore, the determined thermodynamic parameters suggest that the adsorption process is intuitive. Scanning electron microscope (SEM), Fourier-transform infrared (FT-IR) spectroscopy, and atomic force microscopic technique (AFM) were employed to examine the surface analysis of the low carbon steel samples.



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### Article

## Structural, AC and DC Electrical Transport Properties of Nano Titania - Polyacrylamide Composite Films

March 2022 · Indian Journal of Pure & Applied Physics 60(3):227-237

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### References (14)

#### Abstract



The microstructural features as well as the AC and DC electrical properties of titanium dioxide (titania or TiO<sub>2</sub>) nanoparticle (NP) filled polyacrylamide (PAM) composite films with filler level (FLs) Varied from 0.02 up to 19.5 Wt % were experimentally studied. SEM images revealed that the composite films with FLs equal to 0.02 and 0.40 Wt % (low FLs) showed homogeneous dispersion of spherical TiO<sub>2</sub> NPs, whereas aggregation of the filler was observed at higher FLs. The XRD patterns of these composite films revealed an increase in their amorphousness at low FLs. The activation energy (E<sub>a</sub>) determined from Arrhenius equation showed that the composite with FL equal to 0.40 Wt % exhibited the lowest value of E<sub>a</sub> (equal to 0.84 eV). Dielectric study revealed that the composite film with FL equal to 0.40 Wt % exhibited the highest value bulk conductivity at room temperature (4.39×10<sup>-6</sup> S m<sup>-1</sup> at 303 K). Hence, the composite sample with FL 0.40Wt %, along with pure PAM, were subjected to a detailed dielectric study at various fixed temperatures ranging from 303K up to 353K. The

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## Experimental investigations on the beta attenuation properties of lead monoxide – Polycarbonate composite films

Vijayashri Ashok Kandoqal, Rajeshwari Mirji, Blaize Lobo  

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### Abstract

Lead monoxide filled polycarbonate polymer composite films have been prepared with twelve different filler levels, ranging from 0.5 up to 10.0 percent by weight, by using ultrasonic dispersion of lead monoxide in the polycarbonate solution, followed by solution casting. For these composites, beta radiation shielding properties such as mass attenuation coefficient, range of beta particles and half value layer thickness for beta particles from low activity thallium-204 and yttrium-90 radioactive sources have been found experimentally and computationally, along with the mass density and modified atomic number of the composite material. Two different computational methods, namely Baltakmet's empirical formula method and Bragg's mixture rule have been used to calculate the theoretical value of mass attenuation coefficient, whereas Katz and Penfold relationship has been used to calculate the range of the beta particles obtained from these sources in the prepared composite films. The results obtained are discussed.



### Introduction

The knowledge about interaction of radiation with matter is important to develop radiation shielding materials which have wide applications in institutions and industries handling radioactive sources, preservation of food by radiation treatment, as well as in the nuclear power industry and dosimetry [1], [2]. The study of mass attenuation coefficient ( $\frac{\mu}{\rho}$ ) and half value layer (HVL) of beta particles in a condensed medium (material or sample) is important in order to obtain basic information regarding its composition [3] and makes it possible to solve various problems in the radioactive processing of agricultural produce as well as in the medical field (like for example, in the radioactive diagnosis and treatment of cancer), in addition to different areas of physical and bio-sciences [4].

In this paper, lead monoxide (PbO) filled polycarbonate (PC) composites with thirteen different filler levels (FLs) of PbO in PC, starting from 0.0wt% up to 10wt%, have been used for beta particle attenuation. PC is a thermoplastic material



## Optical analysis of polycarbonate – Lead nitrate composite films for UV-A shielding applications

[Manjappa C.K.](#), [Baleshwari Mirji](#), [Blaise Lobo](#)  

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### Abstract

Due to global warming and ozone depletion in the atmosphere, protection for human beings from UV radiation becomes necessary. It is possible to shield a selective part of the solar light falling on the earth's surface by using polymeric composite materials. In this work, polymeric composite films have been prepared by using polycarbonate as the host matrix and lead nitrate as filler. Different filler levels, equal to 0, 5, 15, 25, 35, and 50 weight percentages (wt%) of lead nitrate are dispersed in polycarbonate by ultrasonication, followed by solution casting. The prepared films are characterized by using UV–Visible absorption (optical) spectroscopy, and the resulting spectra have been analysed. It is found that the absorption edge is shifted towards higher wavelengths (red shifted) as the filler level increases, and for the composites with filler levels greater than 15 wt%, it is observed that there is strong absorption of the incident electromagnetic radiation in the wavelength range varying from 335 nm up to 375 nm (which is in the UV-A range). However, the transmittance in the visible region (400–700 nm) decreases from 87% down to less than 43%. The 15 wt% (FL) composite film has 64% of visible light transmittance. Hence, after exploring further improvements, it is a good candidate to replace glass in different applications like UV-A band filters, as well as Ultra-Violet (UV) protection windows, doors, face shields and safety visors of helmets.

### Introduction

It is widely agreed that, day by day, the depletion of ozone layer is increasing because of the increasing emission of carbon substituents into the atmosphere, which worsens the global warming situation. Due to ozone depletion in the Earth's atmosphere, the direct approach of harmful UV radiation from the Sun (to surface of the Earth) leads to deleterious effects on human beings as well as the stability of materials [1]. It is necessary to shield both living and non-living matter from UV radiation, by using suitable materials as radiation shields. In this direction, research on polymer composites is increasingly gaining importance. It is possible to tune the physical, chemical, mechanical and thermal properties of composite materials by adding suitable additives (in proper concentration) into the polymeric

# Interactions of Environmental Pollutant Aromatic Amines With Photo Excited States of Thiophene Substituted 1,3,4-Oxadiazole Derivative: Fluorescence Quenching Studies

Original Article Published: 11 May 2022

Volume 32, pages 1543–1556, (2022) Cite this article



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**Thippeswamy, M.S., Lohit Naik, C.V. Maridevarmath & G. H. Malimath**

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## Abstract

In the present work, the fluorescence quenching of novel thiophene substituted 1,3,4-oxadiazole derivative 2-(4-(4-vinylphenyl) phenyl)-5-(5-(4-vinylphenyl)thiophen-2-yl)-1,3,4-oxadiazole (TSO) by five different environmental pollutant aromatic amine derivatives like 2,4-dimethylaniline, 3-chloroaniline, 4-chloroaniline, o-anisidine, and m-toluidine has been studied at room temperature through steady-state and time-resolved methods. It is observed that, the quenching efficiency is highest in the case of o-anisidine and least in the case of 3-chloroaniline. The fluorescence quenching mechanism between





# Influence of substituent position in aromatic diamines on coumarin derivative

Nirupama J.M.<sup>a</sup>, Raveendra Melavanki<sup>b</sup>, N.I. Khanapurmath<sup>c</sup>, L.S. Chougala<sup>d</sup>, M.V. Kulkarni<sup>e</sup>, J.S. Kadadevarmath<sup>d</sup>

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## Abstract

The Influence of substituent position in aromatic diamines such as *ortho*-phenylenediamine (OPD) and *para*-phenylenediamine (PPD) on 7-methoxy-4-azido methyl coumarin (7MCA) has been studied in different solvents. A hypsochromic shift in the absorption maximum of 7MCA in the presence of aromatic diamine indicates the formation of the complex. From the <sup>1</sup>H NMR study, it is understood that there is an H-bonding between the NH<sub>2</sub> proton of OPD and 7MCA. A shift in the N–H stretching band of OPD observed in FT-IR spectra towards lower frequency indicates H-bonding between 7MCA and OPD. But the nature of the interaction between PPD and 7MCA cannot be determined from NMR and FT-IR study. Non-linear S-V plots obtained from the fluorescence quenching study reveals the involvement of both static and dynamic quenching processes. The value of the quenching rate parameter for *para*-phenylenediamine is more than *ortho*-phenylenediamine in protic solvents. But the value of the quenching rate parameter for *ortho*-phenylenediamine is more than its *para* isomer in aprotic solvents. Electrochemical analysis reveals that there is no electron transfer from these amino anilines to coumarin derivatives. The Nature of force between 7MCA and aromatic diamine (OPD and PPD) is hydrophobic in methanol since the change in enthalpy and entropy are positive but these thermodynamic parameters have negative values in DME solvent indicating, a weak van der Waals force between 7MCA and amino anilines.

## Graphical abstract

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## Dopamine-Assisted Coral Films of Cobalt as Bifunctional Electrodes for Overall Water Splitting

Jyothi S. Doddamani, Sajeeda Shaikh, Mohammad Hussain Kasim Rabinal 

First published: 16 September 2021

<https://doi.org/10.1002/ente.202100264>

Citations: 1

Research data are not shared.

### Abstract

Coral-type cobalt nanostructures are electrodeposited on a dopamine-modified nickel plate under ordinary conditions. The deposited electrodes are studied for both oxygen evolution reaction (OER) and hydrogen evolution reaction (HER) as bifunctional electrodes for overall water splitting. These electrodes show overpotentials of 300 and 290 mV for OER and HER respectively, at a benchmark current density of  $10 \text{ mA cm}^{-2}$ . In case of OER, the absence of dopamine gives higher overpotential and exfoliation of Co coating. In the presence of dopamine, the electrodes show lower overpotential and better long-term stability for both HER and OER for overall water splitting. Hence, the present Ni-dopamine-Co electrode interface can be a better bifunctional electrode for the overall water splitting reaction.

### Conflict of Interest

The authors declare no conflict of interest.

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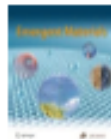
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# Melamine assisted large-scale and rapid synthesis of porous copper oxide nanostructures

Original Article Published: 27 July 2021

Volume 5, pages 1089–1096, (2022) [Cite this article](#)



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[Jyothi S. Doddamani](#), [Rajashree M. Hodlur](#) & [M. K. Rabinal](#)


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## Abstract



Copper oxide nanostructures have been recognized as novel materials for energy conversion/storage applications owing to their attractive energy bandgap, availability and good electrochemical activity, proper redox potentials, environmentally affable, and low cost. Herein, a simple, one-step synthesis of highly porous copper oxide nanostructures via thermal oxidation of simple precursors, like copper nitrate and melamine, under open-air conditions is reported. Melamine plays an important role in the formation of porous  $\text{Cu}_2\text{O}$  nanostructures; when a known amount of it is added during the synthesis, the surface area and pore size of resulting copper oxide (CuO) can be increased. X-ray diffraction clearly shows that heating up to 400 °C gives phase pure monoclinic CuO. As the melamine content



# A comprehensive studies on photophysical and electrochemical properties of novel D- $\pi$ -A thiophene substituted 1,3,4-oxadiazole derivatives for optoelectronic applications: A computational and experimental approach

Thippeswamy M.S.<sup>a</sup>, Lohit Naik<sup>a</sup>, C.V. Maridevarmath<sup>b</sup>, G.H. Malimath<sup>a</sup>  

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## Abstract

In the present paper optoelectronic properties of three newly synthesised thiophene substituted 1,3,4-oxadiazole derivatives namely lithio 4-(5-(5-(4-(4-ethoxycarbonyl(phenyl))phenyl)-1,3,4-oxadiazol-2-yl)thiophen-2-yl) benzoate [TNO], 2-(4-(5-(5-hexylthiophen-2-yl)thiophen-2-yl)phenyl)-5-(5-(5-(5-hexylthiophen-2-yl)thiophen-2-yl)thiophen-2-yl)-1,3,4-oxadiazole [TKO], and 2-(4-(4-vinylphenyl)phenyl)-5-(5-(4-vinylphenyl)thiophen-2-yl)-1,3,4-oxadiazole [TSO] have been explored by a combination of fluorescence spectroscopic techniques and theoretical calculations. The absorption and emission spectra of all the organic fluorescent molecules were recorded in fourteen solvents of different polarity. The ground ( $\mu_g$ ) and excited state dipole moments ( $\mu_e$ ) of all the probes were calculated experimentally by solvatochromic shift method. The ground state dipole moment ( $\mu_g$ ) of all the organic probe molecules in gaseous phase and in different solvents were also estimated theoretically by using the integral equation formalism of polarizable continuum model (IEF-PCM) from *ab initio* computations by using Gaussian 09W software and the results are compared. It is observed that, the estimated values of excited state dipole moments are larger than the ground state dipole moments. This suggests that, the redistribution of the electron densities is more polar in excited state than the ground state. Further, the HOMO-LUMO energy level values of all the probes were estimated using Density Functional Theory (DFT). The electrophilic and nucleophilic sites were also recognised with the help of Molecular Electrostatic Potential (MESP) 3D plots by using TD-DFT computational analysis. The specific and non-specific interactions between the solute-solvent were analysed by multiple linear regression analysis using Kamlet-Abound-Taft and Catalan parameters. Further, the Global Chemical Reactivity Descriptor (GCRD) parameters like, chemical hardness ( $\eta$ ), chemical potential ( $\mu$ ), softness ( $S$ ), electronegativity ( $\chi$ ), and electrophilicity index ( $\omega$ ) were calculated. Electrochemical properties of the probes were investigated (HOMO-LUMO) by using cyclic voltammetry (CV) and is supported by DFT calculations. From the experimental and theoretical observations, we suggest that the organic probe molecules TNO, TKO, and TSO may be considered as potential candidates for OLED, solar cells, chemosensor and detection of explosives applications in the future.



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## HYDROGEOCHEMICAL INVESTIGATION AND GROUNDWATER QUALITY ASSESSMENT OF THE KARANJA RIVER BASIN (KRB), BIDAR DISTRICT, KARNATAKA, INDIA

February 2022 · *Journal of Applied Geochemistry* 23(01):59-78

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## Abstract and Figures

Hydrogeochemical studies were carried out in the Karanja River Basin (KRB) to assess the quality and suitability of groundwater for drinking and irrigation purposes. Forty two groundwater samples were collected during pre-monsoon and post-monsoon seasons of 2015. The physico-chemical parameters of groundwater such as pH, EC, TDS, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Na<sup>+</sup>, K<sup>+</sup>, HCO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup> were determined. In the majority of water samples, the analyzed physico-chemical parameters fall within the desirable limits and suggest their suitability for drinking use as per the standards set by WHO (2011), BIS (2012), and ISI (1983) standards. The Piper's (1953) trilinear diagram (1953) plotted for the chemical data reveals that the majority of the groundwater samples are mainly Ca-HCO<sub>3</sub> and mixed Ca-Na-HCO<sub>3</sub> type during both pre-monsoon and post-monsoon seasons. According to Gibb's (1970), diagrams the overall hydrochemistry of the groundwater samples in both seasons falls in the rock dominance field. The values %Na, SAR, and RBC were calculated for the present study area to interpret the water quality from an irrigation point of view. Wilcox (1954) and USBL (1954) plots along with the values of RBC revealed that groundwater samples from both seasons are suitable for irrigation purposes. The majority of the water samples analyzed during pre-monsoon and the post-monsoon seasons have the %Na, SAR, RBC, etc., values within the prescribed limit. Hence, in the present study area, the groundwater samples are suitable for drinking and irrigation purpose, except a few samples.



Location map of the study area... Piper's (1953) trilinear diagram... Gibb's (1970) diagram for... Wilcox (1955) diagram for... Salinity diagram for classificatio...

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### Mapping of Groundwater potential zones in Lingasugur Taluk in North-eastern part of Kamataka, India using Remote Sensing, GIS and multi-criteria data analysis

December 2021 · Disaster Advances 14(12):13-22

DOI: [10.25303/1412da1322](https://doi.org/10.25303/1412da1322)

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#### Abstract and Figures

Groundwater research has evolved tremendously as presently it is the need of society. Remote Sensing (RS) and Geographical Information System (GIS) are the main methods in finding the potential zones for the groundwater. They help in assessing, exploring, monitoring and conserving groundwater resources. A case study was conducted to find the groundwater potential zones in Lingasugur taluk, Raichur District, Karnataka State, India. Ten thematic maps were prepared for the study area such as geology, hydrogeomorphology, land use/ land cover, soil type, NDVI, NDWI, slope map, lineament density, rainfall and drainage density. A weighted overlay superimposed method was used after converting all the thematic maps in raster format. Thus from analysis, the classes in groundwater potential were made as very good, moderate, poor and very poor zones covering an area of 10.1 sq.km., 169.25 sq.km., 1732.31 sq.km. and 53.66 sq.km. respectively. By taking the present study into consideration, the future plans for urbanization, recharge structures and groundwater exploration sites can be decided.

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***Theriophonum minutum* (Willd.) Ballon (Araceae): A new record for Karnataka state, India 1 1 2 3**

March 2022 · The Journal of Indian Botanical Society 102(1):79-82

DOI:10.5958/2455-7218.2022.00004.3

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#### Abstract

The species of *Theriophonum minutum* (Willd.) Ballon, was recorded for the first time in Raichur district of Karnataka, India. Previously, this *Theriophonum* species was reported from various parts of country such as Andhra Pradesh, Maharashtra, Odisha, Tamil Nadu and Telangana. This species can be easily recognized by its habit and position of sterile flowers and staminate flowers in the spadix. A short description with colour photographs of the plant in its natural habitat is provided.

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ESTIMATION OF TREE BIOMASS AND CARBON SEQUESTRATION IN KARNATAK COLLEGE CAMPUS, DHARWAD, KARNATAKA

September 2021

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Abstract and Figures

Karnatak College Campus, Dharwad lies on 741m above sea level, it has a tropical climate. The campus is spread over an area of 57 acres. A total of 98 tree species belonging to 83 genera of 33 families were studied in 68 quadrats in the campus. Tree species such as *Pelliphorum pterocarpum*, *Delonix regia*, *Senna siamea*, *Tamarindus indica* and *Pongamia pinnata* are spread throughout the campus. Whereas species such as *Bombax ceiba*, *Butea monosperma*, *Couroupita gulanensis*, *Kigelia africana*, *Santalum album*, *Saraca asoca*, *Swietenia mahogany* and *Tabebuia impetiginosa* are also present. In case of *Adansonia digitata* and *Guaiacum officinale* are cultivated have representing a single specimen each in the campus or Dharwad city as such. Total number of individuals of all the tree species measured for carbon sequestration and importance value index are 1387 trees. Fabaceae has the highest Importance Value Index followed by Ulmaceae and Meliaceae. *Senna siamea* is the highest carbon sequestering tree species followed by *Pelliphorum pterocarpum*, *Tamarindus indica*, *Delonix regia* and *Holoptelea integrifolia* being the top five highest carbon sinking tree species respectively, and also with maximum tree biomass in the campus. Estimation of tree biomass through non-invasive and allometric methods leads to the estimation of carbon sequestered. The main aim of this study was to estimate such tree population in Karnatak College Campus, Dharwad, and calculate their carbon storage.



Families with highest...

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July 2021 · Biomedicine 41(2):181-184

DOI: [10.51248/v41i2.779](#)License · [CC BY 4.0](#)

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## Abstract

This review paper highlights the recent updates of the fragrant camphor tree (*Cinnamomum camphora*) and camphor oil is used as a medicine for controlling many human diseases, relief of pain, inflammation and irritation in the body and skin. It can also be very effective in treating and preventing some serious, life threatening diseases. Recently medicinal plants (sweet worm wood; *Artemisia annua*) containing camphor essential oil has been tested against corona virus (SARS-CoV-2) disease (Covid-19). Commercially, camphor is very important with many biological properties and is used as a topical ointment since camphor is a very toxic substance and oral consumption of camphor should be avoided.

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## Traditional Herbal Folk Medicine used for controlling Corona virus (SARS-COV-2) Disease (COVID-19)



Dr. Ravindra B. Malabadi

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This review paper highlights the use of herbal medicine in the management of the coronavirus disease COVID-19 (SARS-CoV-2) pandemic, which has caused a worldwide outbreak of respiratory illness. This is caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), which is zoonotic infecting both animal and human. Vaccines are the most promising solution to mitigate new viral strains. The Indian system of holistic medicine known as "Ayurveda" plays an important role in controlling the viral disease SARS-CoV-2 and other health disorders. Dietary therapy and herbal medicine could be a complementary preventive therapy for COVID-19 (SARS-CoV-2). Plants have been used as a expression systems for the...

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July 2021

Authors:

**Ravindra B. Malabadi**  
Mangalore University, Mangalore, Karnataka India**Kiran P. Kolkar****Neelambika T. Meti**  
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Mangalore university[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(17\)](#)[References \(69\)](#)**Abstract**

This review paper highlights the recent updates of the fragrant camphor tree (*Cinnamomum camphora*) and camphor oil is used as a medicine for topical applications for controlling the current outbreak of corona virus (SARS-CoV-2) Delta variant (B.1.617.2) and Delta Plus (AY.1) in India. One of the best example is medicinal plant (sweet worm wood; *Artemisia annua*) containing camphor essential oil has been tested against corona virus (SARS-CoV-2) disease (covid-19). Therefore, medicinal plants containing camphor molecule could be used as an age old herbal therapy in the form of vapours for inhibiting corona virus (SARS-CoV-2). Traditionally camphor has been used as a fragrance in cosmetics, as a food flavourant, as a common ingredient in household cleaners, as well as in topically applied analgesics and rubefacients for the treatment of minor muscle aches and pains. There are many commercial products available in the Indian market where Camphor is used in products such as Vicks and VapoRub. Ravintsara oil is distilled from the leaves of *Cinnamomum camphora* in Madagascar is also tested against corona virus (SARS-CoV-2). Camphor is biologically characterised by insecticidal, antimicrobial, antiviral, antitumor, antinociceptive, anticancer and antitussive activities. It is also used as a skin penetration enhancer. However, camphor is a very toxic substance and numerous cases of camphor poisoning have been documented. Therefore, *Cinnamomum camphora* is used for topical applications and its components should be investigated further as a viable option in the treatment of viral diseases.

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July 2022 · International Journal of Herbal Medicine 10(3):15-25

Authors:

**Keerthi Patil**  
Kamatak University, Dhanwad**Doris M Singh**[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(1\)](#)[References \(17\)](#)

## Abstract

*Cylindrospermum* is a filamentous cyanobacterium capable of both photosynthesis and nitrogen fixation. Chemical constituents of the *Cylindrospermum* sp. PCC518, *Cylindrospermum* sp. PCC 567 have not been entirely detected. In our present study, *Cylindrospermum* sp. PCC518, *Cylindrospermum* sp. PCC 567 cultures were mass cultured and crude extracts were extracted with soxhlet apparatus by using Ethanol and Hexane as the solvents, the chemical constituents and phyto-components were successively determined by GC-MS. A total of 54 compounds were identified from ethanol and hexane extracts which are having Antifungal, antibacterial, antioxidant, anti-inflammatory, anticancer, antiviral activities.

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## WILD EDIBLE FRUITS AND VEGETABLES OF YADAHALLI CHINKARA WILDLIFE SANCTUARY, BAGALKOT, KARNATAKA, INDIA

November 2021 - Journal of Global Biosciences 10:8998-9008

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Karnatak Science College, Dharwad[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(1\)](#)[References \(26\)](#)

## Abstract

**Abstract** Yadahalli Chinkara Wildlife Sanctuary (YCWS) is located in Bagalkot district of Karnataka. The versatile geographical features of the scrub forest area of the sanctuary instrument it to harbour great variety of flora and fauna. The present paper gives a list of wild edible fruits and vegetables of YCWS area on which people of the adjoining area are dependent since long. There were 30 species of 28 genera belonging to 23 families which contributed to the list of wild edible fruits. Among these plants two species were listed from the families Capparaceae, Cucurbitaceae, Fabaceae, Rhamnaceae, Rubiaceae, Rutaceae and Phyllanthaceae each. Remaining families had contributed with only one species each. There were 20 species of 19 genera belonging to 14 families that aid to the list of wild vegetables. Amaranthaceae was the dominate family with 6 species followed by Fabaceae with two species. Remaining families had contributed with single species each. Whereas species *Capparis zeylanical.*, *Coccinia grandis(L.)* Volgt, and *Tamarindus Indical.* were common in the list of both fruits and vegetable. The botanical name, family, habit, vernacular name, taste and mode of consumption (in case of fruits), part/s used and mode of preparation (in case of vegetables) and collector number of all the species are give in the table: 1 and 2.

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### Research Article

#### **A Floristic Diversity of Maraladinni Village Forest Raichuru District, Karnataka**

**Savita and Kotresha\***

Taxonomy and Floristic Lab., Department of Botany, Karnatak University's Karnatak Science College, Dharwad - 580001, India

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Article Information: Submission: 20/03/2022; Accepted: 27/04/2022; Published: 30/04/2022

### Abstract

A survey on flora of Maraladinni (Maski Nala Yojana = MNY) was carried out from 2020 to 2021. Maraladinni lies between 16° 00' 40" Latitude North and 76° 33' 30" Longitude East. The catchment has the total length of the Nala from its originates in the Kushtagi taluqa of Koppal District and joins the



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## Abstract

Go to

This literature review paper highlights the recent updates on the use of herbal extracts or essential oils of medicinal plants in the preparation of hand sanitizers. In India, Covid-19 patients with the development of black fungus infections, mucormycosis is another major health issue. Recent outbreak of coronavirus (SARS-CoV-2) with mucormycosis has promoted the hand hygiene so as to achieve a full recognition among healthcare workers, public and particularly elderly people for controlling the cross contamination of the pathogen. Hand hygiene can be achieved either through hand washing, or hand disinfection. Human health hazards are linked with the frequent use of alcohol-based hand sanitizers is a major health issue. The range of available hand sanitizers and their effectiveness as well as the formulation aspects, adverse effects, and recommendations to enhance the formulation efficiency and safety. Adaptation of alternative preparations of hand sanitizers based on natural and plant resources are the possible solution to get rid off toxicity problem. Washing hands is one of the simplest, most effective ways to get rid of germs

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and avoid infection. Aromatic plants with essential oils have been used because of their many different biological properties, including antimicrobial properties. Therefore, herbal based hand sanitization has been promoted during the recent outbreak of SARS- CoV-2.

**Keywords:** Antimicrobial; Aromatherapy; Coronavirus; Hygiene; Hand washing; Medicinal plants

**Abbreviations:** SARS-CoV-2: Severe Acute Respiratory Syndrome-2; ARDS: Acute Respiratory Distress Syndrome; MERS-CoV: Middle East Respiratory Syndrome Coronavirus; ABHS: Alcohol- Based Hand Sanitizers; NABHS: Non-Alcohol Based Hand Sanitizers; NBRI: National Botanical Research Institute; CSIR: Council of Scientific and Industrial Research; WHO: World Health Organisation; LAS: Linear Alkylbenzene Sulfonates

## Introduction

Go to

Coronavirus is a very serious respiratory illness caused by Severe Acute Respiratory Syndrome-2 (SARS-CoV-2) [1-7]. The emergence of the coronavirus-2 (SARS-CoV-2) pandemic has risen to be a significant global public health concern (1) led to the extensive use of hand disinfectants as a promotive factor for controlling the cross contamination of this deadly viral disease (Covid-19). In view of the COVID-19 outbreak, the entire human race across the globe is perturbed. Coronavirus is zoonotic in nature infecting both animal and human, and therefore, a serious global health problem [1,2,8-13]. Further, coronavirus-2 (SARS-CoV-2) has caused a Public Health Emergency of International Concern [3,14,15]. Elderly people and children are more susceptible to viral infections and prone to serious outcomes, which may be associated with Acute Respiratory Distress Syndrome (ARDS) and cytokine storm [1,2,16,17]. The virus can infect cells of the lungs, kidneys, heart and intestine, resulting in the organ damage leading to the multiple organ dysfunction syndrome [1,2,8,9,16,17]. Coronavirus-2 (SARS-CoV-2) which is genetically similar to SARS-Co-V and Middle East Respiratory Syndrome coronavirus (MERS-CoV) is an enveloped, single and positive-stranded RNA virus with a genome comprising 29,891 nucleotides, which encode the 12 putative open reading frames responsible for the synthesis of viral structural and nonstructural [8,9,16,17]. Transmission of COVID-19 is mainly caused by respiratory droplets, direct human to human contact and fecal to oral transmission might also be associated. COVID-19 prominently affect the respiratory tract (both lower and upper respiratory tract), with the initial symptoms of common cold, fever, dry cough, fatigue, nasal congestion, sore throat and diarrhoea to severe pneumonia, difficulty in breathing and ends with the patient death [1-3,8,9,16,17].

The reservoir hosts of the disease are bats and Himalayan palm civets. Mutation is very common with RNA based

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[Recruit researchers](#) [Join for free](#) [Login](#)[Home](#) > [Indigenous Medicine](#) > [Medicine](#) > [General Practice](#) > [Herbal Medicine](#)Article [PDF Available](#)The Iconic Baobab (*Adansonia digitata* L.): Herbal medicine for controlling Coronavirus (SARS-CoV-2) disease (Covid-19)

August 2021

Authors:

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Mangalore university[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(20\)](#)[References \(87\)](#)

## Abstract

This review paper highlights the medicinal properties particularly the immunogenic potentiality of iconic baobab (*Adansonia digitata* L.) (Kalphavraksha or Wish) tree species belongs to Malvaceae family. During the recent outbreak of second wave of coronavirus (SARS-CoV-2) mutants, Delta variant (B. 1. 617.2) strain and Delta Plus (AY.1) in India has created a major health issue resulted in more hospitalizations and death. Another problem is fully vaccinated people with "breakthrough" infections is rare but reported. This has created a situation and therefore, promoted herbal medicine, fruit pulp of baobab as an immunity booster for controlling the coronavirus (SARS-CoV-2). The baobab (Kalphavraksha or Wish tree) fruit pulp is very rich in vitamin C (280-350 mg/g of the fruit), zinc, and the source of protein and used as a herbal medicine long time ago by local traditional healers in India, Africa, Madagascar and other Asian countries. In addition to this, the baobab fruit pulp is acidic in nature and also known for protease inhibitors which limits the consumption of fruits. Plant protease inhibitors are directly involved in blocking the viral replication and inhibited the viral synthesis. Therefore, two dose vaccination with additional dietary and medicinal therapy will help to prevent the human body against invading viral antigen and improved the overall health condition of the Covid-19 patients. In India, the oral consumption of baobab (Kalphavraksha or Wish tree) fruit pulp with milk as an immunity booster has improved the Covid-19 patients health condition. However, there are no clinical evidences to support the scientific validation. Therefore, clinical experimental studies should be conducted particularly for the scientific validation of immunogenic potentiality of baobab fruit pulp. This will help in developing a novel drug for controlling the coronavirus infections in future pandemic.

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## NATURAL PLANT GUM EXUDATES AND MUCILAGE : PHARMACEUTICAL UPDATES

November 2021

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## Abstract

This review paper highlights the multiple applications of natural plant gum exudates and mucilages in the field of food, cosmetics, textile, paint, paper making, gelling, thickening, emulsifying, suspending, bio-adhesive, biomedical-drug delivery and pharmaceutical industries. India is the first and leading country in the world which has successfully completed the vaccination of 1 billion people against SARS-CoV-2. Two dose vaccine with Indian traditional Ayurvedic herbal medicine treatment has protected many people and reduced the hospitalization. One such example is Okra gum (Bhindi) (*Abelmoschus esculentus*), Acacia gum (*Acacia nilotica*), Tamarind gum (*Tamarindus indica*), Mango gum (*Mangifera indica*) and Cashew gum (*Anacardium occidentale*) were used as a immunity booster and herbal remedy for throat infections, cough, common cold during the recent outbreak of Covid-19 in India. The use of natural gums as pharmaceutical excipients is very attractive because they are economical, abundant, non-toxic, capable of chemical modifications, potentially biodegradable and biocompatible. There are many health related issues with synthetic polymers in pharmaceutical industries. Therefore, there is an urgent need to develop other natural plant based sources as the modifying formulation of novel drug and other delivery systems. Hence the use of natural gums and their modifications aimed at the development of better biomedical materials for drug delivery has opened up a new ray of hope in solving the current drug delivery issues. A new type of polymeric material explored for pharmaceutical applications is modified plant-based gums and mucilages which have extended the scope of gums in the revolution of formulations

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[Recruit researchers](#) [Join for free](#) [Login](#)[Home](#) > [Natural Product Pharmacology](#) > [Biological Science](#) > [Ethnobotany](#) > [Plant Sciences](#) > [Medicinal Plants](#)Article [PDF Available](#)**Medicinal Plants of Yadahalli Chinkara Wildlife Sanctuary, Bagalkot, Karnataka, India**

June 2021

Authors:

**Maheshwari Koti**  
Karnatak Science College, Dharwad**Kotresha Sekharappa Katrahalli**  
Karnatak Science College, Dharwad[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(5\)](#)[References \(20\)](#)**Abstract**

The protected area has a significant role in the conservation of medicinal plants along with the traditional knowledge. A medicinal plants survey was conducted during 2017 to 2019 in the vicinity of Yadahalli Wildlife Sanctuary, situated in the Bagalkot District of Karnataka. In the present study, 36 medicinal plant species belonging to 20 family and 35 genera have been recorded against the 40 different types of ailments which were used by medicine men. The Information about the botanical name along with local names, habit, parts used and medicinal uses of these plant species also been documented. The present study aimed to document the traditional medicinal plants of the study area and promote the awareness among the local people and forest official to conserve these medicinal resources.

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[Recruit researchers](#) [Join for free](#) [Login](#)[Article](#) [PDF Available](#)**Wild Edible Fruits and their Medicinal Uses in Ballari district of Karnataka**

June 2021

Authors:

**Kotresha Sekharappa Katrahalli**  
Karnatak Science College, Dharwad**M. Siddeshwari**  
Vijayanagara Sri Krishnadevaraya University, Bellary[Download full-text PDF](#)[Download citation](#)[Copy link](#)[Citations \(5\)](#)[References \(15\)](#)[Figures \(2\)](#)**Abstract and Figures**

Fruits play the predominant role in the diet of human beings. Wild edible fruits (WEFs) are among the most widely used non-timber forest products (NTFPs) and play an important role in the nutrition, medicinal and traditional lifestyles of the local people. A total of 81 wild edible fruit-yielding plant species were identified. Of these plants, trees are abundant and account for 36 (51.42%) followed by shrubs 17 (24.28%) and herbs 13 (18.57%) climber 4 (5.71%). These plants are consumed either raw or cooked, they provide the minerals like sodium, potassium, magnesium, iron, calcium, phosphorus, etc. They can be used as a remedy for various diseases. Although religion and cultural norms and values play an important role in the conservation of wild edible plants, population pressure and its associated impacts contributed much to the reduction of these plants. The present study was designed to document the bio-medicinal uses for the conservation of wild edible plants in Ballari district, Karnataka.



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## SHORT COMMUNICATION

# Diversity of Pteridophytes in Nipani Taluk, Karnataka, India

Doris Singh,<sup>1\*</sup> Omkar Koshti,<sup>1</sup> Nilesh Madhav,<sup>2</sup> Aditya Magdum,<sup>3</sup> Sushant Amate,<sup>4</sup>  
Pandit Shirgave<sup>4</sup>

DOI: 10.18811/ijpen.v7i01.12

## ABSTRACT

Considering diverse ecological and topographical conditions, Nipani Taluk is close to the Eastern ranges of Western Ghats. Adi Hill and Stavanidhi Ranges are the extended branches of the Western Ghats. An attempt was undertaken to enumerate the ferns from Nipani Taluk to fill the gap of a valid document of the ferns from the study area. During the study, 14 species from 9 different genera of 6 different families were recorded. The distribution of some species is found to be unique from Adi Hill and Stavanidhi Ranges. The study revealed that the number of species from family Pteridaceae was the highest, common to both the ranges followed by family Ophioglossaceae, Marsileaceae, Lomariopsidaceae, Salviniaceae and Polypodiaceae. *Adiantum philippense* L. was dominantly found in both the studied areas, while *Adiantum incisum* Forssk. and *Actiniopteris radiata* (Sw.) Link are less dominant. Whereas *Microsorium membranaceum* (D. Don) Ching is least populated and found very rarely at both the study area.

**Keywords:** Adi Hill, Diversity, Ferns, Nipani Taluk, Stavanidhi Ranges.

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ISSN: 2454-1117 (Print), 2455-202X (Online)

## INTRODUCTION

Pteridophytes (ferns and fern-allies) are the most primitive vascular plants that appeared on the Earth, in the mid-Paleozoic era during the Silurian period which began 438 million years ago. They are the earliest of the plants ever evolved on the earth heralding the presence of a well developed vascular system, and hence, are referred as 'vascular cryptogams'. India has a rich and varied pteridophytic flora due to its Gondwanaland origin, its drift from south of the Equator towards Eurasia far north, carrying the progenitors of today's pteridophytes from Australia, Africa, Madagascar etc. as well as probable endemics of its own. Moreover India's strategic geographical position would have facilitated migration of species, including several pteridophytes from Eurasia and South-East Asia and vice-versa, a notable factor that would have reduced endemism among the fern community. Today, among the vascular plants, pteridophytes form a major part next only to the angiosperms in India. The major centers for pteridophytes diversity are Eastern and Western Himalayas, Western Ghats, Eastern Ghats, Central India and Andaman and Nicobar Islands (Dudani, *et al.*, 2014).

The presence of perennial streams and rivers, evergreen forests, grasslands and high altitude sholas and many other habitats of this mountain chain harbor almost 320 species of ferns and fern-allies. The pteridophytes tend to increase

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**Conflict of interest:** None

**Submitted:** 27/02/2021 **Accepted:** 30/03/2021 **Published:** 15/04/2021

## MATERIALS AND METHODS

### Study Area

Nipani Taluk of Belgaum district in the state of Karnataka is the third largest city. Since Nipani is close to the branches of the Western Ghats, it enjoys a good rainy season (150 to 250 cm)



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## Triphala: An Indian Ayurvedic herbal formulation for coronavirus (SARS-CoV-2) disease (Covid-19)

October 2021

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Mangalore university

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## Abstract

This review paper updated the significance and pharmaceutical effects of Triphala as an alternative traditional herbal Indian folk medicine used as a immunity booster during the recent outbreak of coronavirus-2 (SARS-CoV-2) mutants, Delta (B.1.617.2) and Delta Plus (AY.1). The current outbreak of coronavirus-2 mutants, Delta (B.1.617.2) and Delta Plus (AY.1) is wreaking havoc in India. The new epicentre of the highest number of corona viral mutant infection cases and death rate has been recorded in Indonesia. The hallmark of the coronavirus disease is the cytokine storm, a massive cytokine and chemokine release due to an uncontrolled dysregulation of the host immune defence that causes loss of function of multiple organs and leading to death. One of the evidence to support Triphala alone inhibited the RNA viruses including human coronavirus. Triphala herbal formulation can reduce the production of progeny of human coronavirus, HCoV-NL63 particles and have an antiviral effect under in vitro conditions. In India, Triphala herbal formulation with an additional supplementation of pumpkin seeds, coconut water, sugar cane juice, Aloe vera juice, neem (*Azadirachta indica*) leaf juice, and melatonin rich diet has played an important role in controlling coronavirus disease than Triphala alone. However, clinical trials of Triphala with new additional supplementations is lacking for the scientific validation. On the basis literature survey, there is a ray of hope for the Triphala with additional supplementation as a new therapeutic drug for combating Covid-19 viral infections.

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Karnatak University, Dharwad**Lokeshkumar P.**  
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## Abstract and Figures

The present study aimed to investigate the effects of sublethal concentration of herbicide Fenoxaprop-Pethyl on freshwater edible fish *Cyprinus carpio*. Fishes exposed to a sublethal concentration of herbicide (37.5 µg L<sup>-1</sup>) for 15, 30, and 45 days following the semi-static bioassay method. Haematological and histopathological studies were carried out to evaluate the effects on the vital organs, including the liver, kidney, and gills. Haematological indices such as red blood cells (RBC), haemoglobin, lipid profile, liver function tests, and kidney function tests varied with increasing exposure period. Histopathological alterations revealed hyperplasia, telangiectasia, epithelial separation, and destruction of secondary lamellae in the gills of herbicide-exposed fishes. The liver showed vacuolation, necrosis, nuclear degeneration, and blood infiltration. The kidney exhibited dilated Bowman's space, haematopoietic necrosis, tubular necrosis, pyknosis, and dilated tubules. The histo-architectural changes were directly dependent on the duration of exposure and manifested an increased detrimental effect on the physiology of the fish *Cyprinus carpio*.

**Gill tissues of  
*Cyprinus carpio*...** **Lipid profile of  
*Cyprinus carpio*...**Figures - available via license: [CC BY-NC](#)

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## Fenoxapro-P-Ethyl Induced Biochemical Changes in Fresh Water Fish *Cyprinus carpio* under Sublethal Exposure

January 2022

DOI: [10.36349/easjals.2022.v05i01.001](https://doi.org/10.36349/easjals.2022.v05i01.001)

Authors:



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**Muniswamy David**

Karnatak University, Dharwad

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Abstract

Fenoxapro-P-Ethyl is an herbicide which has wide scope of uses in agrarian fields to control weeds. The used Fenoxapro-P-Ethyl part is let off into streams which definitely influences the endurance of the fish. In the current investigation an endeavor was made to dissect the

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## Studies on Fenaxoprop-P-Ethyl Induced Antioxidant Response in *Cyprinus carpio* L. CARAS

January 2021

Authors:



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## Investigation of Acute Toxicity and the Effect of Fenaxoprop-P-Ethyl Herbicide on the Behavior and Respiratory Dysfunction of the Common Carp (*Cyprinus carpio* L.)

December 2021

Authors:



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


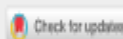


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Research Article

# Investigation on seed oil chemistry of *Bauhinia racemosa* for the production of liquid biofuel

Kariyappa S. Katagi , Nikhil S. Kadam, Ravindra S. Munnolli & Sangeeta D. Benni

Received 02 Nov 2020, Accepted 30 Sep 2021, Published online: 27 Oct 2021

 Cite this article  <https://doi.org/10.1080/15567036.2021.1991527> Full Article Figures & data References Citations Metrics Reprints & Permissions

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## ABSTRACT

The biodiesel is produced from *Bauhinia racemosa*. *Bauhinia racemosa* seeds which yield 25% seed oil. The component fatty acids present in the seed oils is estimated via GC-FID technique. The seed oil has IV of 72.6 g of I<sub>2</sub>/ 100 g of oil, SV of 202.0 mg of KOH/g oil, density of 0.898 g/cm<sup>3</sup>, and viscosity of 31.25 mm<sup>2</sup>/s. The synthesized biodiesel or liquid fuel is characterized by <sup>1</sup>H NMR, IR, and TGA. It has the CN of 56.9, CFPP of 1.3°C, CP of 5.5°C, density of 0.856 g/cm<sup>3</sup>, HHV of 40.0 MJ/kg, FP of 144°C, KV of 3.2 mm<sup>2</sup>/s, and PP of -1.49°C. The biodiesel properties are evaluated experimentally and computationally, and the results are compared with those of existing biodiesels and other reported biodiesels. Thus, investigated biodiesel is confirmed for its quality by comparison with ASTM, BIS, and EN standards.



**KEYWORDS:** *Bauhinia racemosa* seed oil transesterification biodiesel fuel properties

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# Mussel shells as sustainable catalyst: Synthesis of liquid fuel from non edible seeds of *Bauhinia malabarica* and *Gymnosporia montana*

Sangeeta D. Bennis<sup>a, \*</sup>, Ravindra S. Munnoli<sup>a, 1</sup>, Kariyappa S. Kotagi<sup>a, 2</sup>,   Nikhil S. Kadam<sup>b</sup>

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## Highlights




- Using *Bauhinia malabarica* and *Gymnosporia montana* seed oils in biodiesel synthesis.
- Mussel shell-a sustainable catalyst used to reduce the biodiesel production cost.
- Thus obtained biodiesel is optimized and compared with standard biodiesel.
- Further scope of this investigation relay on blending of these feed-stocks.

## Abstract

The utilization of waste resources is an important element of renewability and sustainable growth. The mussel shells are rich in calcium carbonate which can be converted to useable calcium oxide catalyst upon calcination. The novel feed stocks *Bauhinia malabarica* seed oil (BMSO) and *Gymnosporia montana* seed oil (GMSO) are investigated for their physico-chemical data source and are opted for liquid fuel synthesis. The catalyst used is characterized by XRD, FT-IR and SEM. The transesterification reaction is carried out by optimizing 9:1 methanol to oil molar ratio,



# Facile synthesis of libraries of functionalized cyclopropanes and oxiranes using ionic liquids – A new approach to the classical Corey-Chaykovsky reaction

Shruti S. Malunavar<sup>a</sup>, Suraj M. Sutar<sup>a</sup>, Pavanikumar Prabhalo<sup>a</sup>, Hemantkumar M. Savanur<sup>b</sup>,  
Rajesh G. Kalkhambhar<sup>a</sup>, , Gopalakrishnan Aridoss<sup>c</sup>, Kenneth K. Loali<sup>a</sup>  

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<https://doi.org/10.1016/j.tetlet.2021.153339> 

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## Highlights

- Functionalized cyclopropanes from enones.
- Functionalized oxiranes from aldehydes and ketones.
- Ylides from sulfoxonium/sulfonium salts.
- [PAIM][NTf<sub>2</sub>] as basic-IL and BMIM-ILs as solvent.
- Potential for recycling/reuse.



## Abstract

The potential of [PAIM][NTf<sub>2</sub>]/BMIM-ILs as a base/solvent in the Corey-Chaykovsky reaction is demonstrated by the facile synthesis of libraries of functionalized cyclopropanes from enones and oxiranes from aldehydes and ketones, at room temperature in respectable isolated yields. To demonstrate their application, the synthesized epoxides were employed as substrates for the synthesis of a library of 2,3-disubstituted quinolines, using [BMIM(SO<sub>3</sub>H)][OTf]/[BMIM][PF<sub>6</sub>] as a catalyst/solvent. The potential for recycling/reuse of the IL solvents was also explored.





# *In silico* molecular docking and *In vitro* antimicrobial evaluation of some C5-substituted imidazole analogues

Pavankumar Prabhala <sup>a</sup>, Hemantkumar M. Savanur <sup>a</sup>, Suraj M. Sutar <sup>a</sup>, Krishna N. Naik <sup>a</sup>, Manoj Kumar Mittal <sup>b</sup>, Rajesh G. Kalkhambkar <sup>a</sup>  

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<https://doi.org/10.1016/j.ejmech.2021.100016> 

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## Abstract

Multi-drug resistant pathogens are becoming hard-to-treat causing severe infections in humans across the globe emphasizing the prevailing need to discover new therapeutic agents. Imidazole is an important five membered heterocyclic unit with extensive biological activities in medicinal chemistry, especially as anti-fungal agent. In this context, we report a series of C5-substituted imidazole drug conjugates (synthesized by Van-Leusen method followed by employing Suzuki, Heck and Sonogashira cross coupling reactions in Ionic Liquids [ILs]) which were assessed for their antimicrobial activities along with *in silico* molecular docking evaluation. Based on the SAR understanding, molecular docking studies and *in vitro* evaluations of these molecules, together with the resultant inhibitory efficiencies and binding energies, the compounds **2**, **8**, **16–20**, **24** and **27** were found to be excellent antimicrobial molecular entities. However, among these candidates, especially compounds **8**, **16** and **20** found to be the most promising antibacterial drug conjugates showing significant inhibitory potential with MICs ranging from 1 to 16  $\mu\text{g/ml}$  against Gram+ve strains. In case of antifungal activities, compounds **2**, **8**, **15–21**, **24** and **27** exhibited moderate to excellent inhibitions with MIC values in range of 1–16  $\mu\text{g/ml}$ . Perhaps, from the present study compounds **8** and **20** emerge out to be most promising antimicrobial agents with highest binding affinity and maximum inhibition efficiency (1–4  $\mu\text{g/ml}$ ).




## Graphical abstract

Open Article

# Thermal degradation kinetics of ethyl vanillin crosslinked chitosan/poly(vinyl alcohol) blend films for food packaging applications

Shivayagi S. Narasagoudr<sup>a</sup>, Yogesh Shanbhag<sup>b</sup>, Ravindra B. Chougale<sup>c</sup>,  
Basavarajeshwari M. Baraker<sup>d</sup>, Saraswati P. Masti<sup>a</sup>      Blaise Labo<sup>†</sup>

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<https://doi.org/10.1016/j.cdc.2021.100729>

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## Highlights



- Ethyl vanillin (EV) incorporated Chitosan(CS)/poly(vinyl alcohol)(PVA) blend films of different mass percent were prepared by solvent casting technique.
- Inclusion of cross linking agent EV improved the thermal stability of the of CS/PVA matrix by forming Schiff base and inter molecular hydrogen bonding.
- Non-isothermal (dynamic) thermogravimetry was used with three different heating rates ( $\beta$ ) namely 5.0, 7.5 and 10.0 °C  $min^{-1}$ .
- Kinetic parameters such as activation energy ( $E_a$ ) and pre exponential factor ( $A$ ) were evaluated using Flynn-Wall-Ozawa (FWO) equation, Kissinger-Akahira-Sunose (KAS) equation and Kissinger method.
- Results of percent of crystallinity ( $X_c$ ) calculated from XRD found to be in good agreement with the values of  $X_c$  obtained from DSC.

Abstract


# Experimental investigations on nano-titania incorporated polyvinyl alcohol- polyvinyl pyrrolidone composite films

Blaise Lobo  & G. Veena 

Pages 1697-1717 | Received 05 Apr 2021, Accepted 11 May 2021, Published online: 17 Jun 2021

 Cite this article  <https://doi.org/10.1080/25740881.2021.1930045>



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## ABSTRACT

Composite films were prepared by using polyvinyl alcohol – polyvinyl acetate copolymer (PVA/Ac) blended with polyvinyl pyrrolidone (PVP) as the host polymeric material and titania (TiO<sub>2</sub>) nanoparticles (NPs) as the filler, by using ultrasonic dispersion of the filler in PVA/Ac-PVP blend solution, followed by solution casting method. Free standing films of this composite were characterized by using powder x-ray diffraction (XRD) technique, differential scanning calorimetry (DSC), thermo-gravimetric (TG) analysis, transference number determination, as well as DC and dielectric measurements. XRD patterns confirmed the incorporation of titania NPs within the polymer blend (PVA/Ac-PVP). DSC and TG techniques show that the glass transition temperature of the composite decreased, whereas its thermal stability increased on incorporating TiO<sub>2</sub> NPs in PVA/Ac - PVP blend. Wagner's polarization technique, which was employed to determine the transference number revealed that ions were the majority mobile charge carriers. The activation energy ( $E_a$ ) has been determined from DC electrical measurements by using the Arrhenius equation;  $E_a$  was found

Volume 64, Issue 2, December 2022

Articles

# ***Luisia trichorrhiza* (Orchidaceae-Vandeeae): A new addition to Karnataka, India**

<https://doi.org/10.20324/nelumbo/v64/2022/169696>

Published 2022-12-31

Shreyas B., K. Kotresha

Affiliation

## **Abstract**

The present article is about wild epiphytic orchid, which is collected during a field visit in Jogimatti Forest Range of Chitradurga district, Karnataka. The collected species was similar with *Luisia zeylanica* L., based on the morphological investigation, we conclude it as *Luisia trichorrhiza* (Hook.). The characters are usually highlighted with minute trichomes on the roots, labellum structure and size flower size, sepal size, petals size, ovary length etc. and based on literature survey it is confirmed that, it has not been recorded from Karnataka state. The present article is about the addition of *L. trichorrhiza* in Karnataka state, India.







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Volume 54, Part 3, 2022, Pages 786-796

# Garcinia livingstonei leaves extract influenced as a mild steel efficient green corrosion inhibitor in 1 M HCl solution

Manohar R. Rathod<sup>a</sup>, S.K. Rajappa<sup>a</sup>  , A.A. Kittur<sup>b</sup>Show more [+](#) Add to Mendeley  Share  Cite<https://doi.org/10.1016/j.matpr.2021.11.084> [Get rights and content](#) 


## Abstract



Garcinia livingstonei leaves extract (*GLE*) comprises several bioactive components. The environmentally sustainable inhibitor *GLE* was evaluated for mild steel (MS) corrosion control in 1 M HCl solution, employing mass loss, electrochemical impedance spectroscopy, and Tafel polarization methods. The *GLE* adsorption showed the ability of inhibitor on MS. *GLE* appears to be a mixed inhibitor. The rate of corrosion, inhibitor performance and effect of temperature were studied. Adsorption thermodynamic

# Polysaccharide-based blend films as a promising material for food packaging applications: physicochemical properties

Original Research | Published: 04 January 2022

Volume 31, pages 503–518, (2022) [Cite this article](#)

[Vishram D. Hiremani](#), [Tilak Gasti](#), [Saraswati P. Masti](#), [Ravindra B. Malabadi](#) & [Ravindra B. Chougale](#) 

 737 Accesses  9 Citations [Explore all metrics](#) →

## Abstract


To achieve eco-friendly polysaccharide-based blend films, the different weight percentages of chitosan (CH) and oxidized maize starch (OMS) were mixed and the blend films were fabricated by employing the solution casting method. The interaction between the components of the blend films were confirmed by Fourier transform infrared spectroscopy. The presence of hydrogen bonding interaction enhanced the elongation of the blend films from  $3.430 \pm 0.75\%$  to  $43.26 \pm 1.21\%$ . The results from the differential scanning calorimetry exhibited a single glass transition temperature for all the films, depicting that the components of the blend films are miscible over the entire composition.

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# Ionically Crosslinked Chitosan/Tragacanth Gum Based Polyelectrolyte Complexes for Antimicrobial Biopackaging Applications

Original Paper | Published: 09 January 2022

Volume 30, pages 2419–2434, (2022) [Cite this article](#)

[Naganagouda Goudar](#), [Vinayak N. Vanjeri](#), [Vishram D. Hiremani](#), [Tilak Gasti](#), [Sheela Khanapure](#),  
[Saraswati P. Masti](#) & [Ravindra B. Chougale](#) 

 602 Accesses  6 Citations [Explore all metrics](#) →

## Abstract

The novel polyelectrolyte complexes (PEC) were prepared by mixing different Wt% of Tragacanth gum (TG) to Chitosan (CS) and systematic evaluation of multifunctional properties of colloidal solution and films was carried out. The formation of PEC was dependant on the order of mixing of solutions. Particle size analysis, Zeta potential and FTIR confirmed the formation of PEC. SEM studies revealed the homogeneous distribution of colloidal particles on the surface. Contact angle analysis, water solubility, and moisture





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International Journal of Biological  
Macromolecules

Volume 187, 30 September 2021, Pages 451-461



# Smart biodegradable films based on chitosan/methylcellulose containing *Phyllanthus reticulatus* anthocyanin for monitoring the freshness of fish fillet

[Tilak Gasti](#)<sup>a</sup>, [Shruti Dixit](#)<sup>b</sup>, [Oshin J. D'souza](#)<sup>a</sup>, [Vishram D. Hiremani](#)<sup>a</sup>, [Shyam Kumar Vootla](#)<sup>b</sup>,  
[Saraswati P. Masti](#)<sup>c</sup>, [Ravindra B. Chougale](#)<sup>a</sup> , [Ravindra B. Malabadi](#)<sup>d</sup>

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<https://doi.org/10.1016/j.ijbiomac.2021.07.128>

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## Abstract

The current work aims to prepare biologically active and pH responsive smart films based on Chitosan (CS)/Methylcellulose (MC) matrix integrated with *Phyllanthus reticulatus* (PR) ripen fruit anthocyanin. The prepared smart films (CMPR) were fabricated through a cost-effective solvent casting technique. The existences of secondary




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# Exploration of Multifunctional Properties of *Piper betel* Leaves Extract Incorporated Polyvinyl Alcohol–Oxidized Maize Starch Blend Films for Active Packaging Applications

Original Paper | Published: 01 September 2021

Volume 30, pages 1314–1329, (2022) [Cite this article](#)



[Vishram D. Hiremani](#), [Naganagouda Goudar](#), [Tilak Gasti](#), [Sheela Khanapure](#), [Vinayak N. Vanjeri](#), [Sarala Sataraddi](#), [Oshin Jacintha D'souza](#), [Shyam Kumar Vootla](#), [Saraswati P. Masti](#), [Ravindra B. Malabadi](#) & [Ravindra B. Chougale](#) 

 819 Accesses  15 Citations [Explore all metrics](#) →

## Abstract

This study explains the development of eco-friendly polyvinyl alcohol (PVA)/oxidized maize starch (OMS)/Betel leaves extract (BLE) blend films by employing a cost effective technique. The influence of BLE on structural, Thermal, Mechanical, Morphological, Optical, Antibacterial and Antioxidant properties of the PVA/OMS blend were investigated using various characterization techniques. The hydrogen bonding

# Chitosan/pullulan based films incorporated with clove essential oil loaded chitosan-ZnO hybrid nanoparticles for active food packaging

[Tilak Gasti](#)<sup>a</sup>, [Shruti Dixit](#)<sup>b</sup>, [Vishram D. Hiremani](#)<sup>a</sup>, [Ravindra B. Chougale](#)<sup>a</sup>  ,  
[Saraswati P. Masti](#)<sup>c</sup>, [Shyam Kumar Vootla](#)<sup>b</sup>, [Bhagyavana S. Mudigoudra](#)<sup>d</sup>

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<https://doi.org/10.1016/j.carbpol.2021.118866> 

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## Highlights

- CEO loaded CS-ZnO NPs incorporated CS/PL nanocomposite films (CPCZC) were prepared.
- CPCZC films act as strong barrier against UV rays, oxygen, and water vapors.



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## International Journal of Biological Macromolecules



Volume 193, Part B, 15 December 2021, Pages 2192-2201



# Preparation and physicochemical assessment of bioactive films based on chitosan and starchy powder of white turmeric rhizomes (*Curcuma Zedoaria*) for green packaging applications

[Vishram D. Hiremani](#)<sup>a</sup>, [Sheela Khanpure](#)<sup>b</sup>, [Tilak Gasti](#)<sup>a</sup>, [Naganagouda Goudar](#)<sup>a</sup>,

[Shyam Kumar Vootla](#)<sup>b</sup>, [Saraswati P. Masti](#)<sup>c</sup>, [Ravindra B. Malabadi](#)<sup>d</sup>, [Bhagyavana S. Mudigoudra](#)<sup>e</sup>

, [Ravindra B. Chougale](#)<sup>a</sup>  

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<https://doi.org/10.1016/j.ijbiomac.2021.11.050> 

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### Highlights

- White turmeric incorporated chitosan films were successfully prepared by





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## Chemical Data Collections



Volume 36, December 2021, 100796



Data Article

# Evaluation of spectroscopic, microscopic and hydrophobic properties of cetrимide and polyethylene glycol-400 plasticized ethyl cellulose films

[Naganagouda Goudar](#)<sup>a</sup>, [Vinayak N. Vanjeri](#)<sup>a</sup>, [Vishram D. Hiremani](#)<sup>a</sup>, [Tilak Gasti](#)<sup>a</sup>,

[Oshin Jacintha D'souza](#)<sup>a</sup>, [Ravindra B. Chougale](#)<sup>a</sup>  , [Saraswati P. Masti](#)<sup>b</sup>

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<https://doi.org/10.1016/j.cdc.2021.100796> 

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### Highlights

- Novel CI & PEG-400 doped ethyl cellulose films were prepared & studied systematically.





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International Journal of Biological  
Macromolecules

Volume 200, 1 March 2022, Pages 50-60



# Development and evaluation of Moringa extract incorporated Chitosan/Guar gum/Poly (vinyl alcohol) active films for food packaging applications

[Veena G. Bhat<sup>a</sup>](#), [Shivayogi S. Narasagoudr<sup>a</sup>](#), [Saraswati P. Masti<sup>a</sup>](#)  , [Ravindra B. Chougale<sup>b</sup>](#), [Adivappa B. Vantamuri<sup>c</sup>](#), [Deepak Kasai<sup>d</sup>](#)

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<https://doi.org/10.1016/j.ijbiamac.2021.12.116> 

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## Highlights

- The solvent casting technique was used to develop environmental friendly Moringa extract incorporated CGPM active films.
- The FTIR study and XRD analysis suggested the interaction of ME with CGP

# Effect of (E)-2-furan-2-ylmethyleneaminoacetic acid on Corrosion protection of soft steel in HCl Environment

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DOI: [10.52711/0974-4150.2022.00002](https://doi.org/10.52711/0974-4150.2022.00002) 

Address: Arjun G. Kalkhambkar, Rajappa S. K\*

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Published In: Volume - 15, Issue - 1, Year - 2022



## ABSTRACT:

Schiff base (E)-2-Furan-2-ylmethyleneamino acetic acid (FMAA) was prepared and investigated as inhibitor for corrosion protection of soft steel in hydrochloric acid medium. Mass change measurement and electrochemical technique employed for corrosion studies. Inhibitor protects the metal from corrosion up to maximum efficiency of 95.58 % at concentration of 0.004 M. [?PID=2022-15-1-2](#) parameters were calculated for corrosion of soft steel with different temperature. Soft-steel corrosion

# Fabrication and Study of Poly (vinyl alcohol) Film Functionalized with *Basella alba* Stem Extract

Original Paper | Published: 22 February 2022

Volume 30, pages 2888–2904, (2022) [Cite this article](#)

[Oshin Jacintha D'souza](#), [Vishram D. Hiremani](#), [Tilak Gasti](#), [Naganagouda Goudar](#), [Varsha S. L. Saraswati P. Masti](#), [Bhagyavana S. Mudigoudra](#), [Ravindra B. Malabadi](#) & [Ravindra B. Chougale](#) 

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## Abstract

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In this study eco-friendly composite films were prepared based on poly(vinyl alcohol) (PVA) containing different content of *Basella alba* stem extract (BA) (1.5 mL, 2.5 mL and 3.5 mL) by cost effective solvent casting technique. The physicochemical properties of the prepared films were investigated using different instrumental techniques. The molecular interaction between PVA and BA was confirmed by FTIR studies. The incorporation of BA at higher content leads to more strengthen and less flexible bio-composite films which was

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# Fabrication and Study of Poly (vinyl alcohol) Film Functionalized with *Basella alba* Stem Extract

Original Paper | Published: 22 February 2022

Volume 30, pages 2888–2904, (2022) [Cite this article](#)

[Oshin Jacintha D'souza](#), [Vishram D. Hiremani](#), [Tilak Gasti](#), [Naganagouda Goudar](#), [Varsha S. L. Saraswati P. Masti](#), [Bhagyavana S. Mudigoudra](#), [Ravindra B. Malabadi](#) & [Ravindra B. Chougale](#) 

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## Abstract

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In this study eco-friendly composite films were prepared based on poly(vinyl alcohol) (PVA) containing different content of *Basella alba* stem extract (BA) (1.5 mL, 2.5 mL and 3.5 mL) by cost effective solvent casting technique. The physicochemical properties of the prepared films were investigated using different instrumental techniques. The molecular interaction between PVA and BA was confirmed by FTIR studies. The incorporation of BA at higher content leads to more strengthen and less flexible bio-composite films which was

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## Ionic conductivity enhancement of PVA: carboxymethyl cellulose poly-blend electrolyte films through the doping of NaI salt

Vipin Cyriac · Ismayil · I. M. Noor ·  
Kuldeep Mishra · Chetan Chavan ·  
Rajasheshkar F. Bhajantri · Saraswati P. Masti

Received: 24 July 2021 / Accepted: 10 February 2022 / Published online: 7 March 2022  
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**Abstract** In this paper, we report the effect of doping sodium iodide (NaI) salt into a polymer blend matrix of sodium carboxymethyl cellulose (NaCMC) and poly(vinyl alcohol) (PVA). Solution casting approach was used to prepare solid polymer electrolyte (SPE) films. The films were characterized by Fourier-transform infrared spectroscopy (FTIR), X-Ray diffraction (XRD), electrical impedance spectroscopy, thermogravimetric analysis (TGA), and differential scanning calorimetry (DSC). XRD showed that NaI incorporation decreased the crystallinity of NaCMC/PVA-based SPE. FTIR technique confirmed the complexation of salt with polymer matrix due to the formation of the coordination bond between  $\text{Na}^+$

and  $-\text{OH}$  group and hydrogen bond between  $\text{I}^-$  and  $-\text{CH}$  group. The sample with 30 wt% NaI showed the highest conductivity of  $2.52 \times 10^{-3} \text{ S cm}^{-1}$ , strongly influenced by the highest charge concentration ( $n$ ), not its mobility ( $\mu$ ). DSC analysis revealed an increase in glass transition temperature ( $T_g$ ) with increasing salt content. TGA studies showed a decrease in thermal stability with salt inclusion. The transference number was found to be 0.99 for the highest conducting sample showing the primary charge carriers are ions. The highest conducting sample exhibited a mechanical strength of 15.42 MPa at room temperature, and it has been used to fabricate a battery to evaluate its suitability in energy storage devices.

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Education, Manipal, Karnataka 576104, India

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# <sup>1</sup>H-NMR-based serum metabolomic study to evaluate the effect of asarone and metformin on experimentally induced diabetic hepatocellular carcinoma in rats

[Bhriгу Kumar Das](#), [Jayalakshmi K](#) & [Pramod C. Gadad](#) 

*Bulletin of the National Research Centre* **46**, Article number: 164 (2022) | [Cite this article](#)

**1519** Accesses | [Metrics](#)

## Abstract

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### Background

The increased prevalence of hepatocellular carcinoma (HCC) in diabetic patients has focused on the need to characterize the role of altered metabolites in liver carcinogenesis. In this study, together with the serum biochemistry and histopathological observation, <sup>1</sup>H nuclear magnetic resonance (<sup>1</sup>H-NMR)-based metabolomics was carried out to study the effect of asarone and metformin in diabetic HCC rats. Intraperitoneal administration of streptozotocin (STZ; 55 mg/kg b.w.) was used to induce diabetes in male Wistar rats. Further, 2 weeks later, after confirmation of diabetes, another group received diethylnitrosamine (DEN; 200 mg/kg b.w.) to simulate the diabetic HCC condition. The combined dose of  $\alpha$ - and  $\beta$ -asarone (50  $\mu$ g/kg b.w. in the ratio of 1:1) and metformin HCl (250 mg/kg b.w.) treatment was orally given to the diabetic HCC rats for 18 weeks. The serum samples were subjected to <sup>1</sup>H-NMR-based metabolomics analysis to explore the metabolite changes at the end of the study.

## ASSESSMENT OF SUB-SURFACE WATER QUALITY FOR IRRIGATIONAL SUITABILITY IN RAICHUR TALUK, ONE OF THE HARD ROCK REGIONS OF KARNATAKA

Riyaz<sup>\*</sup>, Manjunatha, S<sup>†</sup> and Ajaykumar N. Asode<sup>1\*</sup>

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### Abstract

The present investigations deal with evaluation of water quality in Raichur Taluk of Karnataka, for irrigational suitability. Fifty nine groundwater samples were collected each during pre- and post- monsoon season from various locations covering the entire Raichur taluk, Karnataka. Physico-chemical parameters such as pH, EC, TDS, TH, Ca, Mg, Na, K, CO<sub>3</sub>, HCO<sub>3</sub>, Cl, SO<sub>4</sub>, F and NO<sub>3</sub> were analyzed following standard procedures. Based on the above results, agricultural parameters like SAR, Na%, RSC, MAR, MH, PI, KI were calculated. From the results, it was noticed that most groundwaters in the study area falls under Good to Permissible class of irrigational use based on EC and Na% values during both the seasons. Based on the values of TH it is suggested that 50 and 45 number of samples during PRM and POM respectively were falling in Very Hard category. Further, based on values of parameters- SAR and RSC the water samples were found to be falling in class Excellent to Good during both seasons. Based on Richard's USSI diagram the water samples were found to be low to moderately saline during both seasons. Groundwater infiltration rate in the study area is slow and less due to erratic trend of rains.

**Keywords:** Irrigation, Water quality, Sodium Absorption Ratio, Permeability Index, Raichur, Karnataka

### 1. Introduction

The quality and quantity of any type of water

been affected, resulting in land degradation. Therefore, suitability of water for irrigation and better crop yield

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# Physicochemical and antimicrobial properties of *Phyllanthus reticulatus* fruit extract doped chitosan/poly (vinyl alcohol) blend films for food packaging applications

Original Paper | Published: 04 December 2022

Volume 17, pages 1548–1561, (2023) [Cite this article](#)

[Vishram D. Hiremani](#), [Naganagouda Goudar](#), [Sheela Khanapure](#), [Tilak Gasti](#), [Manjunath P. Eelager](#), [Shivayogi S. Narasagoudr](#), [Saraswati P. Masti](#) & [Ravindra B. Chougale](#) 

 209 Accesses  3 Citations [Explore all metrics](#) →

## Abstract

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Biodegradable polymers were broadly utilized to diminish plastic waste for ecological sustainability. Therefore the current study aims to prepare the novel ecofriendly *Phyllanthus reticulatus* fruit extract (PRFE) functionalized Chitosan (CH)—Poly (vinyl alcohol) (PVA) blend films by employing cost effective solvent casting method. The obtained CH/PVA/PRFE blend films were coded as CPP. The effect of different amounts of PRFE (2 mL, 4 mL, 6 mL and 8 mL) on the physicochemical properties of CH/PVA film was





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## International Journal of Biological Macromolecules


Volume 225, 15 January 2023, Pages 673-686






# *Basella alba* stem extract integrated poly (vinyl alcohol)/chitosan composite films: A promising bio-material for wound healing

[Oshin Jacintha D'souza](#)<sup>a</sup>, [Tilak Gasti](#)<sup>b</sup>, [Vishram D. Hiremani](#)<sup>c</sup>, [Jennifer P. Pinto](#)<sup>a</sup>,

[Shafa S. Contractor](#)<sup>d</sup>, [Arun K. Shettar](#)<sup>e</sup>, [Diana Olivia](#)<sup>f</sup>, [Suresh B. Arakera](#)<sup>d</sup>, [Saraswati P. Masti](#)<sup>b</sup>,

[Ravindra B. Chougale](#)<sup>a</sup>  

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<https://doi.org/10.1016/j.ijbiomac.2022.11.130>

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## Abstract

Natural extract-based bio-composite material for wound healing is gaining much attention due to risk of infection and high cost of commercial wound dressing film causes serious problem on the human well-being. Herein, the study outlines the preparation of Poly (vinyl alcohol)/Chitosan/*Basella alba* stem extract (BAE) based bio-composite film through solvent casting technique and well characterized for wound healing application.

# Cetrimide Crosslinked Chitosan/Guar Gum/Gum Ghatti Active Biobased Films for Food Packaging Applications

Original Paper | [Published: 02 November 2022](#)Volume 31, pages 579–594, (2023) [Cite this article](#)[Shivayogi S. Narasagoudr](#), [Saraswati P. Masti](#) , [Veena G. Hegde](#) & [Ravindra B. Chougale](#) 355 Accesses  1 Citation [Explore all metrics](#) →

## Abstract

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Chitosan/Guar Gum/Gum Ghatti (CS/GG/GGh) active biobased films were fabricated by employing cetrimide as crosslinking and antimicrobial agent in presence of polyethylene glycol as plasticizer through solvent casting technique. The effect of various concentrations (0.05 0.1 0.15 and 0.2%) of cetrimide on the physico-chemical and functional properties of plasticized CS/GG/GGh active biobased films were studied. FTIR analysis confirmed the interactions of cetrimide with polymer chains. The incorporation of cetrimide significantly improved the mechanical, thermal and barrier properties.

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## Current Research in Green and Sustainable Chemistry

Volume 4, 2021, 100216



# $^1\text{H}$ -NMR based lipid profiling of *Gossypium hirsutum* seed oil at different developmental stages

[Nikita J. Kurkuri](#)<sup>a</sup>, [Sanjay Annarao](#)<sup>b</sup>, [Prashanth Miyapadavu](#)<sup>b</sup>, [Jayalakshmi Kamaiah](#)<sup>a</sup>  

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### Highlights

- $^1\text{H}$ -NMR spectroscopy is emerging as powerful robust analytical technique in analyzing bio constituents present in plants.
- The study will be useful in understanding lipid biosynthesis pathways at different developmental stages.





## Seidel Energy of $k$ -fold and Strong $k$ -fold Graphs

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### Abstract

The Seidel energy of a graph is the sum of absolute values of the eigenvalues of its Seidel matrix. In this paper, an explicit expression for the Seidel energy of  $k$ -fold graphs and strong  $k$ -fold graphs is obtained. As a consequence, certain Seidel equienergetic graphs are characterized. Moreover, some new class of Seidel equienergetic graphs are presented.

**Keywords:** Seidel energy, Double graph,  $k$ -fold graph, Strong double graph, Strong  $k$ -fold graph

**Mathematics Subject Classification [2010]:** 05C50, 05C76

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## 1 Introduction

The most elaborated matrix corresponding to a graph  $G$  with  $n$  vertices is the *adjacency matrix*  $A(G) = [a_{ij}]$ , defined by  $a_{ij} = 1$  if a vertex  $v_i$  is adjacent to a vertex  $v_j$  and 0 otherwise. Another well known matrix corresponding to a graph is the *Seidel matrix*  $S(G)$  [20] introduced by van Lint and Seidel in 1966. It is defined as  $S(G) = J_n - I - 2A(G)$ , where  $J_n$  is the matrix with all its entries equal to 1 and  $I$  is an identity matrix both of same order  $n \times n$ . The one of important spectral properties of Seidel matrix is that the

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# Energy of Extended Bipartite Double Graphs

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## Abstract

The energy of a graph is the sum of the absolute values of its eigenvalues. In this article, an exact relation between the energy of extended bipartite double graph and the energy of a graph together with some other graph parameters is given. As a consequence, equienergetic, borderenergetic, orderenergetic and non-hyperenergetic extended bipartite double graphs are presented. The obtained results generalize the existing results on equienergetic bipartite graphs.

## 1 Introduction

All graphs in this article are simple, finite and undirected. The order and the size of a graph  $G$  is the number of vertices and the number of edges in it. Let  $d_i$  denotes the degree of a vertex  $v_i$  of a graph  $G$ . The *eigenvalues* of a graph  $G$  are the eigenvalues

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## ON $\Delta$ -PREREGULAR $e^*$ -OPEN SETS IN TOPOLOGICAL SPACES

*Jagadeesh B. Toranagatti*

### ABSTRACT

In this paper, we introduce a new class of sets called,  $\delta$ -preregular  $e^*$ -open sets and investigate their properties and characterizations. By using  $\delta$ -preregular  $e^*$ -open sets, we obtain decompositions of complete continuity and decompositions of perfect continuity.

### KEYWORDS

Keywords :  $\delta$ -preopen,  $e^*$ -open,  $e^*$ -closed,  $\delta pe^*$ -open,  $\delta pe^*$ -closed,  $\delta pe^*$ -continuity.

### FULL TEXT:

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### REFERENCES

# On rnp-open sets in nano topological spaces

pdf

## Keywords:

nano preopen, nano preclosed, mp-open, mp-closed, rnp-continuity, nano pre continuity.

J.B.Toranagatti

## Abstract

The notion of rnp-open sets in nano topological spaces is introduced. Some properties and characterizations of mp-open sets are established. Also, a new class of continuity called rnp-continuity is introduced and its properties are investigated.

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## ON REGULAR $\delta$ -PREOPEN SETS

J. B. TORANAGATTI<sup>(1)</sup> AND T. NOIRI<sup>(2)</sup>

**ABSTRACT.** The aim of this paper is to introduce a new class of sets called regular  $\delta$ -preopen sets in topological spaces. We characterize these sets and study some of their fundamental properties. Also, new decompositions of complete continuity and perfect continuity are obtained.

### 1. INTRODUCTION

In 1968, Veličko [20] introduced the concept of  $\delta$ -open sets as a stronger form of open sets. In 1993, Raychaudhuri and Mukherjee [18] introduced the concept of  $\delta$ -preopen sets as a generalization of  $\delta$ -open sets. This paper deals with a new class of sets called regular  $\delta$ -preopen sets. Some properties and characterizations of regular  $\delta$ -preopen sets are established. Moreover, we obtain decomposition theorems of completely continuous functions and perfectly continuous functions.

Throughout this paper,  $(U, \tau)$  and  $(V, \eta)$  (or simply  $U$  and  $V$ ) represent topological spaces on which no separation axioms are assumed unless explicitly stated and  $f : (U, \tau) \rightarrow (V, \eta)$  or simply  $f : U \rightarrow V$  denotes a function  $f$  of a topological space  $U$



## A comment on weakly $\pi g$ -closed sets in topological spaces

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**Abstract.** In this paper, we show that the notions of  $\pi gp$ -closed sets and weakly  $\pi g$ -closed sets are equivalent.

**Keywords:**  $\pi$ -open sets, preclosed sets,  $\pi gp$ -closed sets, weakly  $\pi g$ -closed sets.

### 1. Introduction

Mashhour et al. [2] introduced the notion of preopen sets and obtained their properties. In 1968, Zaitsav [5] introduced the concept of  $\pi$ -open sets in topological spaces. Many results had been obtained by using the concept of  $\pi$ -open sets.

In 2004, J. H Park [3] introduced and studied the concept of  $\pi gp$ -closed sets. Recently, O. Ravi et al. [4] discussed and established the concept of weakly  $\pi g$ -closed sets in topological spaces.

In this paper, we show that the concept of  $\pi gp$ -closed set and a weakly

Article

## Equienergetic graphs using Cartesian product and generalized composition

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#### Abstract

The energy of a graph is the sum of the absolute values of its eigenvalues. Two graphs of same order are said to be equienergetic if they have same energy. Several papers dealing with equienergetic graphs exists in the literature and most of these papers consists of equienergetic regular graphs. In this paper we give regular as well as non-regular, equienergetic graphs using the Cartesian product and also by generalized composition



## On $A$ -energy and $S$ -energy of certain class of graphs

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**Abstract.** Let  $A$  and  $S$  be the adjacency and the Seidel matrix of a graph  $G$  respectively.  $A$ -energy is the ordinary energy  $E(G)$  of a graph  $G$  defined as the sum of the absolute values of eigenvalues of  $A$ . Analogously,  $S$ -energy is the Seidel energy  $E_S(G)$  of a graph  $G$  defined to be the sum of the absolute values of eigenvalues of the Seidel matrix  $S$ . In this article, certain class of  $A$ -equienergetic and  $S$ -equienergetic graphs are presented. Also some linear relations on  $A$ -energies and  $S$ -energies are given.

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Computing Classification System 1998: G.2.2

Mathematics Subject Classification 2010: 05C50

**Key words and phrases:** graph energy, Seidel energy, equienergetic graphs, Seidel equienergetic graphs, energy linear relations, graph products



## Some relations between energy and Seidel energy of a graph

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**Abstract.** The energy  $E(G)$  of a graph  $G$  is the sum of the absolute values of eigenvalues of  $G$  and the Seidel energy  $E_S(G)$  is the sum of the absolute values of eigenvalues of the Seidel matrix  $S$  of  $G$ . In this paper, some relations between the energy and Seidel energy of a graph in terms of different graph parameters are presented. Also, the inertia relations between the graph eigenvalue and Seidel eigenvalue of a graph are given. The results in this paper generalize some of the existing results.

### 1 Introduction

Let  $G$  be a simple, finite and undirected graph of order  $n$  with vertex set  $V = \{v_1, v_2, \dots, v_n\}$ . The adjacency matrix  $A = [a_{ij}]$  of  $G$  is a square matrix of

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## SIGNLESS LAPLACIAN POLYNOMIAL FOR SPLICE AND LINK OF GRAPHS

H. S. RAMANE<sup>1\*</sup>, D. PATIL<sup>1</sup>, B. PARVATHALU<sup>2</sup>, K. ASHOKA<sup>1</sup> §

**ABSTRACT.** The signless Laplacian matrix of a graph  $G$  is  $Q(G) = A(G) + D(G)$ , where  $A(G)$  is the adjacency matrix and  $D(G)$  is the diagonal degree matrix of a graph  $G$ . The characteristic polynomial of the signless Laplacian matrix is called the signless Laplacian polynomial. The present work is all about the study of signless Laplacian polynomial for the splice of more than two graphs and the link of such graphs. It is noted that such a study is easier when we take into account of the vertex set partition being an equitable partition, because equitable partition of the vertex set reduces the computational steps and also the quotient matrix polynomial is a part of the polynomial of a graph. In this paper we consider the splice and links of complete graphs and of complete bipartite graphs and obtain the signless Laplacian polynomial of these using equitable partition of the vertex set.

**Keywords:** Signless Laplacian polynomial, equitable partition, splice, link.

**AMS Subject Classification:** 05C31, 05C50.

### 1. INTRODUCTION

The spectra of signless Laplacian matrix perform better when it is compared with the spectra of other commonly used graph matrices (Laplacian, Seidel matrix). Among the generalized adjacency matrices, the signless Laplacian appears to be most convenient in studying graph properties. The study of  $Q$ -spectra of graphs got additional motivation with advancement in the theory of graphs with least eigenvalue  $-2$ . Hence, the study of signless Laplacian matrix is the subject of flurry of recent research. The related research can be seen in [1, 3, 5, 6, 7, 8, 19, 18]

# Spatial Distribution and Regional Inequalities of Rural Infrastructure Facilities: A Case Study of Gadag District, Karnataka, India



Editor Ijss

2021, Indian Journal of Spatial Science

Infrastructure is one of the predominant sectors that propel the overall development of a region. Most of the academicians, planners, and Government and Non-government agencies have However, infrastructure facilities are unevenly spread over the space owing to environmental, economic, cultural, and political processes that often produce areas of concentration and specialization. The current article is an attempt to evaluate the spatial distribution of select infrastructure facilities (education, health, transport, and banking) and assessed the regional equalities in the Gadag district of Karnataka. The investigation is based on secondary data collected from various government agencies. Quantitative techniques (z-score, infrastructure development index, correlation coefficient, etc.) are used to test hypotheses and investigate the relationship between infrastructure and per capita income, poverty, settlement size, and population. *Keywords:* Infrastructure facilities, Gadag district, Karnataka, India, spatial distribution, regional inequalities.

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Comparative Analysis of Spatial Disparities Based on Infrastructure Development and Socioeconomic

## Regional Imbalance in the Levels of Development in Bagalkot District- Karnataka: A Spatial Analysis

<sup>1</sup>Dr. L.T. Nayak and <sup>2</sup>Mr. B.D. Ajjodi

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### Abstract


After independence India has made remarkable progress in the socio-economic status of the people. But the attainment of this has spread highly uneven among the urban and rural areas. Regional imbalances are common phenomenon in the world, which occurred across different continents, countries and regions in different extent and India is not exception in this context. This phenomenon spread among inter-regions, inter-states and intra-states in India. This resulted into uneven development in the country. This process of imbalance is not exception in Bagalkot district. There are three major rivers namely the Krishna, the Malaprabha and the Ghataprabha and their tributaries flow in the study area and play important role in the development of the district. However, the study reveals that there exists a wide imbalance in the level of socio-economic development in the region. In view of this, an attempt has been made in this research work to evaluate and compares temporal growth and spatial pattern of disparities in the levels of socio-economic development at block level in Bagalkot district. Correlation coefficient technique has been applied to understand the correlation between different factors which are responsible for widening the regional imbalance. To analyses the regional imbalance of six taluks of Bagalkot district, 23 social, economic and demographic indicators have been considered. The present paper is based on secondary information based on which the socio-economic imbalance among the taluks of the district is made with the help of composite development index for two time of point i.e. 1997 and 2017 data. It has been observed that the social indicator values varied from 11 to 27. The study period witnessed Bagalkot, Badami, Hunagund and Jamkhandi are the three taluks which represent high social development, whereas low (< 11) social development was observed in Bilagi taluk. The outstanding causes for this backwardness are, less number of education institutes, communication centers, adult education centers, health centers, family planning centers, recreational centers etc. The observed values of economic development are ranging between 19 and 35. It had been observed in only two taluks viz Bilani

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## Research Article

### PERFORMANCE OF BHAGYALAXMI PROGRAMME IN GADAG DISTRICT: A SPATIO- TEMPORAL ANALYSIS

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#### ABSTRACT

After independence the Government of India had concentrated on welfare oriented approaches particularly women's related issues. The National Perspective plans for Women advocating a holistic approach for social and economic development of women. Government had envisaged an alternative strategy which can set out a series of action plans relating to the sectors of rural development, health, legislation, political participation, education, employment, supports services, communication and voluntary action. Keeping the background in the mind an investigator envisaged to evaluate the performance of government Scheme of Bhagyalaxmi in Gadag District. The entire research work is based on secondary data. Quantitative techniques viz. Standard deviation is applied to make the study area into different categories like Best, Fair and worst performance. Spatio-Temporal performance of Bhagyalakshmi in Gadag District has been analyzed for 10 years i.e. from 2010-11 to 2019-20. Out of 8,61,956 BPL family girl children, 45,689 girl children's have been benefited that accounts only 5.3 per cent during study period. Temporal data reveals that there was growing trends in the number of beneficiaries during study periods. During 2010-11 there were 6,712 girl children were benefited, but in 2019-20 this figure has increased to 9,438, net increase was by 2,726 beneficiaries. Spatial analysis depicts that there is a wide variation in the performance of Bhagyalaxmi scheme in the district. During the study period i.e., 2010, 2015 and 2020 Gadag taluk well Performed as a result it registered under best performance group followed by Ron taluk which had lies in fair performance in 2010 and 2015, but in 2019-20 its performance was not good therefore, it exists under low performance range. The rest of the taluks namely Nargund, Shirabatti and Mundergj performance was not at the expected level in 2010-11, and in 2015-16 and 2019-20 Nargund taluk retains its worst performance position. Overall changes during the study period reveal that almost all the taluks registered under negative growth in rest of performance of Bhagyalakshmi scheme.

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# Identification of Regional Disparities in the Level of Agriculture and Allied Development in North Karnataka: A Spatial Analysis

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DOI: <https://doi.org/10.31305/rrijm.2022.v07.i04.005>

**Keywords:** Agriculture and allied, Regional Disparity, Areas, Developed, Backward, Spatial, CCDI

## ABSTRACT

After independence India has achieved remarkable progress in the levels of socio-economic development. However, the attainment of this progress has spread highly uneven from region to region, society to society, sector



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Article

# Deterministic and stochastic models for unemployment

April 2021

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## Abstract

The study aims at proposing deterministic and stochastic models for unemployment. Both discrete state and continuous state models are considered using Poisson process and stochastic differential equations respectively. Solutions for proposed models are derived and compared the proposed models, by using simulation study. This study concludes that stochastic model is more realistic than deterministic model. **Keywords and phrases:** unemployment, deterministic model, stochastic model, Laplace transformation, stochastic mean value, Euler-Maruyama method.



## RESEARCH ARTICLE

### AN OVERVIEW OF SWARM INTELLIGENCE IN ARTIFICIAL INTELLIGENT SYSTEMS

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#### Manuscript Info

##### Manuscript History

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#### Abstract

Swarm intelligence refers to a kind of problem-solving ability that emerges in the interactions of simple information-processing units. The concept of a swarm suggests multiplicity, stochasticity, randomness, and messiness. Advancement of technology has led to problems that are complex and more challenging. Swarm intelligence techniques were mostly developed for solving optimization problems.

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#### Introduction:-

Swarm intelligence is a collective behavior in decentralized, self-organized systems, natural or artificial. SI systems are made up of a population of simple agents interacting locally with one another and their environment. The inspiration often comes from nature, especially biological systems. The agents are no centralized control structure dictating how individual agents should behave, local and to a certain degree random, interaction between such agents lead to the emergence of intelligent global behavior, unknown to the individual agents.

#### Swarm

It is an aggregation of similar animals generally towards the same direction is called swarm.

#### Intelligence

Anything which acts intelligently, then that behavior is called as intelligence



4 years ago

## Design and Synthesis of Polycyclic Acridin-(9-yl-Amino)Thiazol-5-yl)-2H-Chromen-2-One Derivatives: As Antiproliferative and Anti-TB Pharmacophores

Smita. G. Mane, Kariyappa. S. Katagi, Nikhil. S. Kadam, Mahesh. C. Akki, Shrinivas. D. Joshi

A series of novel acridine-thiazole bridged coumarin derivatives **3a–3i** were designed, synthesized and subjected for their *in-vitro* antiproliferative activity on human breast cancer (MDA-MB-231), lung cancer (A-549) and colon cancer (HT29) cell lines. In case of human breast (MDA-MB-231) cell line, among the nine screened compounds, **3d**, **3c**, **3g**, and **3a** exhibited moderate to good antiproliferative activity with  $IC_{50}$  values in the range 14.06–8.03  $\mu\text{M}$  concentration. The compound **3d** exhibited higher activity with  $IC_{50}$  value 8.03  $\mu\text{g/mL}$ , compared to **3c** with  $IC_{50}$  value of 12.03  $\mu\text{g/mL}$ . Whereas, compounds **3g**, **3b**, **3h**, **3a**, and **3i** also exhibited significant cytotoxicity with  $IC_{50}$  values in the range 05.18–18.17  $\mu\text{M}$  concentration. Further, the compound **3g** exhibited distinct activity with  $IC_{50}$  value 05.18  $\mu\text{g/mL}$ , followed by compound **3b** with  $IC_{50}$  value of 09.09  $\mu\text{g/mL}$  for A-549 cancer cell line. However, for HT29 cell line all of the compounds showed significantly lesser activity when compared with standard drug Cisplatin. In addition, the synthesized compounds were screened for their anti-TB activity and its cytotoxicity, the compound **3g** exhibited excellent antitubercular activity with MIC of 0.78  $\mu\text{g/mL}$ , while the compound **3b** exhibiting MIC of 1.56  $\mu\text{g/mL}$  with the highest safety percentage survival of 72% and 78%.

Publisher URL: <https://www.tandfonline.com/doi/full/10.1080/10406638.2020.1734636>





## On Spectral Polynomial of Splices and Links of Graphs\*

Harishchandra S. Ramane, Dhaneshwari Patil, K. Ashoka and B. Parvathali

ABSTRACT: The spectral polynomial of a graph is the characteristic polynomial of its adjacency matrix. Spectral polynomial of the splice and links of complete graph and star have been obtained recently in the literature. In this paper we generalize these results using the concept of equitable partition.

Key Words: Spectral polynomial, splices, links, equitable partition.

### Contents

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<b>2 Spectral polynomial of splice of graphs</b>	<b>2</b>
<b>3 Spectral polynomial of link of graphs</b>	<b>4</b>

### 1. Introduction

A graph  $G = (V(G), E(G))$ , where  $V(G) = \{v_1, v_2, \dots, v_n\}$  is a finite non-empty set of elements called vertices and  $E(G)$  is a set of unordered pairs of distinct vertices called edges. Graphs considered here are simple and undirected. We follow the book [2] for terminology and definitions. The adjacency matrix  $A(G)$  of a graph  $G$  of order  $n$  is the  $n \times n$  matrix indexed by  $V(G)$ , whose  $(i, j)$ -th entry is defined as  $a_{ij} = 1$  if  $v_i v_j \in E(G)$  and 0, otherwise. The spectral polynomial of  $G$  is defined by  $|xI_n - A(G)|$  and is

# Effect of *Artabotrys odoratissimus* extract as an environmentally sustainable inhibitor for mild steel corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> media

Manohar R. Rathod, R.L. Minagalavar, S.K. Rajappa  

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## Highlights

- Corrosion experiments were performed using an ecologically friendly *Artabotrys odoratissimus* leaf extract (AOLE).
- Electrochemical findings indicate that AOLE is a corrosion inhibitor of the mixed type.
- The adsorption of AOLE molecules followed the Langmuir isotherm.
- According to the surface investigation, *Artabotrys odoratissimus* leaves extract possesses a strong anti-corrosion activity.
- The SEM, contact angle and AFM studies revealed the adsorption of the components of AOLE on the surface of MS 0.5 M H<sub>2</sub>SO<sub>4</sub>.

## Significances of Bioengineering & Biosciences

### Role of Plant Based Hand Sanitizers During the Recent Outbreak of Coronavirus (SARS-CoV-2) Disease (Covid-19)

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Volume5 Issue1

### Abstract

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This literature review paper highlights the recent updates on the use of herbal extracts or essential oils of medicinal plants in the preparation of hand sanitizers. In India, Covid-19 patients with the development of black fungus infections, mucormycosis is another major health issue. Recent outbreak of coronavirus (SARS-CoV-2) with mucormycosis has promoted the hand hygiene so as to achieve a full recognition among healthcare workers, public and particularly elderly people for controlling the cross contamination of the pathogen. Hand hygiene can be achieved either through hand washing, or hand disinfection. Human health hazards are linked with the frequent use of alcohol-based hand sanitizers is a major health issue. The range of available hand sanitizers and their effectiveness as well as the formulation aspects, adverse effects, and recommendations to enhance the formulation efficiency and

**2022-23**





## Experimental investigations on Nano Titania - Polyacrylamide Composite Films

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**Abstract:** TiO<sub>2</sub> nanoparticles (titania) filled polyacrylamide (PAM) based composite films were prepared by solution casting technique, with filler levels (FLs) varying from 0.0 up to 19.50 Wt%. Spectroscopic, thermal, and electrical properties of these composite films were experimentally studied. Optical studies revealed a decrease in optical band gap of TiO<sub>2</sub> NPs filled PAM composite with increase in titania NP content in the composite, and also showed the formation of intermediate bands due to formation of CTCs. Thermal studies revealed that TiO<sub>2</sub> NP filled PAM composite samples exhibited low value of T<sub>g</sub> and improved thermal stability at low (0.02 and 0.4 Wt%) and moderate FLs. The samples were subjected to temperature dependent Direct current (DC) electrical measurements in the temperature range of 303K to 340K. Variable Range Hopping (VRH) model was used to analyze the data. Activation energy and most parameters were determined from VRH model. Results revealed a decrease in activation energy for thermally stimulated mobility of charge carriers, and so the electrical conductivity increases at low FLs. SEM images revealed good dispersion of titania NPs in the polymeric (PAM) host material at low FLs (FL = 0.02 and 0.4 Wt%). EDS spectra indicated the existence of C, N, O, Ti elements as the constituents of the studied polymer composites.

**Index Terms:** EDS analysis, Optical studies, PAM-TiO<sub>2</sub> composite, Thermal analysis, VRH Model analysis.

### 1. INTRODUCTION

Polymeric materials, due to their unrivalled properties of being highly flexible, easily processable and having low density are widely employed in the fabrication of flexible displays, capacitors and in various other energy storage applications (Li et al, 2018; Zhou & Jiang, 2020). But, most of the common polymeric materials have low ionic conductivity (Zulkifli, 2012; Zhao & Liu, 2010), and one of the methods which can be adopted to overcome this problem is to incorporate inorganic

and ceramic fillers into the polymeric matrix. This results in the formation of a new polymer based composite material. In recent times, a large number of research reports have been devoted to characterizing and scrutinizing the nano-scale inclusions in traditional polymeric materials; such composite materials are prepared because of their potential applications in different areas (Shukla et al, 2021; Shameem et al, 2021; Hassan et al, 2021; Wang et al, 2021). The incorporation of nano-fillers into a polymer matrix results in an enhancement in physical properties of the resulting polymer composite even at very low levels of filler when compared to their bulk counterparts. When nano-sized inorganic fillers are used as polymer additives, they exhibit additional advantages due to modifications in reactivity and properties, due to the nano -size of the filler. The advancement in the field of nanotechnology has resulted in the use of nano-filler incorporated polymer composites as promising materials for the fabrication of electro-optical devices, solid state sensors, anti - corrosive coatings and electronic devices (Harb et al, 2020; Singh et al, 2020; Rajeh et al, 2020; Faupel et al, 2010). The enhancement in material properties of the nano-filler incorporated polymeric composite is due to their higher surface area to volume ratio, which results in significantly enhanced interaction between the filler nanoparticles (NPs) and polymer molecules in the host matrix, and also due to the quantum confinement effects, which becomes active in these materials at the nano-scale (Ayanoglu & Dogan, 2020). In fact, a small amount of filler made up of NPs could be dispersed in large volumes of the polymeric host to achieve desired properties in the resultant composite material, without affecting its processability. Various nano-fillers can be introduced in the polymeric host in order to tailor the properties of these composite materials (Mai & Yu, 2006; Shrivastava et al, 2016; Kim et al, 2015). As the performance of any device using polymeric composite materials mainly depends on properties of the polymeric host material which has been used, the search for

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# Experimental investigations on the beta attenuation properties of lead monoxide – Polycarbonate composite films

Vijayashri Ashok Kandagal, Rajeshwari Mirji, [Blaise Lobo](#),

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## Abstract

Lead monoxide filled polycarbonate polymer composite films have been prepared with twelve different filler levels, ranging from 0.5 up to 10.0 percent by weight, by using ultrasonic dispersion of lead monoxide in the polycarbonate solution, followed by solution casting. For these composites, beta radiation shielding properties such as mass attenuation coefficient, range of beta particles and half value layer thickness for beta particles from low activity thallium -204 and yttrium - 90 radioactive sources have been found experimentally and computationally, along with the mass density and modified atomic number of the composite material. Two different computational methods, namely, Baltakment's empirical formula method and Bragg's mixture rule have been used to calculate the theoretical value of mass attenuation coefficient, whereas Katz and Penfold relationship has been used to calculate the range of the beta particles obtained from these sources in the prepared composite films. The results obtained are discussed.



## Introduction

The knowledge about interaction of radiation with matter is important to develop radiation shielding materials which have wide applications in institutions and industries handling radioactive sources, preservation of food by radiation treatment, as well as in the nuclear power industry and dosimetry [1], [2]. The study of mass attenuation coefficient ( $\frac{\mu}{\rho}$ ) and half value layer (HVL) of beta particles in a condensed medium (material or sample) is important in order to obtain basic information regarding its composition [3] and makes it possible to solve various problems in the radioactive processing of agricultural produce as well as in the medical field (like for example, in the radioactive diagnosis and treatment of cancer), in addition to different areas of physical and bio-sciences [4].

In this paper, lead monoxide (PbO) filled polycarbonate (PC) composites with thirteen different filler levels (FLs) of PbO in PC, starting from 0.0wt% up to 10wt%, have been used for beta particle attenuation. PC is a thermoplastic material




# Optical analysis of polycarbonate – Lead nitrate composite films for UV-A shielding applications

Manjappa C.K., Rajeshwari Mirji, Blaise Lobo  

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## Abstract

Due to global warming and ozone depletion in the atmosphere, protection for human beings from UV radiation becomes necessary. It is possible to shield a selective part of the solar light falling on the earth's surface by using polymeric composite materials. In this work, polymeric composite films have been prepared by using polycarbonate as the host matrix and lead nitrate as filler. Different filler levels, equal to 0, 5, 15, 25, 35, and 50 weight percentages (wt%) of lead nitrate are dispersed in polycarbonate by ultrasonication, followed by solution casting. The prepared films are characterized by using UV-Visible absorption (optical) spectroscopy, and the resulting spectra have been analysed. It is found that the absorption edge is shifted towards higher wavelengths (red shifted) as the filler level increases, and for the composites with filler levels greater than 15wt%, it is observed that there is strong absorption of the incident electromagnetic radiation in the wavelength range varying from 335nm up to 375 nm (which is in the UV-A range). However, the transmittance in the visible region (400 – 700nm) decreases from 87% down to less than 43%. The 15wt% (FL) composite film has 64% of visible light transmittance. Hence, after exploring further improvements, it is a good candidate to replace glass in different applications like UV-A band filters, as well as Ultra-Violet (UV) protection windows, doors, face shields and safety visors of helmets.

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# Morphological, linear and nonlinear optical characteristics of PVA/Ac-PVP blend filled with nanoparticles of titania

G Veena & **B Lobo** 

*Bulletin of Materials Science* **45**, Article number: 195 (2022)

**154** Accesses | [Metrics](#)

## Abstract

Titanium dioxide (TiO<sub>2</sub>) nanoparticle (NP)-filled poly(vinyl alcohol-co-acetate) [PVA/Ac]-polyvinyl pyrrolidone (PVP) blend composite films were prepared with filler level (FL) ranging from 0.0 to

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# Structural, AC and DC Electrical Transport Properties of Nano Titania - Polyacrylamide Composite Films

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## Abstract

The microstructural features as well as the AC and DC electrical properties of titanium dioxide (titania or  $\text{TiO}_2$ ) nanoparticle (NP) filled polyacrylamide (PAM) composite films with filler level (FLs) Varied from 0.02 up to 19.5 Wt % were experimentally studied. SEM images revealed that the composite films with FLs equal to 0.02 and 0.40 Wt % (low FLs) showed homogeneous dispersion of spherical  $\text{TiO}_2$  NPs, whereas aggregation of the filler was observed at higher FLs. The XRD patterns of these composite films revealed an increase in their amorphousness at low FLs. The activation energy ( $E_a$ ) determined from Arrhenius equation showed that the composite with FL equal to 0.40 Wt % exhibited the lowest value of  $E_a$  (equal to 0.84 eV). Dielectric study revealed that the composite film with FL equal to 0.40 Wt % exhibited the highest value bulk conductivity at room temperature ( $4.39 \times 10^{-6} \text{ S m}^{-1}$  at 303 K). Hence, the composite sample with FL 0.40Wt %, along with pure PAM, were subjected to a detailed dielectric study at various fixed temperatures ranging from 303K up to 353K. The composite sample with FL 0.40 Wt % showed a maximum bulk conductivity of  $1.12 \times 10^{-4} \text{ S m}^{-1}$  at temperature 353K, while it was  $3.45 \times 10^{-8} \text{ S m}^{-1}$  for pure PAM at 303 K.



Research Article

# Computation of gamma radiation shielding parameters of lead monoxide filled polycarbonate composite films

Vijayashri Ashok Kandagal, [Blaise Lobo](#)

This is a preprint; it has not been peer reviewed by a journal.

<https://doi.org/10.21203/rs.3.rs-1468949/v1>

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Status: **Posted**

Version 1

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## Abstract

The gamma radiation shielding properties of lead monoxide filled polycarbonate composite materials for fourteen different filler levels (ranging from 0.25wt% up to 10wt%) have been studied theoretically by computing radiation shielding parameters such as mass attenuation coefficient, linear attenuation coefficient, half value layer and mean free path. The mass attenuation coefficient of gamma rays having specific energies (from 59.54 keV up to 1332.5 keV) has been calculated by using polynomial formula method and also by using two other methods, namely, Lagrangean interpolation method and Logarithmic interpolation method. Other shielding parameters like linear attenuation coefficient, mean free path, half value layer and tenth value layer have been calculated for these composites. The calculated values of mass attenuation coefficients fit well with NIST-XCOM data. The results suggest that, at higher filler levels, PbO filled PC composites can be good gamma shielding materials for ionizing electromagnetic radiation, especially in the low energy gamma or x-ray region.

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# Variation of optical parameters of physically stacked polyvinylidene chloride films with thickness and wavelength

M.B. Akkamma, **Blaise Lobo** ✉

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## Abstract

A study of thickness variation and the wavelength dispersion of optical parameters for thin physically stacked films of polyvinylidene chloride (PVDC), namely, refractive index, skin depth and dielectric constant have been performed. The refractive index and dielectric constant of these PVDC films initially increases with increasing film thickness, but for film thickness greater than 0.0048cm, it is observed that these parameters vary with thickness to a much lesser extent, but continues to vary significantly with wavelength. The observations are discussed in terms of variation of average values of these optical parameters, along with errors estimated from residual analysis. The variation of these parameters with wavelength of electromagnetic radiation in the visible region (varying from 400nm up to 700nm) is presented and discussed. The analysis of the UV-visible spectra revealed the existence of both direct and indirect electronic transitions in k-space by the absorption of photons of suitable energy. The optical band gap depends on the thickness of the films, and there are significant changes in all other optical parameters of PVDC films with both the thickness of the stacked films and wavelength of the incident UV-Visible radiation.

## Introduction

The refractive index (RI) of a material is one of its fundamental properties, because it is closely related to the electronic polarizability of ions and the local field inside the material [1]. The evaluation of RI of materials is of considerable importance due to its application in integrated optical devices such as switches, filters and modulators, where it is the key parameter for device design. Polymer films of decreasing thickness are being employed in many microelectronic applications, including multi-layer applications wherein the films are stacked to make multiple interfaces, and so the thickness of a thin film is an important design and characterization parameter. As expected, the constraints imposed by the thin polymer film geometry will lead to a deviation of the thin film properties from that of their bulk counterparts. Thus, a fundamental understanding and detailed elucidation of thickness dependent optical behaviour of polymer





# Experimental investigation of the structural features of polycarbonate (PC) filled with bismuth nitrate pentahydrate (BNP) composite films in terms of free volume defects probed by positron annihilation lifetime spectroscopy

Rajeshwari Mirji<sup>a</sup>, Blaise Lobo<sup>a</sup>, Dhanaadeep Dutta<sup>b</sup>, Saraswati P. Mosti<sup>c</sup>, Manjunath P. Eelgger<sup>c</sup>

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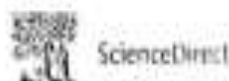
## Abstract

The effect of bismuth nitrate pentahydrate (BNP) on the properties and microstructural features of polycarbonate (PC) has been investigated using PALTR, XRD, SEM, EDX, TG, ATR-FTIR and tensile mechanical measurements. Positron Annihilation Lifetime Spectroscopy reveals that the ortho-positronium lifetime and its corresponding intensity significantly decrease as the filler level of BNP in PC (in the composite) increases from 0.3wt% up to 5.0wt%. This is due to the increasing fraction of positrons that annihilate with the filler particles and also in the interfacial layers of the filler and the host polymer. Fourier Transform Infrared spectra show that there is no significant shift in the IR bands of the composite when compared to those of pure PC, and so there is little molecular level interaction between PC and BNP. The micrographs of SEM revealed a random distribution of filler particles in the composite, and there is the formation of agglomerates of BNP at higher filler levels. There is an increase in the degree of crystallinity of the composite films due to the addition of the crystalline filler, which was confirmed by XRD analysis. Tensile mechanical tests confirmed the improved tensile strength of prepared composites at lower and moderate filler levels, from 0.0wt% up to 2.5wt%. The free volume properties of the composite films are correlated with its tensile mechanical properties.

## Introduction

A polymeric composite is an effective polymer framework that is obtained by mixing polymers with inorganic or organic components called fillers in a specific proportion, so that the desired properties are achieved (Shankar et al., 2020). Polymer composites have been widely explored because of their useful bulk physical properties; for example, physical properties like optical, electrical, mechanical and some chemical properties are enhanced on the incorporation





# Optical properties of UV-C irradiated polyvinylidene chloride films

Akkanna M.B., **Shree Gowd** R. **et al.**

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## Abstract

**Polyvinylidene chloride (PVDC)** polymer films were exposed to ultra-violet light (UV-C light of wavelength 254nm) in air for different exposure times varying from 1h up to 6h. These films were characterized by using ultraviolet-visible (UV-Vis) and Fourier transform infrared (FTIR) spectroscopic, scanning electron microscopy (SEM), as well as powder X-ray diffraction (XRD) techniques. XRD scans reveal that the degree of crystallinity ( $X_c$ ) increased from 4.7% up to 28.6% on increasing the UV exposure time from 1h up to 4h, and a further increase in the exposure time causes a decrease in its value. Analysis of the SEM images revealed an increase in particle size (chemically modified regions) on increased the UV exposure time of PVDC films from 1h up to 6h, and the maximum size of these regions were observed for an exposure time of 4h. The SEM images showed a damaged PVDC surface, the formation of cotton-like fibrous regions, as well as many cracks due to the photo-degradation of polymeric chains. FTIR scans reveal the formation of hydrogen bonded hydroxyl groups as well as carbonyl structures in the PVDC sample on exposure to UV-C radiation. For the study of modification in band structure of the UV irradiated PVDC films, UV-Visible spectroscopy was used. It was found that the optical band gap decreases from 4.70eV down to 3.92eV, as obtained from the plot of  $\sqrt{\epsilon_2}h\nu$  versus  $h\nu$ . The penetration depth ( $\delta$ ) decreased from 0.0074cm down to 0.0035cm at 4.88eV, the energy corresponding to incident UV-C radiation. The calculation of percentage decrease in the value of  $\delta$  with respect to wavelength and with variation in UV-C exposure time reveals that UV-C irradiated PVDC films are good radiation shields against both UV-A and UV-B electromagnetic radiation. The study of refractive index with respect to wavelength reveals that UV irradiation of PVDC films is an effective method to modify the refractive index of PVDC, thereby making the material more suitable for use in different optical applications. The optical dielectric constant was studied systematically, which indicated that the energy storage properties of the PVDC films can be tuned and tailored by UV-C radiation.



## Short communication

## Saussurea obvallata leaves extract as a potential eco-friendly corrosion inhibitor for mild steel in 1 M HCl

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## ARTICLE INFO

**Keywords:**  
 Saussurea obvallata leaves  
 IZS  
 Corrosion inhibitors  
 Tafel plots  
 Inhibition efficiency  
 Nyquist plots

## ABSTRACT

The extract of saussurea obvallata leaves (SOLE) has been examined for corrosion inhibition studies for mild steel (MS) in 1 M HCl solution by electrochemical impedance spectroscopy (EIS), potentiodynamic polarization and traditional mass change measurements. SOLE controlled maximum of 90 % corrosion rate of MS in 1 M HCl solution at 200 ppm of SOLE. SEM-EDX, AFM and Contact angle images revealed that, MS surface was least affected by the acid solution in presence of SOLE. FT-IR and UV-Visible absorption spectral values established the set of a corrosion defensive layer over the MS surface. Potentiodynamic measurement revealed that SOLE act as a both anodic and cathodic type of inhibitor. Quantum chemical calculations shows that, the  $E_{LUMO}$  as an electron donor of SOLE donate electrons to appropriate acceptor molecules to the vacant d orbital of Fe atoms of MS. Unfilled 3d orbital of MS could bind with HOMO of the inhibitors. On the other hand filled 4s orbital could donate the electron to LUMO of the inhibitor as openly  $E_{HOMO}$  indicates the ability of molecules to accept electrons. Variation of experimental temperature studies revealed that the stability of the protective layer decreased at higher temperature and corrosion activation energies increased in the addition of SOLE.

## 1. Introduction

Iron and its alloys have been found large number of industrial uses due to its excellent mechanical strength, high mechanical resistance, durability, toughness, and prominent functional properties due to their relatively low cost in fabrication, construction, engineering, petroleum refinery industries, power plants and other variety of industrial appliances [1–3]. Additionally, due to exposition of mild steel in an open corrosive environment it is more susceptible to cause degradation at high rate [4]. The increasing degradation of materials is a worldwide concern faced by industrialists in several manufacturing units and infrastructural fields. It causes a huge global economic drainage which hinders the smooth functioning of a nation's development. Hence an economic point of view the mitigation of corrosion is of a great importance [5]. Aqueous acid solutions are uses in many industries for removal of undesirable rust pickling, cleaning baths, descaling, and etching of metals and many other uses [6–7]. Among commercially available acids, hydrochloric acid is one of the frequently preferred acid due to its aggressiveness to the metal and it contributes to the different types of metal corrosion [8]. Therefore corrosion inhibitors are specially

applies in aqueous acidic solutions to prevent metal dissolution and acid consumptions [9–11].

The potent inhibitors possessed abundant  $\pi$ -electrons and unshared pair of electrons which are able to transfers to metal empty d-orbitals and chemical adsorption occurs. The inhibitors like N-(8-hydroxyquinolin-5-yl)-methyl-N-phenylacetamide, imidazole derivatives, 8-hydroxyquinoline derivatives, Schiff bases and novel quinazolinone derivatives were developed as efficient inhibitors in different corrosive media [12–17]. Most of the synthetic compounds inhibit corrosion via adsorption on the metal surface and this adsorption mainly depends on some physico-chemical properties of the molecules, which are related to its functional groups [18]. Large number of organic and inorganic compounds, pharmaceutical drugs and polymers were developed as potential corrosion inhibitors for MS in acid media, but use of these causes adverse effect on environment [19]. To overcome this adverse, research is geared towards use of natural resources to encounter the loss of materials due to corrosion.

Organic compounds originated from different plants such as leaves, roots, flowers seeds extracts are readily available, prone to environmentally acceptable and renewable sources for a wide range of corrosion

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## Effect of expired doxofylline drug on corrosion protection of soft steel in 1 M HCl: Electrochemical, quantum chemical and synergistic effect studies

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### ARTICLE INFO

**Keywords:**  
 Dosey's line  
 Synergistic effect  
 Tafel plots  
 Corrosion potential and SEM

### ABSTRACT

The corrosion inhibition property of expired Doxofylline (DF) was tested for soft steel in 1 M hydrochloric acid solution by adopting mass change and electrochemical measurement techniques. At 200 ppm concentration of DF, maximum of 72.84% inhibition efficiency was noticed. However with addition of 50 ppm of VI, it enhances the percentage inhibition efficiency up to 88.46%. DF resists both anodic and cathodic reactions and functioned as mixed-inhibition mechanism. At higher temperatures, electrochemical impedance response noticed that, the diameter of the semicircle decreases as solution temperature increases. As a result, in both absence and presence of the inhibitor the  $R_p$  values were decreased. Quantum chemical studies revealed about structural and electronic effects in relation to the inhibition efficiencies. Surface morphology of both inhibited and corroded soft steel was assessed by means of scanning electron microscopy (SEM) and atomic force microscope (AFM). The SEM images of soft steel reflect the inhibitive property of the DF at optimized concentration and a significant decrease in the surface roughness was observed (surface roughness was reduced from 606 nm to 294 nm as measured by AFM). UV-Visible absorption peaks signifies that C=C and C=O groups from the inhibitor were interacted with iron cations, which is the evidence for the formation protective film over the soft steel surface.

### 1. Introduction

Corrosion is a surface interaction spontaneous phenomenon which outcome in worsening of alloys giving rise to a more stable film, when it contacts with surrounding environmental constituents and it brings the undesired corrosion process which leads to loss of materials [1]. Soft steel is a ferrous alloy possessing good mechanical strength, relatively low-cost and due to its ease of availability it is an important material for fabrication work in many industries. Among many mineral acids in high concentrations such as hydrochloric acid is the most preferred one for the removal of industrial scale, cleaning processes and oil well acidizing but during the process eventually metal dissolution takes place leading to enormous economic and material waste which causing permanent defects to the machines' parts [2,3]. To minimize the dissolution of metals during acid descaling and pickling process various different ways are applied like applying coating, cathodic protection and acid corrosion inhibitors are introduced [4].

The inhibitors are of organic or inorganic chemical compounds possessed with electron rich donor centers which can share their

electrons to empty orbital of iron and are generally added to the acid solution to reduce the aggressive acid attack. Azo Schiff compounds, new heterocyclic compounds are exhibited good inhibitors for carbon steel [5,6]. Most of the available commercial chemical compounds are toxic, hazardous, more economic and less soluble in the corrosive medium which causes undesired environmental effects, due to this reason, they have been changed with green inhibitors.

In recent years, researchers had shown more interest towards the protection of environment and to maintain the ecological balance by the use of green, eco-friendly and medicinal compounds as corrosion inhibitors and also to replace toxic, hazardous, costly chemical inhibitors [7]. As inhibitors gets adsorbed on soft steel surface through hetero atom with lone pair either by physisorption or chemisorption processes.

Several drugs have been investigated as corrosion inhibitors for MS in acid medium [8–11]. Ketosulfone [12], Streptomycin [13], Some Rhodanine Azosulpha Drugs [14], Dapsone [15], Metformin [16], Cefuroxime [17], Ceftezole, Cefadroxil [18] and many more Pharmaceutical drugs have been developed as corrosion inhibitors for MS. As inhibitors gets adsorbed on soft steel surface through hetero atom with


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## Humidity sensing behaviour of Rubidium-doped Magnesium ferrite for sensor applications

[Veeresh G. Hiremath](#), [I. S. Yahia](#), [H. Y. Zahran](#), [B. Chethan](#), [G. H. Malimath](#), [Y. T. Ravikiran](#) & [V. Jagadeesha Angadi](#) 

*Journal of Materials Science: Materials in Electronics* **33**, 11591–11600 (2022)

242 Accesses | 6 Citations | [Metrics](#)

### Abstract

In the present work, the influence of  $Rb^{3+}$  on the structural, microstructure, and humidity sensing properties of  $Mg_xRb_{1-x}Fe_2O_4$  ( $x = 0.025$  to  $0.1$ ) is

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Original Article | [Published: 11 May 2022](#)

## Interactions of Environmental Pollutant Aromatic Amines With Photo Excited States of Thiophene Substituted 1,3,4-Oxadiazole Derivative: Fluorescence Quenching Studies

[Thippeswamy, M.S.](#), [Lohit Naik, C.V.](#), [Maridevarmath & G.H. Malimath](#) 

*Journal of Fluorescence* **32**, 1543–1556 (2022)

189 Accesses | 2 Citations | [Metrics](#)

### Abstract

In the present work, the fluorescence quenching of novel thiophene substituted 1,3,4-oxadiazole



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

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## Solute-solvent interaction and DFT studies on bromonaphthofuran 1,3,4-oxadiazole fluorophores for optoelectronic applications

Lohit Naik<sup>a</sup>, M.S. Thippeswamy<sup>b</sup>, V. Praveenkumar<sup>b</sup>, G.H. Malimath<sup>b</sup>, D. Ramesh<sup>c</sup>, Suraj Sutar<sup>d</sup>,  
Ximantkumar M. Savanur<sup>e</sup>, S.B. Gudennavar<sup>a</sup>, S.G. Bubbly<sup>a</sup>  

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### Abstract



In the present work, computational and experimental studies were carried out to explore the photophysical properties of bromonaphthofuran substituted 1,3,4-oxadiazole derivatives for optoelectronic applications. Density functional theory (DFT) was used to demonstrate the electronic and optical properties of the synthesised molecules. The theoretical ground state dipole moments of the fluorophores in gas and solvent environments were also computed using Gaussian 09W software. Further, the HOMO-LUMO energies of the fluorophores determined using DFT agree well with the experimental values. Molecular electrostatic potential 3D plots were used to identify the sites which are electrophilic and nucleophilic in nature. Dipole moment of both the fluorophores in ground and excited states were determined experimentally. The excited state dipole moments being higher than that of the ground state shows the redistribution of electron densities in the excited state than in the ground state in both the fluorophores. The solute-solvent interactions, both specific and non-specific, were assessed using Catalan parameters. Further, the nature of chemical reactivity was determined based on global descriptors. The photophysical properties of the fluorophores studied suggest their potential use as promising candidates for organic light emitting diode (OLED), solar cell and chemosensor applications.


### Graphical abstract


## Studies on the characterisation of thiophene substituted 1,3,4-oxadiazole derivative for the highly selective and sensitive detection of picric acid

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### Abstract

A novel thiophene substituted 1,3,4-oxadiazole based chemosensor namely 2-(4-(5-(5-hexylthiophen-2-yl)thiophen-2-yl)phenyl)-5-(5-(5-(5-hexylthiophen-2-yl)thiophen-2-yl)thiophen-2-yl)-1,3,4-oxadiazole [TKO] has been characterised for the efficient detection of picric acid (PA) based on fluorescence quenching mechanism. In this regard, the electronic absorption spectra, fluorescence spectra, and fluorescence lifetime of TKO are recorded in the presence of different nitroaromatic compounds (NACs) in ethanol at room temperature. The absorption studies exhibited a blue shift in the absorption maxima with the increase in the concentration of PA. In the fluorescence titration studies, TKO shows a remarkable fluorescence quenching with picric acid as compared to other nitroaromatic compounds. Using the Benesi-Hildebrand plot, the binding constant value of PA with TKO is determined and is of the order of  $6.467 \times 10^4 \text{ M}^{-1}$ . Job's plot analysis confirms the 1:1 binding stoichiometry ratio between TKO and PA and is supported by the  $^1\text{H}$  NMR studies. The detection limit is determined and is of the order of  $10.08 \mu\text{M}$ . The competitive studies revealed that TKO is highly selective for recognizing PA without the interference of other NACs. The theoretical studies were also carried out to understand the binding mechanisms of PA with TKO. The fluorescence quenching of TKO by PA may be attributed to photo induced electron transfer (PET). Overall, the experimental findings suggest that, the novel probe TKO may be used as a highly selective and sensitive chemosensor for the detection of explosives like picric acid.





# Sequential transformation of copper to porous copper (I) sulfide as superior electrode for supercapacitor

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## ABSTRACT

Herein, a highly porous copper (I) sulfide film is formed on the copper surface by employing a sequential chemical transformation. The material is characterized by X-ray diffraction, scanning electron microscopy, X-ray photoelectron spectroscopy (XPS), and electrochemical analyses. The present method is simple, versatile, and economic for obtaining binder-free porous and highly conducting electrodes for an efficient supercapacitor. The supercapacitor of these electrodes with 3 M KOH electrolyte gives a high specific capacitance. The estimated specific capacitance is  $1044 \text{ Fg}^{-1}$  at  $1.5 \text{ Ag}^{-1}$  with retention close to 90% at the end of 3,000 cycles. The proposed method of making these electrodes can be easily scalable for mass production.

## 1. Introduction

Over the past several decades the topics of global warming and depletion of energy resources have attracted the widespread attention of the scientific community and have become the topics of intensive research [1]. Global energy demand is on a rapid rise, the sustainability of 'energy-for-all' with affordable cost are critically important challenges of coming days, hence there is an urgency to develop and deploy sustainable fuel alternatives which are efficient and environmentally benign [2]. In this regard, solar renewable energy is the only solution but it is intermittent, hence the aspect of energy storage is a critical challenge [3]. The supercapacitors which possess almost a million times higher specific capacitance as compared to conventional electrochemical capacitors can be attractive energy storage devices [4]. These are of two types, one is electrochemical double-layer capacitors (EDLC) (non-Faradaic) wherein the charge is stored by forming an electrical double layer known as Helmholtz layer and another is pseudo (Faradaic) capacitors, in latter, besides EDLC the energy is also stored by fast reversible surface reduction/oxidation reactions between electrode and electrolyte [5]. The mechanism here reveals supercapacitors are complementary to electrochemical batteries; the former has a high power density and the latter a high energy density. Hence an effective combination of these mechanisms in a single system leads to hybrid devices that are best suitable for future applications.

During the last decade serious efforts are being made to enhance further the energy density and power density of supercapacitors by focusing on various parameters of electrodes, electrolytes, and device

configurations [6]. Electrode modifications such as enhancement of surface-area [7], ion-intercalation [8], pore size control [9], organic/biomolecule conjugation [10] and active site electroadsorption [11] are prominent ones. Other aspects such as cost, stability, charge/discharge response, mass production, environmental impact, and mechanical flexibility are also under serious consideration [12]. Recently the flexibility has become an important aspect in the development of wearable/bendable electronics [13]. Numerous nano-structured materials are being investigated as electrodes for supercapacitors. Broadly these can be grouped into three main categories: First, the carbon-based materials, which include different forms of carbons such as graphene [14], graphene oxides, [15] carbon nanotubes (single/multi-walled) including activated bulk carbons [16]. Second, the transition metal oxides and metal hydroxides, such as  $\text{PbO}$  [17],  $\text{NiO}$  [18],  $\text{MnO}_2$  [19],  $\text{MoO}_3$  [20],  $\text{RuO}_2$  [21],  $\text{Co(OH)}_2$  [22],  $\text{Ni(OH)}_2$  [23] etc. Third, the conducting polymers and their composites with other materials [24]. No doubt a superior specific capacitance has been observed with these materials but still, there are issues due to low energy density, poor cyclic stability, and high cost of production which need further attention [25].

Looking at these issues, transition metal sulfides have recently been proposed as an alternative electrode material for supercapacitor applications [26]. Notably, copper sulfides are emerging electrodes due to their unique crystal structures, morphology, and multiple valence states [27]. Interestingly, the various phases of this alloy exhibit a high intrinsic electrical conductivity that is an essential requirement to make high performance supercapacitors [28]. The high surface area

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# Tropylium-BF<sub>4</sub> as Organocatalyst for Efficient Synthesis of Nitriles from Aldoximes; Synthetic Scope and Mechanistic Insights

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Structurally diverse aldoximes were conveniently transformed within minutes to the corresponding nitriles by using tropylium BF<sub>4</sub> as organocatalyst, in 1-butyl-3-methylimidazolium ionic liquids (BMIM-ILs) as solvent, under microwave irradiation. The

scope of this convenient, cyanide free, process for nitrile synthesis was explored, and DFT computations were employed to shed light on the mechanistic steps of this catalytic reaction leading to dehydration.

## Introduction

Nitrile groups are widely present in natural products, pharmaceuticals, dyes, and polymers. Moreover, the -CN group is a highly versatile synthon that can be converted to a number of other significant functional groups such as amides, amines, aldehydes, and ketones.<sup>[1–5]</sup> Whereas numerous methods for the synthesis of aromatic and aliphatic nitriles have been developed over the years,<sup>[1–5]</sup> the quest for the development of new, environmentally more acceptable, cyanide free methods continues. To this end, nitrile synthesis by dehydration of aldoximes has received considerable attention. Some of the more recently reported reagents for the preparation of nitriles from aldoximes are acetic anhydride/acetic acid,<sup>[6]</sup> triflic anhydride,<sup>[7]</sup> trichloroacetonitrile,<sup>[8]</sup> SO<sub>2</sub>F<sub>2</sub>,<sup>[9]</sup> and 4-nitro-triflylimidazole.<sup>[10]</sup> The latter reagent is closely related to triflylimidazole reported by us for aldoxime to nitrile conversion almost a decade earlier.<sup>[10]</sup> Complementing these dehydration routes are chemoenzymatic methods developed for enantioselective synthesis of chiral nitriles.<sup>[11,12]</sup>

A recent study reported on the use of *in-situ* generated chlorotropylium chloride as catalyst for conversion of oximes to amides and nitriles.<sup>[13]</sup> The onium salt was generated from tropone and oxalyl chloride (loss of CO and CO<sub>2</sub>) in MeCN

solvent using syringe pump, followed by addition of DBU to effect deprotonation of the aldoxime-tropylium adduct to form nitrile.<sup>[13]</sup> In relation to our long-standing interest in preparation and synthetic application of carbocation and onium salts,<sup>[14–17]</sup> and encouraged by the recently reported efforts to repurpose/ utilize some of these compounds as organocatalysts in synthesis,<sup>[18,19]</sup> we report here on the efficacy of the readily available tropylium-BF<sub>4</sub> as organocatalyst for aldoxime to nitrile conversion, using a very simple set up, employing BMIM-ILs as solvent.

The BMIM-ILs are ideal solvents for synthetic method development involving carbocation and onium salts,<sup>[14,16]</sup> while also providing the opportunity for recycling and reuse. In an effort to shed light on the mechanistic steps of this catalytic reaction leading to dehydration, a DFT computational study was performed.

## Results and Discussion

### Synthetic Aspects

At the onset, benzaldoxime was selected as model to determine efficacy. Working in conventional solvents, low yields of PhCN were obtained by heating in DCE and DMF for extended periods (entries 2–3, Table 1). Improved yields were realized at lower temperatures and shorter reactions times by using MeCN (entry 4, Table 1). These observations correlate with the relative solubility of tropylium salt in these solvents (Table S1). By switching to [BMIM][BF<sub>4</sub>] better conversions were reached in relatively short times (entries 5–6, Table 1). By applying microwave (MW), a 90% yield could be reached after 10 minutes (entry 8, Table 1). Employing [BMIM][PF<sub>6</sub>] as solvent resulted in 83% isolated yield after 10 minutes under MW irradiation. Based on these initial studies, [BMIM][BF<sub>4</sub>] was selected as solvent of choice for the study of the scope of this transformation.

A library of benzonitriles bearing diverse substituents were synthesized in respectable isolated yields by using 10 mol% of tropylium-BF<sub>4</sub> in [BMIM][BF<sub>4</sub>] as solvent under MW (entries 1–11, Table 2). Reactions could also be performed in the recycled

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# A Facile synthesis of Biaryl ketones in recyclable system: Triazenes as new coupling partners in the carbonylative Suzuki and Hiyama cross-coupling reactions using NFSac as CO source

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Palladium-catalyzed carbonylation reactions aid as potent tools for the insertion of carbonyl unit(s) in a wide array of molecules possessing vast number of applications in multiple domains. An efficient and facile protocol has been reported for the carbonylative Suzuki (CO-S) and carbonylative Hiyama (CO-H) coupling of aryl triazenes using phenyl boronic acid and triethoxy(phenyl)silane respectively via a Pd-catalysis in combination with ionic liquids (ILs). Four different ILs have been

employed as solvent/reagent/promotor(s) to afford the targeted products in reasonably good yields. As per the predictive mechanism, an *in situ* generated *N*-Heterocarbene-ionic liquid-Palladium (NHC-IL-Pd) species serve as a regenerative catalyst while the *N*-formyl saccharin (NFSac), a non-hazardous and commercially available crystalline compound was used as carbon monoxide (CO) surrogate playing important roles to accomplish the desired products in good yields.

## Introduction

Carbon monoxide (CO) had crossed several phases for its extensive applications in various fields, right from the fear concerning its toxicity to essential biological roles.<sup>[1]</sup> Carbonylation is a process which refers to the introduction of either one or two molecules of carbon monoxide into the substrates to result carbonyl compounds,<sup>[2a-c]</sup> amides,<sup>[2d-e]</sup> carbamates,<sup>[2f-g]</sup> carboxylic acids,<sup>[2h-i]</sup> acyl fluorides,<sup>[2j-k]</sup> esters,<sup>[2m-n]</sup> ketoesters,<sup>[2o]</sup> and their derivatives<sup>[2p-q]</sup> etc. Using various metal catalysts for this reactions Ni,<sup>[3a-d]</sup> Fe,<sup>[3e-f]</sup> Cu,<sup>[3g-h]</sup> Co,<sup>[3i-j]</sup> Rh,<sup>[3k-l]</sup> Ru<sup>[3m-n]</sup> and etc.

Since the last few decades, the potential of ionic liquids (ILs) in different roles has been explored to accomplish various chemical reactions and transformations. Owing to their attractive properties, such as physicochemical properties, including

high polarity, ion conductivity, negligible volatility, chemical stability, non-flammability and structural designability etc. they became an attractive choice of research community. Even though, some of their properties such as chemical stability, compatibility, volatility, toxicity etc., have been challenged,<sup>[4]</sup> ILs are considered as green reaction media and are appropriate for a range of organic reactions while displaying typical effects. Some of these properties include enhanced reaction rate, control of product distribution, homo and heterogeneous reactions environments, ease of product separation, with additional advantage of catalyst and/or IL solvent recovery and recyclability for chemical reactions. Further, ILs are proven to be designer solvents, task-specific components, bases, additives, phase transfer catalysts, etc.<sup>[5a-d]</sup> Also, they are well-known as mobile and versatile "carriers" of functional units (such as metal complexes, ancillary ligands, supporting materials, polymer supports etc.) through the formation of covalent bonds.<sup>[6a-c]</sup>

Among various widely known carbonylative reactions,<sup>[7a-d]</sup> particularly carbonylative Suzuki<sup>[8a-c]</sup> and carbonylative Hiyama couplings<sup>[9a-b]</sup> are of our interest. "Carbonylative coupling reactions" are the cross-coupling reactions between two coupling partners that result in the formation of two new carbon-carbon bonds in the presence of carbon monoxide (CO). The incoming carbon monoxide molecule typically comes from either CO atmosphere or from CO surrogates (few carbon monoxide sources were given in Figure 1).

Till date, several reagents, such as carbon dioxide,<sup>[10]</sup> chloroform,<sup>[11]</sup> formic acid,<sup>[12]</sup> formaldehyde and its derivatives<sup>[13]</sup> metal carbonyls,<sup>[14]</sup> methanol,<sup>[15]</sup> DMF<sup>[16]</sup> oxalyl chloride,<sup>[16]</sup> oxalic acid derivatives,<sup>[17]</sup> silacarboxylic acids<sup>[18]</sup> and amides,<sup>[19]</sup> and others<sup>[20]</sup> have been developed as CO substitutes. Various carbonyl surrogates, acetic formic anhydride (AFA)<sup>[21]</sup> and *N*-

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# Aryltriazenes as Coupling Partners in the Hiyama, Hiyama-Suzuki and Hiyama-Heck Cross-Coupling Reactions Using Conventional and Ionic Liquid Reagents and Solvents

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Application of conventional and ionic liquid (IL) solvents and reagents in the Hiyama cross-coupling reactions using triazenes as coupling partners was investigated. The microwave-assisted and Pd-catalyzed reactions in ROH/HBF<sub>4</sub>, ROH/BF<sub>3</sub>·Et<sub>2</sub>O and in [BMIM][X]/[BMIM(SO<sub>3</sub>H)][OTf]/[BMIM][F] proved effective and gave respectable isolated yields within minutes. The scope of the Hiyama coupling reaction with triazenes was investigated in these media. The IL reagents and solvents were successfully

employed to develop stepwise and sequential/tandem Hiyama-Suzuki (H-S) and Hiyama-Heck (H-H) methods. Study of the scope of these transformations led to facile synthesis of libraries of biaryls, hetero-biaryls, diphenylmethanes, styryl-biphenyls, and a host of biphenyl-appended heterocycles. The potential for the recycling/reuse of the IL solvents in the Hiyama reaction, and in stepwise and sequential transformations was also examined.

## Introduction

The Hiyama reaction is a powerful metal-mediated cross-coupling method for the synthesis of biaryls.<sup>[1–10]</sup> A key mechanistic difference between Hiyama and Suzuki or Heck cross-coupling is that in the former an *in-situ* generated pentacoordinated silicon species, formed by reaction of a fluoride ion source (such as TBAF or CsF) with ArSiX<sub>3</sub> (with X=OR used most widely), is responsible for transmetalation. Reactions are typically carried out at high temperatures using DMF, THF, dioxane, DME, or NMP as solvents, and employ a variety of palladium catalysts and ligands. A review published in 2016 summarized the more recent progress in this area,<sup>[6]</sup> and a 2020 review provided more recent examples, including those using vinyl silanes, as well as other metal catalysts and ligands, and application of microwave.<sup>[5]</sup> Despite a wealth of literature on the efficacy of arenediazonium salts in metal-mediated cross-coupling,<sup>[11]</sup> there have been little reported work on the use of arenediazonium salts, and aryltriazenes as masked diazoniums, in the Hiyama cross-coupling,<sup>[12]</sup> and only few studies on the use of ILs in the Hiyama coupling have been reported.<sup>[13]</sup>

In previous studies, we demonstrated the potential of aryltriazene salts and aryltriazenes as coupling partners in the

Suzuki, Heck, and Sonogashira reactions, employing ionic liquids (ILs) as solvents, in combination with acidic or basic ILs as promoters and catalysts, generating diverse libraries of small molecule building blocks.<sup>[14,15]</sup> In continuation, we report here on the utility of aryltriazenes as coupling partners for the Hiyama coupling, and examine the influence of conventional and ionic liquid (IL) reagents and solvents. We also report on the stepwise and sequential/tandem Hiyama-Suzuki (H-S) and Hiyama-Heck (H-H) reactions in IL solvents, employing basic and Brønsted-acidic ILs. Synthetic utility of these reactions was demonstrated by facile synthesis of libraries of biaryls, hetero-biaryls, diphenylmethanes, styryl-biphenyls, and a host of biphenyl-appended heterocycles. The potential for the recycling/reuse of the IL solvents in these transformations is also addressed.

## Results and Discussion

Encouraged by the earlier reported studies of Qi et al.<sup>[13]</sup> in the Hiyama reaction with ArN<sub>2</sub>,<sup>+</sup> employing MeOH, and the work by Tamao et al.<sup>[11]</sup> on cross-coupling of ArSiF<sub>3</sub> with aryltriazenes using BF<sub>3</sub>·Et<sub>2</sub>O we began our investigation with an optimization study (Figure 1, Table 1), employing H<sub>2</sub>O and alcohols as well as imidazolium (BMIM) and tetramethylguanidinium (TMG) ILs as solvents, using HBF<sub>4</sub>, BF<sub>3</sub>·Et<sub>2</sub>O and [BMIM(SO<sub>3</sub>H)][OTf], with NaF, KF, and [BMIM][F] as fluoride source. Reactions were performed at r.t. with or without sonication, or with mild conventional heating or by using microwave (MW).

Whereas the bulk of the optimization reactions were carried out with [Pd] as catalyst, [Ni] and [Cu] catalysts were also tested. Optimal conversions for ROH/HBF<sub>4</sub> and ROH/BF<sub>3</sub>·Et<sub>2</sub>O systems were reached within minutes under MW (Table 1, entries 2 and 5). The use of [BMIM][BF<sub>4</sub>] as solvent, [BMIM(SO<sub>3</sub>H)][OTf] as promoter to unmask the triazene and [BMIM][F] as fluoride source proved highly effective resulting in 88% isolated yield

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# Synthesis, *in vitro* and theoretical studies on newly synthesized deep blue emitting 4-(*p*-methylphenylsulfonyl-5-aryl/alkyl)oxazole analogues for biological and optoelectronic applications

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## ABSTRACT

In the present study, a series of 4,5-di-substituted oxazole derivatives (compounds 2a-p) were synthesized, using a novel methodology for the simultaneous determination of their biological and optoelectronic applications. Among the screened molecules, compounds 2j, 2 l and 2o showed very good antimicrobial potencies with MICs up to 1 µg/mL. Furthermore, the photophysical parameters were estimated using theoretical and experimental techniques for optoelectronic applications. The excited-state dipole moment being higher than that of the ground state, investigated using solvato-chromatic method showed a redistribution of the electron densities in the excited state for the fluorophores. The HOMO-LUMO energies of the fluorophores estimated by using density functional theory (DFT) are found to be in good agreement with the experimental values. The electrophilic and nucleophilic sites were also recognized with the help of molecular electrostatic potential 3D plots using time-dependent-DFT computational analysis. The specific and non-specific interactions between the solute-solvent were analyzed by multiple linear regression analysis using Kamlet-Abboud-Taft and Catalan parameters. Further, the global chemical reactivity descriptor parameter was also calculated. The photophysical properties of the fluorophores suggest that these may be considered as potential probes for OLED, solar cell, and chemosensor applications.

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## 1. Introduction

Microbial infections are one of the alarming global menaces causing threats to the life of humans, plants and the livestock. The growing prevalence of infectious diseases has been unraveled by many research reports from various organizations across the globe. If these infections are not recognized in early stages, some of them may turn into potentially fatal or lethal complaints that cause terrible consequences and severe damage to the victims. The continuous upward trend in the sales of global antimicrobial products has indicated the lurking danger to society in the form of microbial infections. Furthermore, the development of drug hostility to existing antimicrobial remedies has triggered the urgent need to discover new synthetic drugs with active templates to address the parameters mentioned above. Diverse libraries of molecules have been designed, synthesized, and tested with the

Abbreviations: ARG, Arginine; ATP, Adenosine triphosphate; CCDC, Cambridge Crystallographic Data Centre; COX-2, Cyclooxygenase-2; DFT, Density Functional Theory; EA, Electron Affinity; CCRD, Global Chemical Reactivity Descriptor; GSK3, Glycogen Synthase Kinase-3; GLY, Glycine; HATU, Hexafluorophosphate Azabenzotriazole Tetramethyl Uronium; HOMO, Highest Occupied Molecule Orbital; HIV, Human Immunodeficiency Virus; ICT, Intramolecular Charge Transfer; IP, Ionization Potential; IQE, Internal Quantum Efficiency; LSD, Lysergic acid diethylamide; LUMO, Lowest Unoccupied Molecule Orbital; LYS, Lysine (Amino acid); MET, Methionine; MIC, Minimum Inhibitory Concentration; OD, Optical Density; OLED, Organic Light Emitting Diode; ORTEP, Oak Ridge Thermal Ellipsoid Plot; SER, Serine; TOSMIC, *p*-toluenesulfonylmethyl isocyanide; TYR, Tyrosine (Amino Acid); 3LD6, Human lanosterol-14- $\alpha$ -demethylase CYP51: 1B14, Mevalonate-5-diphosphate decarboxylase; VLA-4, Very Late Antigen-4; XRD, X-ray Diffraction.

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# A Copper-catalysed Facile Synthesis of Highly Functionalized Aryl Sulphones in Guanidinium IL(GIL) aided with Ultrasound

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Ultrasound aided copper catalyzed facile synthesis of highly functionalized aryl sulphones has been demonstrated by employing aryl sulphonyl hydrazides as suitable substrates in excellent yields in short time. Various 1-aryltriazene derivatives were used as a coupling partner in the presence of a [TMG][CH<sub>3</sub>COO] IL without any base or additives. The potential

for the recycling and reuse of IL was also explored. Similarly, we elaborated the reaction scope by synthesizing copper-catalyzed aryl sulphones aided by ultrasonication replacing aryltriazenes with aryl boronic acids as coupling partner in [TMG][CH<sub>3</sub>COO].

## Introduction

Sulphur-containing compounds epitomize a vital class of chemical compounds due to their extensive biological and pharmaceutical properties. Several compounds comprising C–S bond(s) are frequently found in nature, with their omnipresence. They are commonly found in many natural food ingredients such as garlic (*Allium sativum*), onion and cruciferous vegetables like broccoli, kale, arugula, and cabbage etc, as an inseparable ingredient from our daily life. The C–S bond construction is one of the essential synthetic architectures that hold score significance for the synthesis of molecular frame works that encompass functional groups such as disulphides, sulphones, sulphides, sulphonate esters, sulphoxides, mercaptans, sulphenic acids etc. Among various functions that contain the sulphur atom, sulphone has its own prevalence with wide-spread applications. Sulphone affiliation, with a prominent role,

is often found in various pharmaceuticals,<sup>[1,2]</sup> polymers,<sup>[3,4]</sup> agrochemicals,<sup>[5]</sup> fragrances<sup>[6]</sup> and etc. They establish diverse skeletal frameworks of several natural products as well as pharmacophores, biologically useful midbodies and have gained substantial attention due to their imperative biological properties.<sup>[7]</sup> Additionally, sulphones are multifarious functional groups displaying versatile and attractive properties in synthetic organic chemistry by acting as nucleophiles, electrophiles, or even radicals, under different reaction conditions. Among various organosulphur compounds, particularly the condition dependant reactivity of sulphonyl groups varies demonstrating useful applications for the construction of versatile small molecule building blocks, key pharmaceutical intermediates and exploratory synthons to access sulphide analogues etc.

The efficacy of organosulphones as synthons inorganic synthesis is well known<sup>[8]</sup> while displaying comprehensive and vast range of physical, chemical and biological applications.<sup>[9]</sup> Some representative molecular structures of sulphone-containing compounds of material and biological significance are depicted in Figure 1. On account of this plethora of possible applications, it is not surprising that a number of adequate methods for the synthesis of sulphones have been extensively explored.<sup>[10]</sup> Among various strategies used to synthesize sulphones, oxidation of sulphide is the most expeditious and convenient way. However, traditional approaches mainly include oxidation of sulphides or sulphoxides; sulphonylation of arenes in the presence of strong acids, or the cross-coupling reaction of sulphinates with pre-functionalized coupling partners such as halides, triflates, aryl boronic acids, and diaryliodonium salts or the addition of sulphonyl radical precursors to alkenes, alkynes<sup>[10a–c]</sup> and so on. Although these protocols have their own advantages, they suffer from several curbs like - need for external additives, multi-step pre-functionalization, limited substrate scope, harsh reaction conditions, toxic solvents, long reaction times, low yields and residual catalysts,

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# N-ethyltetramethylguanidinium ionic liquid [ETMG][EtSO<sub>3</sub>] as organocatalyst and solvent for facile amide synthesis by formyl-transfer with N-formyl-saccharin

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## ABSTRACT

We report a simple and highly efficient, acid and metal free, method for the synthesis of libraries of primary and secondary formamides employing N-ethyltetramethylguanidinium IL, [ETMG][EtOSO<sub>3</sub>] as dual organocatalyst and solvent, and N-formyl-saccharin (N-formyl-SAC) as formyl-transfer agent. Good to excellent isolated yields are achieved at r.t. within minutes under sonication. A rationale for the efficacy of this organocatalyst is provided by DFT computations.

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The amide moiety is of paramount importance in chemistry and biology, and is ubiquitous in pharmaceuticals, natural products and bioactive compounds, while also serving as a highly versatile platform for organic synthesis. The direct reaction of amines with carboxylic acids, either at high temperatures or under milder conditions by using metal catalysts, are among the most widely employed methods for amidation [1]. These methods are not suited to compounds that bear acid-sensitive functional groups; they typically have poor atom economy, and often lead to unwanted by-products [1]. Transamidation offers an acid-free alternative, and the pros and cons of this approach have been reviewed [1]. Carboxylic acids can be activated by using various coupling reagents, and the benefits and drawbacks of these methods for large-scale amide synthesis have been examined [2]. Application of supported metal catalysts [3], Brønsted acidic ILs [4,5], and KPF<sub>6</sub> [6] as catalysts for amidation have also been reported.

N-Formylation of amines using glycol ethers with AgSbF<sub>6</sub> as catalyst in boiling 1,4-dioxane [7], and with MeOH as a C1 source,

in combination with Cu/TEMPO along with other additives, in DMF solvent [8], are among the recently reported N-formylation approaches. Alternative formylation protocols, utilizing CO<sub>2</sub> as a C1 source have also received attention, with CO<sub>2</sub>/PhSiH<sub>3</sub> on a polymeric IL [9] and CO<sub>2</sub>/B(C<sub>6</sub>F<sub>5</sub>)<sub>2</sub>/M<sub>2</sub>NH-BH<sub>3</sub> complex [10] as notable examples.

Despite significant progress in this area, development of methods that are acid and metal free, proceed at room temperature, do not use harsh reagents and special equipment, and avoid the use of organic solvents, are highly desirable. In continuation of our studies in synthetic method development using ILs as catalyst and solvents [11], we report here a facile method that employs the N-ethyl-tetramethylguanidinium IL [ETMG][EtOSO<sub>3</sub>] as a dual organocatalyst and solvent, and formyl-SAC as transfer formylation reagent.

Formyl-SAC was first reported over a decade ago, and its efficacy for formylation of amines was shown in representative examples using dry THF as solvent [12]. Since then, it has been employed as a CO source in [Pd] catalyzed alkoxy carbonylation [13], and fluorocarbonylation [14]. The present study expands the utility of this readily available reagent.

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# Tropylium-BF<sub>4</sub> as Organocatalyst for Microwave-assisted Beckmann rearrangement in [TMG][BF<sub>4</sub>]: One-pot conversion of Ketones to Amides

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The microwave assisted one pot efficient conversion of ketones into respective amides has been achieved by utilization of environmentally benign catalytic system tailored by tropylium tetrafluoroborate (Tp<sup>+</sup>BF<sub>4</sub><sup>-</sup>) and 1,1,3,3-tetramethylguanidinium tetrafluoroborate [TMG][BF<sub>4</sub>]. The mild reaction conditions,

shorter reaction time, and affordable catalytic system are the key points that highlight the importance. The high product yield and ease of recycling impacts the successful product conversion.

## Introduction

Amide is an important functional group that can be found in several medicines, agrochemicals and natural compounds.<sup>[1]</sup> They play a significant role in biological systems as it enables interaction with biological receptors and enzymes due to the electrical charges present.<sup>[2]</sup> Because of the unique functionality of amides, a wide range of pharmaceutical drugs have been developed. The medicinal chemistry database estimates that around 25% of drug molecules include an amide functional group.<sup>[3]</sup>

There are several synthetic methods reported that may be used to synthesize desired amides. However, these techniques are undesirable due to the poisonous nature of the used chemicals, the poor catalytic activity, the cost-effectiveness and the high amount of waste they generate. Among the reported synthetic techniques, the conventional Beckmann rearrangement is still a key pathway in the synthetic chemistry because it offers very easy access to a wide spectrum of primary and secondary amides.

Beckmann rearrangement (BKR) is the process of converting targeted oxime into corresponding amides.<sup>[4]</sup> Typically, BKR

requires powerful Brønsted or Lewis acids, which results in the formation of environmentally harmful byproducts and usage of acidic reagents cause major corrosion issues.<sup>[5]</sup> Many commercial procedures use a two-step reaction to produce amides by oximation of the ketone in presence of base followed by acid-catalysed BKR. However, in many cases the direct synthesis of amides from ketones via BKR is carried out in an acid medium and observed formation of ketoximes.<sup>[6]</sup> This reveals that, oximation of ketones followed by BKR is achieved through an acidic condition, which provides new hope to a researcher working on one-pot synthesis methodologies. Thus, the direct conversion of ketones to amides has recently been carried out using some eco-friendly reagents, such as FeCl<sub>3</sub>·6H<sub>2</sub>O,<sup>[7]</sup> [RhCl(cod)]<sub>2</sub>,<sup>[8]</sup> Fe<sub>2</sub>O<sub>3</sub>@SiO<sub>2</sub>,<sup>[9]</sup> thiamine hydrochloride.<sup>[10]</sup> Still, these synthetic methods have some limitations such as use of volatile organic solvents, prolonged reaction time and requirement of high temperature.

In search of new efficient and eco-friendly methodologies for the one-pot conversion of ketones to amides. We found that, the combination of microwave irradiation and the utility of reusable ionic liquids for solvent-free synthesis along with especially, non-benzenoid carbocyclic aromatic ions may give good outcomes. Numerous studies based on the synthesis of organic molecules using ionic liquids<sup>[11]</sup> and microwave radiation<sup>[12]</sup> have been published, and ionic liquid utility. Non-benzenoid carbocyclic aromatic ions on the other hand, have piqued interest of researchers in recent years. The non-benzenoid carbocyclic aromatic ions<sup>[13]</sup> are charged aromatic systems (Figure 1) behave as Lewis acids or bases that may form covalent bonds with substrates to form active intermediates.<sup>[14]</sup> Furthermore, the re-aromatization of active intermediates provides a driving force for catalytic processes. Tropylium (Tp<sup>+</sup>) ion as chlorotropylium chloride (ClTp<sup>+</sup>Cl<sup>-</sup>) has demonstrated good catalytic activity in BKR under microwave irradiation.<sup>[15]</sup> Regardless of its high selectivity and yield, this approach has certain limitations, such as the use of poisonous and corrosive oxalyl chloride to replenish the catalyst. Because of these limitations, there is still a need for a simpler and more broadly applicable approach for one-pot synthesis of amides.

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# Microwave and Ultrasonic-Assisted Synthesis of Highly Functionalized Carbazoles And Dibenzofurans from Biaryl-Triazines Promoted by Acidic Ionic Liquid

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Bronsted acidic ionic liquid promoted synthesis of functionalized carbazoles and dibenzofurans is reported employing biaryl-triazene as intermediate. The shorter reaction time, diverse functional group tolerance, high yield, mild reaction condition and employment of microwave and ultrasonic

assistance highlight the importance of this reaction. Approximately 80–92% of the product yield was achieved with this highly efficient green technique. Along with this, recycling and re-use of ionic liquids are also addressed.

## Introduction

Heterocycles are vital class of organic molecules and in particular carbazoles and dibenzofurans received much emphasis owing to their comprehensive application in the fields of medicine and organic materials.<sup>1</sup> Recent years have witnessed these tricyclic scaffolds in many biologically pertinent alkaloids and pharmaceuticals. Likewise, they are selective towards some technological fields due to their definite photo active properties.<sup>2</sup> Owing to their attractive structural aspects, substantial research has been dedicated towards the optimal synthesis of these frameworks<sup>3</sup> by adopting either classical methods or non-classical new synthetic approaches.<sup>4</sup> Among them, metal-mediated C–N or C–O bond formation through displacement reaction has been emerged as better methods.<sup>5</sup> Most specifically, Pd or Cu catalysts are usually employed for such reactions. Recently, C–H activation reactions have also been reported employing such metal catalysts.<sup>6</sup> Similarly, sequential C–H activation with concomitant C–N or C–O bond formation has been reported by Buchwald<sup>7</sup>, Liu<sup>8</sup>, and Chang<sup>9</sup> by introducing metal catalyst towards the access of carbazole or dibenzofuran. On other hand, intramolecular and intermo-

lecular arylation reaction by C–H bond activation are also a convenient method. Alternatively, various inter and intramolecular cycloaddition or cyclization and carbonylative annulations for the synthesis of benzofurans and carbazoles via Cu, Ni or Rh catalysis or by photo-induced methodology have also been reported.<sup>10</sup> Additionally, benzofuran synthesis could also be achieved by gold catalysis by 3,2 shift.<sup>11</sup>

Apart from C–H activation, carbazole synthesis has been also achieved by bromination using NBS,<sup>12</sup> Similarly, various base mediated cyclizations from chalcones<sup>13</sup> and from biaryl compounds using K<sup>+</sup>OBu could furnish these fused heterocycles.<sup>14</sup> On the other hand, palladium catalyzed alkylation and ene reaction of the allylics and metal oxalates too led to fused heterocycles.<sup>15,16</sup>

Due to the easy preparation from arylamines, and identical reactivity corresponding to arenediazonium salts, aryltriazenes have gained high synthetic interest.<sup>17</sup> 1-Aryltriazenes have emerged as an efficient arylating agent as they are stable under ambient conditions, and thus are more useful for practical purposes in comparison to that of diazonium salts.<sup>18</sup> Owing to their importance as an efficient coupling/arylation partner, aryltriazenes have been opted as a better replacement for the existing other arylating sources.<sup>19</sup>

Similarly, ionic liquids (ILs) have emerged as an environmentally benign reaction media in organic synthesis in lieu of their numerous advantages.<sup>20</sup> Acidic ionic liquids (AILs) are especially important because of their crucial role as promoter, catalyst and solvent.<sup>21</sup> As an alternative to the existing promoters,<sup>22</sup> greener Bronsted acidic IL [BMIM(SO<sub>3</sub>H)] [OTf] is emerged as a convenient and efficient promoter for the 1-aryltriazenes. Recent reports, including mine,<sup>12(a)</sup> on various reactions where [BMIM(SO<sub>3</sub>H)] [OTf] has been introduced as an efficient promoter for 1-aryltriazenes either in presence or absence of [BMIM][X] solvents.<sup>13</sup>

Several reports state the utilization of the microwave technique for the Suzuki-Miyaura and other C–C bond formation reaction.<sup>14</sup> These conversions could be achieved under micro-wave heating at lower temperatures and with shorter reaction times.<sup>15</sup> It has been documented well that

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## Data Article

# Molecular modeling and *In vitro* antimicrobial evaluation of some 2-Aryl-Benzoxazoles/Benzothiazole analogues containing alkyl, alkenyl and alkynyl linkages

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## ABSTRACT

A series of Suzuki, Heck and Sonogashira coupled Benzoxazole and Benzothiazole analogues were synthesized and screened for their *in vitro* antimicrobial activities, aided by molecular modeling and structure activity relationship (SAR) studies. Among the tested 11 molecules, compounds 13 (series 1), 17 (series 2) and 30 (series 3) displayed magnificent MICs (1 µg/ml) against the antibacterial species used compared to the standard drugs. Similarly, compound 13, 17, 22, 26 and 30 also displayed similar inhibition properties (1 µg/ml) against fungal strains used. Further, these results were supported by molecular docking studies demonstrating excellent binding affinities of -85.84 Kcal/mol and -113.57 Kcal/mol respectively for compound 13 (series 1) with 3LD6 and t427 proteins. Similarly, few other compounds also exhibited excellent docking scores e.g. -99.32 Kcal/mol, -85.26 Kcal/mol for series 2 and -98.65 Kcal/mol, -87.03 Kcal/mol for series 3, providing good insights to understand the structural features responsible for the microbial activity of these molecules.

## 1. Rationale

Infectious diseases are a major cause for the high fatality proportions across the globe [1]. One of the prime factors which is alarmingly contributing to the exponential toll of the mortality rate is - antibiotic resistance (ABR). Another difficulty adding similar consequence is the antimicrobial resistance (AMR), which is responsible for thwarting the therapeutic response of the infected patients against the efficiency of existing antimicrobial drugs [2]. Scouring the noteworthy advancements and developments in the domain of research and treatment of infectious diseases, the community is facing arduous challenges in the regulation and obliteration of these diseases. Though microbes are causing infections, most of them do not cause ailments in humans. In fact, humans are inhabited and tenanted by group of microbes, known as the microbiome, which are accountable for several important and beneficial roles in our bodies. In this context, discovering novel compounds that could manage the antimicrobial resistance are critical, especially in the context of the ongoing pandemic with medications used against COVID-19 is also affecting immunity and made us to be more vulnerable to the opportunistic microbial infections [3-6]. Immuno-compromised patients are quite often prone to deadly infections

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# Synthesis, *in vitro* and theoretical studies on newly synthesized deep blue emitting 4-(*p*-methylphenylsulfonyl)-5-aryl/alkyl)oxazole analogues for biological and optoelectronic applications

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## ABSTRACT

In the present study, a series of 4,5-di-substituted oxazole derivatives (**compounds 2a-p**) were synthesized, using a novel methodology for the simultaneous determination of their biological and optoelectronic applications. Among the screened molecules, compounds **2j**, **2l** and **2o** showed very good antimicrobial potencies with MICs up to 1 µg/mL. Furthermore, the photophysical parameters were estimated using theoretical and experimental techniques for optoelectronic applications. The excited-state dipole moment being higher than that of the ground state, investigated using solvato-chromatic method showed a redistribution of the electron densities in the excited state for the fluorophores. The HOMO-LUMO energies of the fluorophores estimated by using density functional theory (DFT) are found to be in good agreement with the experimental values. The electrophilic and nucleophilic sites were also recognized with the help of molecular electrostatic potential 3D plots using time-dependent-DFT computational analysis. The specific and non-specific interactions between the solute-solvent were analyzed by multiple linear regression analysis using Kamlet-Ahond-Taft and Catalan parameters. Further, the global chemical reactivity descriptor parameter was also calculated. The photophysical properties of the fluorophores suggest that these may be considered as potential probes for OLED, solar cell, and chemosensor applications.

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## 1. Introduction

Microbial infections are one of the alarming global menaces causing threats to the life of humans, plants and the livestock. The growing prevalence of infectious diseases has been unraveled by many research reports from various organizations across the globe. If these infections are not recognized in early stages, some of them may turn into potentially fatal or lethal complaints that cause terrible consequences and severe damage to the victims. The continuous upward trend in the sales of global antimicrobial products has indicated the lurking danger to society in the form of microbial infections. Furthermore, the development of drug hostility to existing antimicrobial remedies has triggered the urgent need to discover new synthetic drugs with active templates to address the parameters mentioned above. Diverse libraries of molecules have been designed, synthesized, and tested with the

**Abbreviations:** ARG, Arginine; ATP, Adenosine triphosphate; CCDC, Cambridge Crystallographic Data Centre; COX-2, Cyclooxygenase-2; DFT, Density Functional Theory; EA, Electron Affinity; GCRD, Global Chemical Reactivity Descriptor; GSK3, Glycogen Synthase Kinase-3; GLY, Glycine; HATU, Hexafluorophosphate Azabenzotriazole Tetramethyl Uronium; HOMO, Highest Occupied Molecule Orbital; HIV, Human Immunodeficiency Virus; ICT, Intramolecular Charge Transfer; IP, Ionization Potential; IQE, Internal Quantum Efficiency; LSD, Lysergic acid diethylamide; LUMO, Lowest Unoccupied Molecule Orbital; LYS, Lysine (Amino acid); MET, Methionine; MIC, Minimum Inhibitory Concentration; OD, Optical Density; OLED, Organic Light Emitting Diode; ORTEL, Oak Ridge Thermal Ellipsoid Plot; SER, Serine; TOSMIC, p-toluenesulfonylmethyl isocyanide; TYK, Tyrosine (Amino Acid); ULD, Human lanosterol-14-alpha demethylase; CYP51, 14H, Mevalonate 5-diphosphate decarboxylase; VLA-4, Very Late Antigen-4; XRD, X-ray Diffraction.

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## *In vitro* antimicrobial combat, molecular modelling and structure activity relationship studies of novel class of aryl-ethyne tethered coumarin analogues and some 3-aryl coumarin derivatives

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### ABSTRACT

A series of novel class of aryl ethyne tethered coumarin analogues (series 1) and some 3-aryl coumarin cognates (series 2) were synthesised, and their *in vitro* antimicrobial activities aided by molecular modelling and the structure activity relationship (SAR) has been studied. Compounds 1a, 1g, 1h, 1m, 1o and 2e, 2f, 2g, 2h, 2i displayed excellent antimicrobial activities against the screened microbial strains with very good minimum inhibitory concentrations. Perhaps, from the present study, compounds 1g, 1e, 2f and 2h emerge out to be the most promising antimicrobial agents with MICs of 1–4 µg/ml. Further, molecular modelling study had also supported these outcomes by demonstrating very good binding affinities at the active site of the protein 1A19 (*Candida albicans* dihydrofolate reductase - *C. albicans* DHFR) up to 6.24 kcal/mol and 5.48 kcal/mol, close to that of the standard drug, hinting the possible drug like properties of some of these molecules.

### 1. Introduction

In the present era, innumerable bacterial infections are growing fiercely and becoming lethal to infected patients. Additionally, another major problem, in treating the affected patients is alarmingly increasing bacterial resistance to the existing antibacterial spectrum of drugs. These problems are triggering a profound need for the discovery of new and robust front line antimicrobial agents with pronounced potencies to alleviate the infected from chronic microbial infections. In this context, antimicrobial resistance has been a stem issue right from the evolution followed by the pioneering introduction of the first-generation limited spectrum antimicrobial agents around the 1940s, into the clinics. Although the discovery and development of diverse new classes of antimicrobial drugs have been gearing up extensive arrays of treatment possibilities, the available options are becoming inept due to the alarmingly growing fatal and life-threatening infections together with antimicrobial resistance. Thus, the impending antibiotic-resistant catastrophe has been attracting the attention of clinicians, therapists, and researchers. Anti-Microbial Resistance (AMR) is a frightening global

anomaly causing annihilating repercussions against living organisms that must be addressed. Commonly, the over usage or misuse of antimicrobial drugs (such as antibiotics, antifungals, antivirals, antimalarials and anthelmintics, etc.) in humans and animals is the main cause of this consequence. Other factors such as weak immunity, uncontrollable growth, the degree of pathogenicity and virulence of the microorganism and their transmission modes, etc., are the other fuelling factors to increase the rate of AMR. As this can affect any living organism, at any phase of life, by weakening the immune system and thereby increasing the risk of morbidity and lethality, it is essential to address this peril. Further, the economic impact of AMR is tough to compute causing threats like mass infections, elevated treatment costs and etc. There is a strong and abstruse need to address this menace, as the existing front-line antimicrobial agents are slowly fading their activity. Therefore, these perplexed factors re-insist the necessity for the development of effective and robust next-generation antimicrobial agents with no off-target toxicity or minimal side effects.

Coumarins are well-known chemical entities possessing distinct features like simple structure, high solubility, good bioavailability, low

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2772-4174/© 2022 The Author(s). Published by Elsevier Masson SAS. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## Organic &amp; Supramolecular Chemistry

Ultrasonication Assisted  $\alpha$ -Arylation of *N*-heteroarenes Employing 1-Aryltriazenes Promoted by Brønsted Acidic Ionic Liquid under Aerobic ConditionsPavankumar Prabhala,<sup>[a]</sup> Suraj M. Sutar,<sup>[a]</sup> Rajesh G. Kalkhambkar,<sup>\*[a]</sup> and Yeon T. Jeong<sup>\*[b]</sup>

An efficient and facile methodology for the synthesis of  $\alpha$ -arylated *N*-heteroarenes was developed under aerobic conditions by means of ultrasound assistance, as well as conventional heating via a direct  $\alpha$ -arylation protocol employing imidazolium based ionic liquids serving as both acid promoter and solvent. Structurally diverse *N*-heteroarenes and 1-aryltriazenes were evaluated for this reaction. This methodology has

successfully provided a synthetic handle for various electron-rich and electron-deficient arylated *N*-heteroarenes under metal and/or peroxide free conditions in good to excellent yields. The total synthesis of the known oxoisoalloxazine class of alkaloids Menisporphine & Daurioxoisoalloxazine C was successfully accomplished using the current methodology as a key step in the total synthesis.

## Introduction

C–H bond is the most prevalent chemical bond due to its omnipresence in organic compounds and can be transformed into other functional groups through its activation. It has emerged as a powerful tool in molecular synthesis with its enduring applications in organic chemistry, material sciences, and drug discovery, etc. Remarkable advancements have been comprehended in this area, and have mainly relied on metal-mediated functionalization of these ubiquitous bonds. This reactivity generally stems from the reaction partners and is assisted by various other factors involved in the reaction processes.<sup>[1–2]</sup> A large number of natural products consist of various *N*-heterocyclic units in their structures such as isoquinoline, pyrazine, pyridine, and their analogues in their structures. They possess conspicuous structural features together with a wide range of remarkable biological activities besides finding applications as assorted pharmacophore(s) in drug discovery. Some biologically significant isoquinoline analogues were shown in Figure 1.

In many cross-coupling reactions, arene diazonium salts were used as arylation sources and electrophilic coupling partners,<sup>[3]</sup> while their utility suffers from various shortcomings

such as solubility, polymerizations, decomposition, scalability, risk of detonation, etc.<sup>[4]</sup> Meanwhile, aryltriazenes have evolved as a powerful alternative and amenable tool to serve similar tasks addressing major concerns associated with diazonium salts, featuring advantages such as simple, facile synthesis, improved reactivity, etc. Triazenes are a distinct class of reaction partners that have a generic formula [–N=N–N<], possessing several advantages for instance ready availability, good reactivity, versatility, diverse transformational abilities, operational simplicity, etc.<sup>[5]</sup> They have many applications such as adaptable intermediates for the synthesis of natural products,<sup>[6]</sup> heterocyclic compounds,<sup>[7,8]</sup> DNA alkylating agents aimed at cancer therapy,<sup>[9]</sup> in host-guest chemistry,<sup>[10]</sup> photoactive materials,<sup>[11]</sup> as linkers in solid phase synthesis,<sup>[12]</sup> combinatorial chemistry,<sup>[13]</sup> oligomer architectures,<sup>[14]</sup> incorporated in polymer,<sup>[15]</sup> ligands in organometallic chemistry<sup>[16]</sup> and organic synthesis<sup>[17]</sup> to access designated transformations.<sup>[18]</sup> As these capped arene diazonium salts possess several advantages, such as multiple reaction sites, decent stability, longer shelf life, etc., they were opted as convenient mid-bodies to construct C–hetero atom bonds.<sup>[19]</sup>

On the other hand, ionic liquids have been steadily emerging as green reaction media for proteins, along with other multiple practical applications such as promoters, catalysts, dispersion agents, co-solvents, prodrugs, modifiers etc. Therefore, we sought to develop a methodology, where triazenes can be exploited in combination with ionic liquids (ILs) as sustainable arylating partners. However, as aryltriazenes are well-known surrogates of diazonium ions in their masked form<sup>[20]</sup> requires treatment with Lewis or Brønsted acids to undergo substitution reactions triggered by the cleavage of *N*–*N* bond forming the suitable aryl cation<sup>[21]</sup> providing access to a wide range of functionalities.<sup>[22]</sup>

In this context, some research groups have reported the direct  $\alpha$ -arylation of different *N*-heterocycles with various coupling partners, using diverse metal-mediated, multifarious,

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## Experimental investigation of the structural features of polycarbonate (PC) filled with bismuth nitrate pentahydrate (BNP) composite films in terms of free volume defects probed by positron annihilation lifetime spectroscopy

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### ARTICLE INFO

**Keywords:**  
Bismuth nitrate pentahydrate  
Polycarbonate  
Positron annihilation lifetime spectroscopy  
Free-volume hole  
Microstructure

### ABSTRACT

The effect of bismuth nitrate pentahydrate (BNP) on the properties and microstructural features of polycarbonate (PC) has been investigated using PALT, XRD, SEM, EDX, TG, ATR-FTIR and tensile mechanical measurements. Positron Annihilation Lifetime Spectroscopy reveals that the ortho-positronium lifetime and its corresponding intensity significantly decrease as the filler level of BNP in PC (in the composite) increases from 0.3 wt% up to 5.0 wt%. This is due to the increasing fraction of positrons that annihilate with the filler particles and also in the interfacial layers of the filler and the host polymer. Fourier Transform Infrared spectra show that there is no significant shift in the IR bands of the composite when compared to those of pure PC, and so there is little molecular level interaction between PC and BNP. The micrographs of SEM revealed a random distribution of filler particles in the composite, and there is the formation of agglomerates of BNP at higher filler levels. There is an increase in the degree of crystallinity of the composite films due to the addition of the crystalline filler, which was confirmed by XRD analysis. Tensile mechanical tests confirmed the improved tensile strength of prepared composites at lower and moderate filler levels, from 0.0 wt % up to 2.5 wt%. The free volume properties of the composite films are correlated with its tensile mechanical properties.

### 1. Introduction

A polymeric composite is an effective polymer framework that is obtained by mixing polymers with inorganic or organic components called fillers in a specific proportion, so that the desired properties are achieved (Shankar et al., 2020). Polymer composites have been widely explored because of their useful bulk physical properties; for example, physical properties like optical, electrical, mechanical and some chemical properties are enhanced on the incorporation of suitable additives (Wang et al., 2020; Baraker et al., 2018; Saleh et al., 2020). When a polymeric material is filled with different components (or additives), the filler can initiate alterations in the molecular structure, and subsequently, the microstructural features of the resulting polymeric composite get modified. Specifically, inorganic salt reinforced polymers are viewed as a separate class of composite materials because of the extensive change in their physical properties on the incorporation of an

additive (filler) in the polymeric host (Ashassi-Sorkabhi and Kazempour, 2020). These modified properties depend upon the chemical structure of the filler and the polymer molecules and also depend on how they interact with each other.

Amorphous polymeric materials generally consist of dynamic local cavities in atomic and molecular dimensions called free volume holes (FVHs), due to irregular molecular arrangements and flexible movements of polymeric chains above the glass transition temperature ( $T_g$ ) (El-Garnal and Elsayad, 2020). In the case of semi-crystalline polymers, the number density of these FVHs is reduced because of an increase in the extent of the crystalline phase in the polymeric matrix. Positron annihilation spectroscopy (PAS) involves the use of non-destructive techniques like the positron annihilation lifetime technique (PALT) and Doppler broadening of annihilation radiation (DBAR) technique among many others in order to investigate the FVHs, electron density and the porosity of a molecular material (Utsalla et al., 2020). The

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## Evaluation of mechanical, antimicrobial, and antioxidant properties of vanillic acid induced chitosan/poly (vinyl alcohol) active films to prolong the shelf life of green chilli

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### ARTICLE INFO

**Keywords:**  
Vanillic acid  
Mechanical properties  
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Food packaging

### ABSTRACT

Vanillic acid incorporated chitosan/poly(vinyl alcohol) active films were prepared by employing a cost-effective solvent casting technique. FTIR investigation validated the intermolecular interaction and formation of Schiff's base (C=N) between functional groups of vanillic acid, chitosan, and poly(vinyl alcohol). The addition of vanillic acid resulted in homogenous and dense morphology, as confirmed by SEM micrographs. The tensile strength of active films increased from 32 to 59 MPa as the amount of vanillic acid increased and the obtained values are more significant than reported polyethylene (2231 MPa) and polypropylene (31–38 MPa) films, widely utilized in food packaging. Active film's UV, water, and oxygen barrier properties exhibited excellent results with the incorporation of vanillic acid. Around 40 % of degradation commences within 15 days. Synergistic impact against *S. aureus*, *E. coli*, and *C. albicans* pathogens caused the expansion of the inhibition zone, evidenced by the excellent antimicrobial activity. The highest antioxidant capacity, 73.65 % of CFV-4 active film, proved that active films could prevent the spoilage of food from oxidation. Green chillies packaging was carried out to examine the potential of prepared active films as packaging material results in successfully sustaining carotenoid accumulation and prolonging the shelf life compared to conventional polyethylene (PE) packaging.

### 1. Introduction

Food preservation become more pressing issues in an era of food scarcity. Because of its large population, India accounts for 40 % of the total annual worldwide food wastage of 1.3 billion tonnes [1]. It could be a result of several challenging factors such as climate variability, nutrition security, and improper food preservation. Food spoilage has a negative environmental impact due to CO<sub>2</sub> emissions that promote global warming. To avoid food wastage and preserve food there is an increasing demand for food packaging. As a result, the food packaging industry is several billion-dollar unicorns in the present market. Previously paper, metal cans, and glassware were used in traditional food packaging. As time passed most of the population highly relied on packaged foods in plastic. Plastic as a food packaging alternative fills the

void due to its ease of use and low cost. Petroleum based plastics such as polyamide, polypropylene, PET, PVC, etc. are now ubiquitous in the packaging industry [2] as the packaging is also responsible for the preservation of food quality during transportation and storage [3]. Despite all these pros, the major drawback of packaging with petroleum based plastics is its non-biodegradable nature which persisted in nature for several years and become the leading cause of all kinds of pollution [4,5]. Contamination of packing plastics due to packed foods and constituents leads to the recycling process being uneconomical and laborious. Hence, the accumulation of single used plastic causes severe environmental and waste disposal problems, which snowball every year [6]. In addition, the widespread utilization of petroleum based products in recent years has limited their supply owing to a shortage of fossil fuel sources and gained the attraction of biodegradable polymers for food

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## Development of Chitosan-Copolydione nanocomposite films with antioxidant and antibacterial properties for food packaging applications

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### ARTICLE INFO

#### Keywords

Chitosan  
Poly (1-vinylpyrrolidone-co-vinyl acetate)  
Silver nanoparticles  
Blocking effect  
Antibacterial  
Antioxidant

### ABSTRACT

In this study, green synthesized silver nanoparticles (AgNPs) functionalized Chitosan/ Copolydione nanocomposite films were prepared by solvent casting method using glycerol as plasticizer. The AgNPs were synthesized by in-situ reduction with the aid of *Syzygium cumini* (SC) leaf extract, as a reducing agent of the precursor AgNO<sub>3</sub>. The main focus of this study was to examine the consequences of varying concentrations of AgNPs on the polymer blend matrix. The nanocomposite films obtained exhibited obstruction to UV light, with good transparency. The UV blocking effect of AgNPs was also computed. The developed nanocomposite films were subjected to various studies such as XRD, FTIR, Mechanical testing, SEM, hydration properties and biological activities. The outcomes indicated that the films were semi-crystalline in nature and there was effective interaction between the film components. Mechanical strength was found to improve with increasing concentration of AgNPs and the morphological images showed absence of cracks and pores. The fabricated nanocomposite films were hydrophobic in nature with lower solubility in water. They also possessed good antibacterial activity against food pathogens such as *E. coli* and *S. aureus*. The developed nanocomposite films have also exhibited retarding oxidation potential that could make it a prospective material for packaging applications especially with respect to food.

### 1. Introduction

The increase in environmental concerns due to the non-degradability of plastics and its byproducts, both during its generation and its use have directed the attention towards biodegradable films. Biopolymers also known as polysaccharides also have the potential ability to be used as packaging materials replacing the petroleum based plastic materials. Polysaccharides have found extensive applications in this regard as they are obtained easily and are renewable sources, many of which possess film forming abilities. The bio-cidal biopolymeric films containing inorganic nanofillers are gaining considerable attention due to their reinforcement properties in the polymeric films (Velásquez et al., 2021).

Chitosan (CS), a deacetylated derivative of chitin, obtained from the

exoskeleton of insects and shells of crustaceans such as shrimps and crabs possess incredible uses owing to its biocompatibility, biodegradability, non-toxicity, film forming capacity, scaffolds and gels (Dutta et al., 2009). It is an abundant natural polymer next to cellulose consisting of (1,4)-linked 2-amino-deoxy- $\beta$ -D-glucan. However, given the nature of such natural polysaccharides they tend to exhibit poor mechanical and barrier properties, there arises a need to overcome this drawback by blending it in order to enhance its properties (Costa et al., 2021). The electronegative amino group allows it to accept protons making it positively charged, which provides it with functional abilities such as incorporation of minerals, vitamins, proteins, nanofillers and other substances so as to impart appreciable physicochemical and biological properties (Priyadarshi & Rhim, 2020).

Poly (1-vinylpyrrolidone-co-vinyl acetate) (PVP-co-VA) also known

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## Fabrication of novel gallic acid functionalized chitosan/pullulan active bio-films for the preservation and shelf-life extension of green chillies

Tilak Gasti,<sup>a,b</sup> Shruti Dixit,<sup>c</sup> Ravindra B. Chougale<sup>a,b</sup> and Saraswati P. Masti<sup>d</sup>

The need for eco-friendly and sustainable packaging films for the preservation of fresh food products has received considerable interest. Hence, here we developed green and active bio-films based on chitosan (CS)/pullulan (PL) bio-polymers functionalized with different weight percentages of gallic acid (GA) through the solvent casting technique. The developed CS/PL/GA (CPG) films' properties were investigated through different characterization techniques. The CPG films containing 15 wt% GA exhibited excellent UV ray blocking and high tensile properties (~27.53%) compared to the pristine CS/PL blend film. Further, the barrier property towards water vapor (~21.41%) and oxygen (~34.14%) was significantly enhanced with the GA content, while moisture retention capacity and surface wettability improved but not significantly. Besides these, CPG films showed an overall migration lower than the acceptable limit of 10 mg dm<sup>-2</sup>. In addition, compared to the neat CS/PL film, CPG films exhibited excellent antioxidant (~47.54%) and antimicrobial activities against foodborne pathogens. Moreover, the developed CPG15% film was practically tested for green chilli packaging at room temperature. Comparing CPG15% packed green chillies to unpacked green chillies, the shelf life of the green chillies was extended up to 18 days without affecting the quality. Overall, these findings imply that the developed CPG films attain promising conditions for active packaging applications of fresh food products.

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## 1 Introduction

Nowadays, the preservation and shelf-life extension of fresh food products without affecting their quality is the biggest challenge for the food industry. Hence, the industry is extensively using synthetic and artificial food preservatives. For instance, butylated hydroxyanisole, butylated hydroxytoluene and tert-butyl hydroquinone are some important synthetic antioxidants being used in the food industry. However, these synthetic additives cause alteration to food flavors and produce a distinctive taste.<sup>1</sup> Hence, there is a huge consumer demand for fewer and safer additives in processed food products; therefore, it has become a trend for researchers to be interested in the usage of natural plant extracts in packaging systems, which have bioactivity such as antimicrobial and antioxidant properties. However, the usage of crude plant extracts may lead to

a lack of reproducibility due to the unknown composition of the crude extracts. In this direction, purified plant polyphenols such as boswellic acid, rutin, quercetin, gallic acid and citric acid are utilized as natural active components in food preservation formulations.<sup>2–4</sup> Among these, gallic acid was considered as a suitable active component due to its large availability and convenient synthesis protocol. Gallic acid (GA) (3,4,5-trihydroxybenzoic acid) is a green, commercially available non-toxic and simple compound, which contains three hydroxyl groups.<sup>4</sup> It is widely found in vegetables and fruits and is mainly responsible for the antioxidant process. It is known that GA has been suggested in numerous research studies to have potent antioxidant properties;<sup>5,6</sup> due to this, GA is attracting much more attention from researchers for food packaging films.

The majority of the food industries depend on conventional petroleum-based plastics for food packaging purposes. However, these plastics cause serious effects on the environment due to their non-degradability under atmospheric conditions.<sup>7</sup> Therefore, researchers are much more interested in the development of degradable plastics using natural polymers. Recently, the idea of bio-films, edible films and coatings for food preservation has become an emerging area of research in the packaging sector to safeguard food products, minimizing the accumulation of solid waste and reducing the wastage of

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Short communication

Investigation of African mangosteen leaves extract as an environment-friendly inhibitor for low carbon steel in 0.5 M H<sub>2</sub>SO<sub>4</sub>Manohar R. Rathod<sup>a</sup>, S.K. Rajappa<sup>a,\*</sup>, Ragini L. Minagalavar<sup>a</sup>, B.M. Praveen<sup>b</sup>,  
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## ARTICLE INFO

**Keywords:**  
African mangosteen  
Mass loss  
Inhibition  
Adsorption  
AFM

## ABSTRACT

The African mangosteen plant species comprises a variety of bioactive molecules. In the following research, phytochemicals have been screened with Shinoda test, Benedict's test, etc., for ethanolic African mangosteen leaves extract (AMLE). The inhibition efficacy of AMLE for low carbon steel corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> was assessed by mass-loss, polarization, and electrochemical impedance spectroscopic (EIS) approach. Corrosion studies were performed for various inhibitor concentrations and differing temperatures. The inhibition performance of AMLE on low carbon steel rises with concentration rise. Potentiodynamic polarization results revealed that AMLE bind to the surface of low carbon steel, as they hinder corrosion spots from the bulk media, and the maximum inhibition performance ( $\eta_{\text{max}}$ ) was 96.14% for 1.5 g/L concentration. Electrochemical impedance spectroscopy (EIS), the maximum inhibition performance ( $\eta_{\text{max}}$ ) was 95.57% attributed to AMLE adsorption on the low carbon steel surface. Findings reported from electrochemical and chemical research are well in agreement. The AMLE inhibition activity is stated by the adsorption process on low carbon steel and complies with Langmuir isotherm. The values of  $\Delta G_{\text{ads}}^{\circ}$  were estimated to be between  $-30.27$  to  $-33.06$  kJ mol<sup>-1</sup>, indicating that the inhibition effect is exothermic and spontaneous. Furthermore, the determined thermodynamic parameters suggest that the adsorption process is intuitive. Scanning electron microscope (SEM), Fourier-transform infrared (FT-IR) spectroscopy, and atomic force microscopic technique (AFM) were employed to examine the surface analysis of the low carbon steel samples.

## 1. Introduction

Metal corrosion has been a significant concern for researchers since the ancient era. The threat associated with the control of corrosion risks has risen dramatically over time and needs a tremendous expenditure of resources. There are several ways for mitigating the harmful effects of corrosion, and one of the most efficient, reliable, and simple is the use of corrosion inhibitors [1–8]. For many industries, such as textile manufacturing, pulp, sugar mills, pesticides, etc., acidic solutions are extensively used to eliminate toxic and harmful corrosion materials from the surface of machinery parts. The use of sulphuric acid and hydrochloric acid is employed to remove the scales on the machinery parts since they are more powerful and economical. However, acid solutions corrode metals and promote corrosion, resulting in mass loss throughout

the cleaning and descaling process. Chemical additives such as organic inhibitors are widely used to avoid these unwanted losses in metals and their alloys [9,10]. Many organic compounds have been utilized to prevent corrosion in metals and their alloys. The compounds containing S, N, and O heteroatoms in the aromatic group have anti-corrosion ability in their structure. However, most synthetic compounds are poisonous and cause harmful environmental effects. Due to this reason, experts are concentrating on green corrosion inhibitors from plant leaves, fruits, seeds, barks, etc., that are environmentally friendly and inexpensive [11–16]. Many plant extracts are examined for the same purpose to monitor the degradation of metals in the acidic solution, such as Walnut fruit green husk extract [17], Chamomile flower extract [18], *Mulva sylvestris* [19], *Ziziphora leaves* extract [20], *Glycyrrhiza glabra leaves* extract [3], *Pegatum harmala* [21], *Chrysophyllum albidum* [22],

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## Effect of *Artabotrys odoratissimus* extract as an environmentally sustainable inhibitor for mild steel corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> media

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### ARTICLE INFO

**Keywords:**  
*Artabotrys odoratissimus*  
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 Adsorption  
 FT-IR

### ABSTRACT

*Artabotrys odoratissimus* inhibitory effect on mild steel (MS) corrosion in 0.5 M H<sub>2</sub>SO<sub>4</sub> solution has been assessed utilizing mass loss, electrochemical potentiodynamic polarization, and impedance spectroscopy techniques. The *Artabotrys odoratissimus* plant has a wide range of bioactive compounds. Phytochemicals were tested for ethanolic *Artabotrys odoratissimus* leaves extract (AOLE) using the FeCl<sub>3</sub> test, Salkowski's test, and others. Corrosion tests were conducted at varying inhibitor concentrations and temperatures. The inhibitory impact of AOLE on corrosion of MS was reported to improve with increasing concentration. Polarization experiments revealed that AOLE is a mixed kind of inhibitor and the inhibition efficacy ( $i_{corr}$ ) for MS is 93.27% for 1.25 g/L AOLE. For Electrochemical Impedance Spectroscopy (EIS), maximal inhibitory efficacy ( $i_{corr}$ ) was 91.62% due to AOLE adsorption on the MS surface. The obtained results using each methodology are highly consistent and closely resemble each other. The adsorption of AOLE molecules on an MS surface from the bulk of the solution causes the inhibitor's inhibition action, and the adsorption mechanism follows Langmuir adsorption isotherm. The computed  $\Delta G_{ads}^{\circ}$  values ranged between  $-32.919$  and  $-33.520$  kJ mol<sup>-1</sup>, implying a spontaneous and exothermic inhibitory action. The thermodynamic and activation parameters are often used to understand corrosion inhibition mechanisms. The comparison of corrosion product and pure extract FT-IR spectrum indicates the nature of AOLE adsorption on the MS surface. The surface morphology of MS samples was assessed using atomic force microscopy (AFM), scanning electron microscope (SEM), and contact angle techniques.

### 1. Introduction

Metal is used in most industries because they are relatively inexpensive, deform, firm, and can be used for several other applications. Major manufacturing processes use acid to get rid of scale and rust. Sulphuric and hydrochloric acids are often employed in industrial cleaning, pickling, and descaling [1–3]. During this process, the metallic parts undergo mass loss, due to which the corrosion resistance of metals is a major industrial problem. Due to the extensive use of metal and its alloys in automotive, it is essential to assure that they are effectively protected from the corrosive effects of acid solutions. Corrosion inhibitors, particularly in acidic environments, are among the most efficient methods for protecting metals from corrosion [4]. Numerous organic molecules include S, N, and O in their polar functional group through conjugated double bonds or aromatic rings. These molecules have anti-corrosive properties. However, synthesizing organic molecules may be a time-consuming and expensive process that may be hazardous to humans and the environment [5–8].

As a result, the researchers focus on using environmentally friendly substances and ecologically compatible materials such as plant extract since these plant extracts are biodegradable, affordable, widely available, and renewable material sources. Green corrosion inhibitors do not include toxic substances or other potentially harmful compounds. Plant extracts are outstanding due to their exceptional corrosion resistance and are readily available and non-toxic, making them suitable for this application [9–11]. Simple extraction techniques are typically used to obtain plant extracts. So far, researchers have investigated the utilization of extracts such as *Hymenaea stigonocarpa* fruit shell [12], *Peganum harmala* [13], *Chrysophyllum albidum* [14], *Sweetia chirata* [15], *Magnolia kobus* [16], *Dolichandra unguis cati* leaves [17], *Plectranthus amboinicus* [18], *Walnut fruit green husk* extract [19], *Chamomile flower* extract [20], *Malva sylvestris* [21], *Ziziphora* leaves extract [22], *Glycyrrhiza glabra* leaves extract [23] have been stated as an excellent inhibitor in acidic medium. Most plant extracts contain water-soluble phytochemicals, like terpenoids, alkaloids, flavonoids, phenolic compounds, amino acids, polysaccharides, sugars, and proteins. These phytochemicals form a thin

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## Effect of Schiff's bases on corrosion protection of mild steel in hydrochloric acid medium: Electrochemical, quantum chemical and surface characterization studies

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### ARTICLE INFO

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### ABSTRACT

Schiff's bases such as (E)-3-(3-hydroxybenzylideneamino)-2-(3-hydroxyphenyl)-2,3-dihydroquinazolin-4(1H)-one (SB-1) and (E)-3-(5-bromo-2-hydroxybenzylideneamino)-2-(5-bromo-2-hydroxyphenyl)-2,3-dihydroquinazolin-4(1H)-one (SB-2) were synthesized and investigated to the surface interactions & corrosion protection performance on mild steel (MS) in 2 M HCl medium by means of weight loss, electrochemical polarization and electrochemical impedance spectroscopic (EIS) techniques. Tafel polarization measurements showed that, the synthesized compounds were exhibited as mixed type (cathodic / anodic) inhibitors and the maximum protection efficiencies of 86.44% and 87.36% for SB-1 and SB-2 respectively were observed at optimized concentration. The corrosion control of MS in presence of inhibitors could evaluate through adsorption phenomenon and fitted to Langmuir's adsorption isotherm. Activation energy ( $E_a$ ) values in absence of the inhibitor is minimum 51.45 kJ mol<sup>-1</sup> and higher values of 89.98 kJ mol<sup>-1</sup> and 70.09 kJ mol<sup>-1</sup> in the presence of SB-1 and SB-2 respectively. Thermodynamic adsorption parameters such as  $\Delta H_{ads}$ ,  $\Delta G_{ads}$  &  $\Delta S_{ads}$  were correlated to the corrosion inhibition process. Quantum chemical analysis revealed the nature of chemical interaction established between the inhibitor molecules and metal atoms. The change in surface morphology of mild steel and chemical interactions of inhibitor molecules on specimen surface were evaluated through FT-IR, Scanning electron microscopic linked with EDX, Atomic force spectroscopy and Contact angle techniques. Atomic force microscopy results revealed that, an average roughness of the mild steel surface has been reduced from 443 nm to 11.0 nm and 26.9 nm in presence SB-1 and SB-2 respectively.

### 1. Introduction

The MS materials and hydrochloric acid together were found tremendous applications in many industrial estates. The hydrochloric acid is widely used in various chemical processes such as acid pickling, acid cleaning, acid descaling and oil wet cleaning [1]. MS possessed toughness and ease of availability and economic viability, but it is used in corrosive environment that enhances the higher degree of metal corrosion [2]. A huge number of synthetic organic compounds possessed electronegative functional groups such as N, O, S or imine possessed in their structures were developed as effective inhibitors particularly to MS in acidic environment [3,4]. Generally inhibitor molecules adsorbed over a metal surface and forming a barrier between the metal surface and corrosive medium, which leads to retard the corrosion of metal [5]. The effectiveness of inhibition depends on metal nature, surface charge

of the metal, nature and also chemical structure of the inhibitor [6]. It has been known that, chemical structure of the inhibitor has a large influence on corrosion inhibition [7]. The quantum chemical calculations are strongly correlated with the experimentally obtained inhibition efficiency [8].

Recently it has been reviewed that, many compounds such as 4-dimethylaminopyridine with sodium dodecyl sulfonate [9], hydrophobic-tailed imines [10], Pyrazole ligands [11], epoxy primer [12], Polyaniline modified attapulgite incorporated in alkyd paint [13], green inhibitor and leaves extract of tephrosia purpurea [14,15] and new nonionic surfactant based on coumarin moiety [16] were developed for the corrosion protection of MS in hydrochloric acid solution. Various synthesized compounds containing heterocyclic atoms, aromatic systems and the presence of electronegative atoms in their molecular structure such as benzoin, benzil, benzoin-(4-phenylthiosemicarbazone)

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# Schiff's base Fufural Phenylhydrazone as a Potential Corrosion Inhibitor for Mild Steel in Hydrochloric Acid Solution

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**Abstract:** Heterocyclic Schiff base fufural phenylhydrazone (FPH) was prepared and formulated as a corrosion inhibitor for mild steel in 2M hydrochloric acid solution. Mass change measurement and electrochemical methods adopted to study the effectiveness of the FPH during the corrosion process. FPH inhibitor protected 94.53 % corrosion of mild steel at optimum inhibitor strength of 0.0007 M at 303 ± 1 K. Rate of corrosion protection was interpreted through adsorption of FPH molecules on specimen surfaces in acid solution. Nature of the adsorption was established via Langmuir adsorption isotherm. Stability of the inhibitor was investigated with higher temperatures. Tafel polarization curves revealed, FPH molecules exhibit mixed nature of inhibitor. SEM and AFM images suggested that corroded specimen surface was severely affected in free acid comparatively in presence of FPH inhibitor. FT-IR analysis proved that, chemical interaction takes place between specimen surface atoms with FPH molecules and established chemical bond between them.

**Keywords:** Schiff base, Corrosion inhibitor, Tafel plots, Corrosion rate.

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## I. INTRODUCTION

In various industrial processes mineral acids like hydrofluoric acid, hydrochloric acid, nitric acid, chloroacetic acid and sulfuric acid are most preferably used in order to improve oil/gas recovery and also to removal of iron oxides and salt deposits [1, 2]. Mild steel is also an extensively utilized important structural & industrial material in various chemical industries due to its natural availability, toughness and possessed better-quality mechanical properties [3]. These materials react with acids to form stable compounds, in which the loss of metals take place and the metal surface becomes corroded, leading to enormous economic and material wastes. Corrosion can be controlled or reduced by means of various ways [4, 5]. For controlling the corrosion of metallic substrate, different approaches such as coating and lining, cathodic protection and use of corrosion inhibitors frequently applied in a variety of industrial applications [6]. Several researchers reported that molecules of organic inhibitors possessed N, O, & S hetero atoms, imine group, multiple bonds and aromatic rings are effectively interact to surface of metals and reduce the corrosion in acidic solutions [7, 8].

Recently many Schiff's bases had been developed as inhibitors for various metals and alloys in acidic media and these inhibitors contain heterocyclic atoms, aromatic systems and electronegative atoms in the molecule. Recent developed few Schiff's bases are 2,20-dithiobis(3-cyano-

4,6-dimethylpyridine) [9], 1-methyl-3-pyridin-2-yl-thiourea [10], *N,N*-ortho-phenylacetylacetone imine and 4-[(3-/[1-(2-hydroxy phenyl)methylene] amino/ propyl] ethanemido]-1,3-benzenediol [11], (NE)-N-(thiophen-3-ylmethylene)-4-({4-[(E)-(thiophen-2-ylmethylene)amino] phenyl}methyl)aniline [12], 5-(4-Dimethylaminobenzylidene)thodanine [13] and 2-(3-pyridyl)-3,4-dihydro-4-quinazolinone [14]. These compounds exhibited as good corrosion inhibitors for various metals and alloys.

The present investigation employed for the formulation of fufural phenylhydrazone (FPH) as a mild steel corrosion inhibitor in 2M HCl solution using mass change measurement and electrochemical technique. The investigations focused on the effect of concentration of FPH and temperature, characterization of surface image and metal-inhibitor interactions.

## II. MATERIALS AND METHODS

### A. Chemicals

Corrosive solution of 2M HCl prepared using AR (36-37%) HCl and used as corrosive medium. Stock solution of the FPH inhibitor was prepared by dissolving in a 2M HCl solution. From the stock solution, different concentrations of FPH solution were prepared in 2 M HCl then used for the corrosion studies.

# Experimental and Theoretical Investigations of *Cordia Obliqua* Leaves Extract as an Environmentally Benign Inhibitor for Mild Steel Corrosion in a 1 M HCl Solution

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## Abstract

MS surface deterioration is one of the most challenging problems, since it can be exacerbated by several industrial processes, such as descaling and pickling. In the proposed investigation, chemical and electrochemical techniques determined COLE IE(%) on MS corrosion in a 1 M HCl medium. COLE contains many Pc responsible for an excellent IE(%), since it forms a coating that adsorbs onto the metal surface and shields it from corrosion. Tafel polarization curves outcomes demonstrated that COLE is a mixed kind of CI. According to EIS measurements,  $R_{ct}$  rose as  $C_t$  of COLE was increased. The relationship between T and MS corrosion behaviour in 1 M HCl with COLE addition was investigated from 300 to 320±1 K. G, which was determined from Langmuir's isotherm model, revealed that COLE molecules predominantly blocked HCl attack by mixed physisorption and chemisorption mechanisms. Surface morphology studies validated electrochemical and chemical findings by FT-IR, SEM and WCA techniques. Furthermore, DFT computations demonstrated COLE effective interfacial adsorption onto the MS surface.

**Keywords:** 1 M HCl; CI; COLE; DFT; EIS; FT-IR; MS; SEM; WCA.

## Introduction\*

Different metals, e.g. MS, Zn, Cu, Al, and their alloys, are frequently used to develop liquid-flowing systems, such as steam boilers, gas and oil pipelines. MS is among the most often employed metals, due to its low setup costs and excellent mechanical features [1]. MS main and major disadvantage is its relatively low stability and profound degradation in corrosive environments such as HCl, H<sub>2</sub>SO<sub>4</sub> and HNO<sub>3</sub>. Boilers, heat exchangers and other metallic materials are typically cleansed with HCl to eliminate undesired scaling and rust [2-4]. CI can be added to aggressive media to minimize CR of MS under such environments

\* The abbreviations and symbols definition lists are in pages 249-250.



## Investigation of Laurus Tamala leaves extract as an environmentally acceptable corrosion inhibitor for soft steel in 1M HCl: Electrochemical, DFT, and surface characterization techniques

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Laurus Tamala leaves extract (L.TLE) has been employed as a soft steel corrosion inhibitor in a 1M Hydrochloric acid media. Chemical (weight loss) and electrochemical investigations were carried out to assess the corrosion rate and percentage inhibition efficiency of the extract. The electrochemical polarization results have demonstrated that plant leaves extract functions as a mixed type inhibitor. The stability of the inhibitor is tested at elevated temperatures by weight loss method. The corrosion inhibition mechanism is interpreted through adsorption mechanism, and the L.TLE components has obeyed the Langmuir adsorption isotherm for soft steel. The interaction of the components of the extract is assessed through FT-IR technique. The surface morphology, roughness and hydrophobicity in presence and absence of the extract have been characterized through SEM, AFM and water contact angle techniques respectively. The highest inhibitory efficiency is 96.21% for 24 h as recorded by weight loss method. Additionally, the DFT computations has revealed the inhibitor's adsorption through electron donor-acceptor interactions.

**Keywords:** Laurus Tamala leaves extract, Soft steel, Corrosion inhibitor, Tafel plots.

Metal and its alloys are fascinating industrial materials owing to their increased availability, physicochemical properties, exceptional ductility, significant mechanical characteristics, low cost, and wear resistance. These materials have been commonly applied in engineering disciplines such as casings, metal processing, seawater purification, automobiles, petroleum refineries, tube manufacturing, and gas and oil transportation. However, under the following circumstances, these materials are prone to corrode. These can be removed by proper oil well acidification, rust cleaning, acid descaling, and boiler cleansing processes performed on the equipment to protect metal components machinability and extend their service life. The corrosion processes destroy the metal surface. As a result, the mechanical characteristics of the metal are drastically diminished. During this process, metal loss from the external surface occurs. Metallic material deterioration creates severe environmental and financial issues<sup>1-5</sup>. Therefore, acids attacking soft steel surfaces lead to corrosion problems. Most inhibitors (organic and inorganic) are expensive, environmentally harmful,

and poisonous. Inhibitors are widely used, as evidenced by their excellent anti-corrosion capacity and economic adaptability. As a result of these problems, inhibitors of plants have indeed been explored as a potential remedy<sup>6-9</sup>. This is due to their affordability, accessibility, low cost, inexhaustible, non-toxic, and ecological stability. Natural substances found in plants can be utilized to control or prevent the oxidation of metals and alloys in various industrial applications. Inhibitors control corrosion by blocking surface-active areas, adhering to the surface, and creating an effective barrier to corrosive ions. This has encouraged researchers to discover safe, affordable, biodegradable, and effective green corrosion inhibitors<sup>10,12</sup>.

Furthermore, the use of green corrosion inhibitors was gained into high consideration because of their economic resilience<sup>13-15</sup>. Most naturally occurring phytoconstituents (plant-based) are environmentally safe and work well to prevent metal corrosion in acidic conditions. *Crotalaria Pallida*<sup>16</sup>, *Dolichandra unguis-cati*<sup>17</sup>, *Ficus tikoua* leaves extract<sup>18</sup>, *Chamaecrops humilis* leaves extract<sup>19</sup>,





## Synthesis of coumarin-thioether conjugates as potential anti-tubercular agents: Their molecular docking and X-ray crystal studies

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### ABSTRACT

In this work, we report a series of 4-(2,6-dimethylphenylthio)methyl-2H-chromen-2-one conjugates as promising leads to treat tuberculosis. Spectroscopic and other analytical methods were used to validate the synthesised compounds. The compounds were assessed for in vitro anti-tubercular activity with the H<sub>37</sub>Rv strain of Mycobacterium tuberculosis. Further, cytotoxicity studies were performed using Vero cells. Most of the synthesised conjugates were effective and displayed notable activity with MIC values in the range 0.39–12.5 µg/mL. The most diligent compound **6b** (MIC = 0.39 µg/mL) was twofold more active than standard anti-TB drug Rifampin (0.8 µg/mL) and was comparable to Isoniazid (0.1 µg/mL). Compound **6f** also displayed exemplary activity (MIC 0.78 µg/mL). Both compounds **6b** and **6f** possessed low levels of cytotoxicity. Molecular docking evaluation of the synthesised conjugates and 4DQ3 ligand demonstrated that the synthesised conjugates had higher C-score values that further supports the obtained results. It indicates compound **6b** and **6f** are promising lead compounds in search of novel antitubercular drug-like molecules.

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### 1. Introduction

Mycobacterium tuberculosis (Mtb) is the causative agent responsible for the infectious disease, tuberculosis (TB). Globally, TB is the 13th leading cause of death and the second leading infectious killer after COVID-19 (above HIV/AIDS). According to WHO, 1.5 million people died from TB in 2020 including 214 000 people with HIV. It is estimated that, in 2020 approximately 10 million individuals will become afflicted with tuberculosis (TB) of which 5.0 million males, 3.3 million women, and 1.1 million children [1]. Although there is a cure for TB, the treatment regime is lengthy. The conventional anti-TB treatment regimens of first- and second-line drugs do not achieve the desired cure rate [2]. The initial complica-

tion is that the medication of drug-sensitive ailment is long lasting a minimum of six months [3]. Furthermore, during the first two months of therapy, the four most adequate first-line oral medications such as Isoniazid, Rifampicin, Ethambutol and Pyrazinamide must be taken concurrently followed by two namely Isoniazid and Rifampicin for the next four months in the subsequent phase, leading to patient adherence issues. When administered under suboptimal programmatic conditions, these regimens are associated with a higher incidence of noncompliance and increased mortality, as well as the development of chronic instances of infectious drug-resistant TB [4]. The bacterial persisters can survive up to 100 days after the initiation of anti-TB treatment [5] and require a resuscitation stimulation factor for replication to activate fast multiplication of latent bacilli [6]. These latent bacteria are tolerant to many anti-tubercular medications, [7–10] which is one of the reasons why anti-tuberculosis treatment must be administered for an extended period of time. Hence, new medications and regimens are

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## Coumarin-Pyrazole Linked Carbodithioates as Potential Anti-Cancer Agents: Design, Synthesis, Biological, and Molecular Docking Investigation

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**Abstract**—A series of novel benzyl 5-(substitutedphenyl)-3-(2-oxo-2H-chromen-3-yl)-4,5-dihydro-1H-pyrazole-1-carbodithioate were obtained. The anti-cancer activity of synthesised compounds against lung cancer (A-549) and breast cancer cell lines (MDA-MB-231) was investigated by MTT assay. The most of the synthesised compounds were effective against both cancer cell lines and demonstrated significant cytotoxicity. Molecular docking investigation of the synthesised compounds and the cyclin dependent kinase-2 (CDK2) protein revealed that the synthesised compounds displayed greater C-score values, validating the findings.

**Keywords:** coumarin, pyrazole, anti-cancer activity, molecular docking

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### INTRODUCTION

The most feared disease is cancer, a condition in which cells multiply uncontrollably, attacking normal tissues [1, 2]. Cancer is the second most deadly disease in the world, affecting approximately one in six people. According to reports, the top three most common cancer types are lung cancer, colorectal cancer, and breast cancer. This account for one-third of all cancer cases and deaths worldwide [3, 4]. In 2020, an anticipated 19.3 million new cancer reports were identified and approximately 10 million people died from cancer around the world. With an estimated 2.3 million new cases (11.7% with a fatality rate of 6.9%), breast cancer has surpassed lung cancer as the most often diagnosed malignancy, followed by lung cancer (11.4 percent with the mortality rate of 18 percent) [5]. Cancer is classified as malignant tumors that can metastasize. Various malignancies in humans and their incidence can be linked to genetic/environmental causes such as chemicals, hormones, nutrition, infection, physical inactivity, and radiation [6, 7]. The identification

of several cancer-specific biomarkers, customised treatment for tumor site specific targets has increasingly gained popularity in the advancement of anti-lung cancer medications [8, 9]. Apparently, the restricted use of targeted therapies is caused by both the higher costs for targeted pharmaceuticals as well as the prevalence of resistance associated with targeted medications [10, 11]. Furthermore, not all mutations in lung cancer cells have been found and linked with successful targeted medicines [12, 13], resulting in classical cytotoxic treatments remaining the primary choice for patients who are ineffectual in targeted therapy [14]. In contrast, the use of cytostatics such as Cisplatin and Paclitaxel is associated with side effects and chemoresistance patterns [15, 16], which can limit treatment doses, impose a disease burden, and impair patient lifestyle. The use of existing chemotherapeutic agents is usually limited due to undesirable side effects and the limited choice of anticancer agents. This clearly demonstrates the need to create new chemotherapeutic drugs to eradicate the oncological threat and its impact on the lifeline.

# Coumarin Hydrazone Oxime Scaffolds as Potent Anti-tubercular Agents: Synthesis, X-ray crystal and Molecular Docking Studies

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A series of new Coumarin hydrazone oxime scaffolds were synthesized as potential anti-TB agents. The structures of the scaffolds were confirmed by spectroscopic and analytical techniques. X-ray crystallography confirmed the structure of compound 6-methyl-4-((1Z)-((E)-3-(2-phenylhydrazono)butan-2-ylidene)amino)oxime)methyl-2H-chromen-2-one (5a). The coumarin hydrazone oxime scaffolds were tested *in-vitro* against the *Mycobacterium tuberculosis* H<sub>37</sub>Rv strain, and Vero cells were used to assess cytotoxicity. Compound 5b was obtained as the

hit candidate, exhibiting MIC 0.78 µg/mL, showing more potent anti-TB activity than Rifampicin and comparable activity to Isoniazid. There was minimal cytotoxicity observed against Vero cells for the most active compounds, indicating a good safety profile. In addition, the most diligent compound 5b demonstrated substantial binding interactions at the PDB-4DS2J enzyme's active site and also displayed greater C-score value than that of 4DQU ligand which validates the observed results.

## 1. Introduction

Tuberculosis (TB) continues to be a global pandemic, affecting about a quarter of the population worldwide. Currently, it appears that tackling this disease has become even more difficult due to the sudden outbreak of Covid-19. In general, patients with TB have a higher chance of contracting SARS-CoV-2 due to the fact that both diseases primarily affect the respiratory system especially the lungs.<sup>[1,2]</sup> The treatment results are worse for patients infected with these diseases, especially if TB treatment is stopped.<sup>[3,4]</sup> Drug interactions may worsen the condition preventing co-administration of TB medications and other chronic medications.<sup>[5,6]</sup> Researchers predict a five to eight year delay in TB disease control due to Covid-19 pandemic. Accordingly, an estimated 6.3 million TB cases and 1.4 million TB-related fatalities will be reported in the following five years.<sup>[6,7]</sup> The biggest problem in treating TB today is that the most effective anti-TB drugs are becoming ineffective in

treating TB which leads to multidrug-resistant TB (MDR-TB).<sup>[8,9]</sup> The recurrence of MTB can be caused by the resurrection of the original infecting strain or by reinfection with an MTB strain other than original infecting strain.<sup>[10]</sup> Obviously the tuberculosis is now being replaced by a minimal but rising number of resistant cases, with 2 million MDR-TB cases envisaged over the next 20 years.<sup>[10]</sup> Currently, MDR-TB is treated with eight to ten drugs over the course of 18 to 24 months, due to this the patients suffer with high drug toxicity leading to treatment failure in almost 30% of cases.<sup>[10]</sup> Another critical challenge is the interaction between TB and HIV. The problem has been aggravated by the disease's interactions with HIV, which leave patients vulnerable to re-infection and due to this factor, the risk of developing TB is 50 times more in HIV-positive patients. Indubitably, TB is the leading cause of death among HIV or AIDS patients. HIV or AIDS patients accounted for 8.6 percent of all TB cases.<sup>[12,13]</sup> In light of this, new medications that fight resistance need to be developed rapidly and clinical trials need to be conducted, since there have been a limited number of clinical studies that evaluated therapeutic efficacy in MDR-TB patients in the past.

Oxygen-containing heterocyclic moieties have been discovered to be crucial in the establishment of new medicinal structural entities.<sup>[14–16]</sup> Over the last several decades, medicinal chemists have been intrigued by the synthesis of coumarin as they exhibit a unique ability to interact with a range of enzymes through weak bonds. This makes its derivatives extremely promising as therapeutics.<sup>[12,16]</sup> The coumarin family in recent years have been investigated for their anti-TB properties and some of them exhibit impressive anti-TB potentialities with good safety profiles.<sup>[20–22]</sup> Tremendous work has been put into developing coumarin based molecules as anti-TB modulators with high therapeutic efficacy and active-

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ANGIOSPERMIC MACROPHYTE DIVERSITY OF PAJHAR LAKE KURLI, NIPANI TALUK, KARNATAKA

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ABSTRACT

Present investigation was undertaken to survey angiospermic macrophyte diversity in Pajhar Lake Kurli of Nipani Taluka, District Belgaum (Karnataka State). The study involved extensive floristic survey of the study area, during January, 2020 to December, 2021. 51 species belonging to 44 genera and 28 families were recorded. *Fabaceae* Lindl. was found to be the most dominant family, followed by *Convolvulaceae* Juss. The assessment of macrophyte diversity was done by calculating species frequency, richness and dominance.

**Key Words:** Macrophytes, Diversity Index, Pajhar Lake.

**Introduction**

Aquatic macrophyte includes ferns, mosses, macro-algae, angiosperms as well as small and large trees which require standing fresh water for survival (Sculthrope, 1967). However, in recent days fresh water ecosystems are suffering from decline in biodiversity, as a result of increasing pollution, climatic changes, eutrophication, acidification, and invasion of alien species (Chambers *et al.*, 2008). Present study was therefore undertaken to find out angiosperm species composition and diversity at Pajhar Lake Kurli of Nipani Taluka, District Belgaum (Karnataka State).

**Material and Methods**

Pajhar Lake Kurli is a perennial water body situated in Taluka Nipani, District Belgaum (Karnataka State). The floristic exploration of the study area was undertaken for two years i. e. from January, 2020 to December, 2021. The specimens of flowering plants were collected, perfectly dried and

mounted on hand made Herbarium sheets. The plant specimens were identified following Hooker (1872-1897), Bailey (1949), Dassnayake and Fosberg (1991), Duthie (1903-1929), Fasset (1940), Raizada (1976), Cook (1996) and Subramanyam (1962). The specimens were deposited at Department of Botany, Devchand College, Arjunnagar. Diversity Indices, such as Simpson's Diversity Index, Shanon Index (1949), Berger-Parker Dominance and Margalef Richness Index were calculated following Washington (1984).

**Result and Discussion**

The plants recorded during present study were amphibious, partly submerged, completely submerged or along the bank of water body. During present study in all 51 species, belonging to 44 genera and 28 families were recorded (Table 1). Maximum number of species (6) were belonging to family *Fabaceae*, followed by those from *Convolvulaceae* (4). The values for diversity indices presented in Table 2 were unique, indicating that the community was diverse with Margalef Richness Index of 6.765.



## CHECKLIST OF SUBAERIAL ALGAE FROM KARNATAK COLLEGE CAMPUS, DHARWAD

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### ABSTRACT

In present study an attempt was made to document Subaerial Algae from Karnatak College Campus, Dharwad to fill a gap of valid document. In present study a total of 40 taxa belonging to 24 families from 16 different sites of natural and artificial substratum were surveyed. Members of Microcystaceae and Trentepohliaceae were highly distributed in the study area.

**KEYWORDS:** Subaerial Algae, KCD Campus, Checklist.

### INTRODUCTION

Algae are simple photoautotrophic organisms which are mainly aquatic; some of them successfully colonized terrestrial environments, particularly the streptophyten lineage which gave rise to land plants. Among the subaerial forms, Cyanoprokaryotes have been most successful in colonizing terrestrial environments. Till early 19<sup>th</sup> century there was no specific term as "subaerial algae" which is now accepted after Fritsch (1907) described them as the algae which grow without aquatic environment but on other surfaces. Petersen (1915) for the first time used "aerial" which is equivalent to today's subaerial algae.

Subaerial algae are terrestrial algae that live on stable exposed surfaces above the soil, they are particularly abundant in areas with humid climates sometimes causes significant economic problems. Some members of Cyanoprokaryotes and Trentepohliales are well known agents of Biodeterioration of man-made constructions; they remain underexplored and relatively unknown.

Subaerial algae studies are available mostly from Europe with very limited research from other continents particularly Asia. The prokaryotic cyanobacteria and the eukaryotic Chlorophyta account for the largest numbers of species currently described. Chlorophyceae and Ulvophyceae, among the Chlorophyta, are monophyletic groups, which includes several widespread genera (*Chlorella*, *Stichococcus*, *Chlorococcum* and *Trentepohliales* respectively). Other forms include members of Bacillariophyceae, Desmidiaceae and Xanthophyceae, their studies in India are highly limited and underexplored. India being a tropical country,

promises rich diversity of subaerial forms which needs to be seriously considered for future studies.

In this paper, The authors chief aim remains to point out that even such a small area like KCD campus when explored could represent the richness of the Subaerial algal flora in this region. The paper suggests a further need for such work.

### MATERIALS AND METHODS

Karnatak College Dharwad is the centenary college in Dharwad and recognised as a heritage value of Karnataka state. The college campus is spread over 55 acres with lush beautiful vegetation, promising noteworthy diversity of subaerial algal populations.

Monsoon surveys were conducted in sixteen areas (Table 1) of KCD campus for the period 2019-22. During the sampling period the relative humidity was found to be in the range of 80-100.



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Research Article

### Anticancer activity of fresh water Cyanobacteria *Anabaena* sp. PCC550, *Anabaena* sp. PCC574, and *Cylindrospermum* sp. PCC518, *Cylindrospermum* sp. PCC567

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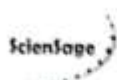
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**Abstract:** In the present study the anticancer activity of *Anabaena* sp. PCC550, *Anabaena* sp. PCC574, *Cylindrospermum* sp. PCC518, *Cylindrospermum* sp. PCC567 methanol, ethanol and hexane extracts were tested on HeLa cell line. The cytotoxicity test of *Anabaena* sp. PCC550, *Anabaena* sp. PCC574, *Cylindrospermum* sp. PCC518, *Cylindrospermum* sp. PCC567 methanol, ethanol and hexane extracts were carried out by MTT assay at 25, 50, 100, 200 and 400 µg/mL concentration. The test compounds from methanol extract and hexane extract i.e. A1M, A2M, C1M, C2M, A1H and A2H showed significant cytotoxicity with IC<sub>50</sub> values at 32.28 µg/ml, 51.3 µg/ml, 66.14 µg/ml, 36.08 µg/ml, 76.44 µg/ml and 96.6 µg/ml respectively. Other compounds from Hexane and Ethanol extract shows moderate toxicity with higher IC<sub>50</sub> values.

**Key words:** A1M- Methanol extract of *Anabaena* sp. PCC550, A2M- Methanol extract of *Anabaena* sp. PCC574, C1M- Methanol extract of *Cylindrospermum* sp. PCC518, C2M- Methanol extract of *Cylindrospermum* sp. PCC567, A1H- Hexane extract of *Anabaena* sp. PCC550, A2H- Hexane extract of *Anabaena* sp. PCC574, HeLa- Human cervix cancer cell line, Anticancer activity.

#### 1. INTRODUCTION

Cancer is a massive cost on society in both economically developed and emerging nations. Cancer is becoming more common as the population grows and ages, as well as the rising incidence of known risk factors like smoking, obesity, physical inactivity, and changing reproductive patterns linked to urbanisation and economic development [1]. In 2012, there were around 14 million new cancer cases and



## OPTIMIZATION OF CULTURE MEDIA FOR THE GROWTH OF ANABAENA PCC550, ANABAENA PCC 574, AND CYLINDROSPERMUM PCC518, CYLINDROSPERMUM PCC 567

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### ABSTRACT

In the present study, *Anabaena* PCC550, *Anabaena* PCC574 and *Cylindrospermum* PCC518, *Cylindrospermum* PCC 567 have been subjected to 7 different inorganic culture media. In order to identify the best growth medium i.e., optimized medium, the nutrient requirement of these two algae have been evaluated as prime requisite. The present investigation analyzed the growth of wet biomass of the four microalgae. In order to attain optimal growth of *Anabaena* and *Cylindrospermum* species, the 7 culture media employed in the current study were (i) BG11 medium (ii) Knops medium (iii) Cyanophycean agar medium (iv) Modified Bristol's medium (v) Pringsheims Medium (vi) Foggs Medium and (vii) Algal culture medium. Highest growth on 60<sup>th</sup> day was seen in *Cylindrospermum* PCC 518 (0.134mg/100ml), *Anabaena* PCC 574 (0.123mg/100ml), *Cylindrospermum* PCC 567 (0.098mg/100ml), *Anabaena* PCC 550 (0.094mg/100ml) in Algal culture media which shows luxuriant growth when compared to BG11, Foggs Media, Modified Bristol's media, Knops media. While, Pringsheims medium did not show any growth of *Anabaena* PCC550, *Anabaena* PCC574 and *Cylindrospermum* PCC518, *Cylindrospermum* PCC 567.

**Keywords:** Culture Media, *Anabaena* PCC 550, *Anabaena* PCC574 and *Cylindrospermum* PCC518, *Cylindrospermum* PCC567.

### 1. INTRODUCTION

Cyanobacteria are ancient photosynthetic prokaryotes that are the progenitors of the higher plant chloroplast. They inhabit virtually any environment that contains water and can grow under diverse conditions [1]. These organisms are the originators of photosynthesis and are responsible for generating the planet's original oxygen supply [2, 3]. The order Nostocales includes filamentous cyanobacteria that are capable of cell differentiation in heterocysts, akinetes or reproductive trichomes (hormogonia).

Cyanobacteria (blue-green algae) are a group of photosynthetic prokaryotes, with an oxygenic photosynthesis like plants [4] and a cellular organization similar to that of gram-negative bacteria (Stanier, 1988). Cyanobacteria are a group photosynthetic and nitrogen fixing organisms. They evolved during protozoic era and consisting of nearly 2000 species. They are cosmopolitan in distribution, found in aquatic, terrestrial habitat and even in extreme and unfavorable places like glaciers, desert and hot springs. Some members show symbiotic association with, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms. They are morpho-

logically and physiologically diverse organisms, showed wide range of organization from unicellular forms, colonial forms true branched filamentous forms [5]. Cyanobacteria are found in fresh and marine waters. They produce a diversity of secondary metabolites having potential activity as antimicrobials, antivirals, and as other pharmacologically active compounds [6]. Marine algae are one of the largest producers of biomass in the marine environments. They produce a wide variety of chemically active metabolites in their surroundings, potentially as an aid to protect themselves against the other settling organisms. These active metabolites also known as biogenic compounds, such as halogenated compounds, alcohols, aldehydes, terpenoids, are produced by several species of marine macro and microalgae and have antibacterial, antifungal and antifouling properties which are effective in the prevention of biofouling and have therapeutics uses [7, 8].

The diversity of their specialised metabolites is due to the ability of cyanobacteria to combine genes encoding nonribosomal peptide synthetases (NRPS) and polyketide synthases (PKSs) through enzymatic reactions such as methylations, oxidations, reductions and other chemical

**ANALYSIS OF JAWAHAR WATER RESERVOIR, NIPANI TALUK, BELGAUM DISTRICT, KARNATAKA.**

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**ABSTRACT**

Present investigation was undertaken to assess water quality of Jawahar Water Reservoir of Nipani Taluk, Belgaum District (KA) India. The physical and chemical parameters such as Temperature (17<sup>o</sup> C-30<sup>o</sup> C) pH (7.5-8.6) Total Dissolved Solids (151-250.77 mg/l) Dissolved Oxygen (3.5-7.2 mg/l) Carbon dioxide (1.1-8.6 mg/l) Hardness (105-180 mg/l) Alkalinity (86.8-210 mg/l) Transparency (38-64) Calcium (24.63-38 mg/l) Magnesium (10.12-18.6 mg/l) Sodium (9.8-15.2 mg/l) Potassium (1.1-9.2 mg/l) Phosphate (0.12-0.58 mg/l) and Nitrate (0.2-0.75mg/l) were studied for the period of one year from January to December, 2021. Those were interpreted with the help of Correlation matrix and Principal component analysis (PCA).

**Key Words:** Jawahar Reservoir, Physicochemical Parameters, PCA, Nipani

**Introduction**

Nipani City is located in Belgaum district of Karnataka state, the Municipal Corporation of which provides drinking water from Jawahar reservoir (Khude, 2019). The quality of the water from this reservoir has been studied and discussed in this paper.

**Material and Methods**

Jawahar Water Reservoir is a perennial tank situated in Nipani city. Rain is the primary source and uplifted water from the river Vedganga is secondary source to the reservoir. Nipani City Municipal Corporation provides water for domestic consumption as well as Agricultural purposes from this reservoir. Monthly, water samples were collected from this place during January to December, 2021. Field analysis involved measurement of Temperature (<sup>o</sup>C), pH and Transparency. Remaining water quality parameters were determined following APHA (1995). Correlation among various parameters was determined and Principal Component Analysis (PCA) was done by using Minitab

**Software.**

**Results and Discussion**

Seasonal fluctuations in temperature were observed. In summer, the temperature ranged between 27-30<sup>o</sup>C, in monsoon 21-24<sup>o</sup>C and in winter 17-20<sup>o</sup> C. The fluctuations in pH were conservative and found mostly Alkaline throughout the study period as recorded in Table 1. The findings were in agreement with those observed by Saksena and Adoni, (1973) and Rajan and Singh, (2018). Total Dissolved Solids fluctuated within the range of 151-250.77 mg/l; the values were, however, below WHO and BIS limits Ravikumar *et al.*, (2013); Sahu and Sikdar (2008) Table 1. In winter, Dissolved Oxygen was observed to be 4.2-7.2 mg/l showing strong positive correlation with Calcium (28.18-40.00 mg/l), Magnesium (10.2-18.6 mg/l), Potassium (1.5-9.2 mg/l), Phosphate (0.28-0.58 mg/l) and negative correlation with Alkalinity as shown in Table 2. Carbon dioxide ranged from 1.1-8.6 mg/l and it showed negative correlation with alkalinity (Fig 1), as was also found by Thakur and Bias (1987). Variation in Hardness was found





## Ethnobotanical Information for the Treatment of Snake Bite and Scorpion Stings by Traditional Health Practitioners in Bagalkot District, Karnataka, India

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### Abstract

Ethnobotanical survey was undertaken to collect information on medicinal plants used in the treatment of snake bites and scorpion stings in Bagalkot District, Karnataka. The field survey was conducted from January 2020 - October 2022. The indigenous knowledge of local traditional healers about the native plant species used for medicinal purposes was collected using a questionnaire through personal interviews during field visits. In the present investigation, 14 plant species, belonging to 14 genera and 12 families used by the different traditional practitioners against snake bite and scorpion stings were documented. Among the collected species 8 were used for snake bites and 4 for scorpion stings. *Ruellia patula* Jacq. and *Strychnos nux-vomica* L. was used for both treatments. The most popular preparations are in powder, juice, and paste. They used different plant parts viz., leaf (5), root (3), seed (2), whole plant (2), bark (1), and stems (1) are utilized in the medicine preparation by the local practitioners. The medicinal practitioners are above the age of 50; which indicates a lack of interest in the young generations. At present both the government and non-government organizations are involved in the documentation of traditional medicinal knowledge before it becomes vanished it will be helpful for the protection of our traditional knowledge and its documentation is for supporting IPR.

**Keywords:** Medicinal plants, Snake bite, Scorpion sting, Bagalkot district.

### Introduction

Over the course of human history, people have used medicinal herbs. This knowledge has been passed down orally from generation to generation. In the last 20 years, there has been a significant increase in scientific attention to the use of medicinal plants to prevent the effects of snake bites (Santosh and Shivaji, 2004). A considerable health risk, snake bites cause remarkable discomfort and a high fatality rate in victims. More than 200,000 cases have been reported in India alone, and it is believed that 35,000 to 50,000 people are passing away each year (Bawaskar, 2004). This happens because people living in rural areas when get bitten by a snake or sting by a scorpion, trust the local nativaidyas (Traditional healers or medicine men). The villagers are

taken treatment and get well soon.

The objective of the current study was to document the diversity of ethnomedicinal plant species utilized by local traditional healers in the Bagalkot district as well as local methods for the preservation and sustainable use of the area's biological resources.

### Materials and Method

**Study Area:** Bagalkot district, is an administrative district in the Indian state of Karnataka. The district is located in the northern part of Karnataka and is surrounded by the districts-Belgaum, Gadag, Koppal, Raichur, and Bijapur. Geographically, it is located in the coordinates 16.18°N and 75.7°E. It is situated along the banks of the River

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## SPECIES

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## Does *Habenaria hollandiana* Santapau (Orchidaceae) Exist?

Shreyas B<sup>1\*</sup>, Kottresha K<sup>2</sup>

## ABSTRACT

*Habenaria hollandiana* Santapau is treated to conspecific to *Pecteilis furcifera* Lindl. Detailed description, habitat, distribution, photographs are provided and easy identification of two species of *Habenaria*.

**Keywords:** Hooked spur, Straight spur, Karnataka, Terrestrial orchid, Western Ghats.

## 1. INTRODUCTION

There are around 1256 species under 155 genera, of these 307 are endemic to India (Singh et al., 2019). The genus *Habenaria* Willdenow is the largest terrestrial in the World comprising of 800 species. In India 58 species and 3 varieties has been recorded (Choudhury et al., 2011). Dangat, (2015) has recorded 40 species of *Habenaria* from Western Ghats out of which 24 species of *Habenaria* are endemic. Karnataka Biodiversity Board has recorded 197 wild orchids out of which 27 *Habenaria* species has been mentioned in the year 2019.

During our field survey in North Karnataka, collected two species of *Habenaria* which are totally different with habit, flower structure, size, labellum, etc. After literature survey there has been misconception with three species of *Habenaria* in Western Ghats, *Habenaria hollandiana* Santapau and *Habenaria furcifera* Lindl. Have similar characters but exact photographs and type specimen of *H. hollandiana* Santapau is not clear up to identification level. And some of them confused it with *Habenaria ovalifolia* Wight with flower colour. *Habenaria furcifera* and *Habenaria ovalifolia* both are different with their own characters and provided a key for identification with photographs in the present work. But after past studies on *H. hollandiana* Santapau its morphological characters are going to merge with *H. furcifera* Lindl.

Mr. Law from Belgaum collected a species and sent to Robert-Wight in the year 1851 and named it as *Habenaria affinis* Wight in *Icones Plantarum Indiae Orientalis* for the first time. Later this species is reported by Father Santapau from Parandhar fort, in the year 1944-1956 as *Habenaria hollandiana* Santapau. Then it has been named as *Habenaria indica* Kumar and Manjal, (1986) due to homonym issue, in *Taxon* journal Volume 35 issue 4 pages 719 in the year 1986. Specimen has been examined at Peninsular, central and eastern India, Tamil Nadu: Coimbatore District, Anamalai Hills, Fischer s.n. (MH Acc. No. 50863). Andhra Pradesh: Kurnool District, way to Digurametta, Nallamalais. J. L. Ellis 22195 (MH).



## RESEARCH ARTICLE

## Rediscovery and taxonomic note on *Oberonia bellii* Blatt. & McCann (Orchidaceae) in Karnataka after nine decades

Shreyas B., K. Kotresha

### Abstract

*Oberonia* Lindl. is one of the smallest flowering genera which include miniatures endemic to the Western Ghats. During field survey collected *Oberonia* species and conserved ex-situ. This species was examined after flowering and got to know that this is *Oberonia bellii* Blatt. & McCann which was rediscovered after 91 years of T. R. Bell's manuscript with the characters like habit size, inflorescence length and modification, flower size and leaf arrangements.

**Keywords:** Epiphytic orchid, faintly scented, Uttarkannada district, Verticillaster inflorescence.

### Introduction

Orchidaceae is one of the diversity of all angiosperms. The genus *Oberonia* was first described by Lindley in 1830, who dedicated it to Oberon, the mythological king of fairies. While establishing the genus, *Oberonia* Lindl. is an old-world genus of mostly epiphytic herbs comprising about 300 species (Mabberley, 2017). Recognised 13 species of which four were from India (Lindley, 1963). Ansari & Balkrishnan recorded 41 species of *Oberonia* from India in the year 1990. There are around 1256 species under 155 genera, of these 307 are endemic to India. Out of these 63 *Oberonia* species are recorded (Singh S. K. et al., 2019). Flora of Karnataka analysis by B. D. Sharma et al., (1984), included *Oberonia bellii* Blatt. & McCann. In his survey. Flora of Karnataka monocotyledons records 16 *Oberonia* species including *Oberonia bellii* and *oberonia*

*verticillata* is recorded (Laxminarasimhan et al., 2019). Karnataka records 17 *Oberonia* species in the year 2019 (Sanjappa M. & A. N. Sringseshwara, 2019).

*Oberonia bellii* Blatt. & McCann, J. Bombay Nat. Hist. Soc. 35: 256, 1931; B.D. Sharma et al., Fl. Karnataka Anal.: 274, 1984; Laxminarasimhan et al., Fl. Karnataka Anal. 3: 72, 2019; Sringseshwara & Sanjappa, Fl. Karnataka Analysis, 2: 547, 2019.

Pendulous epiphytes, 15-18 cm in length. Leaves thick, coriaceous, narrow, ensiform, falcate or sub-falcate, acuminate, broad at the base, 5-8x1 cm; bent outside at the apex. Inflorescence a raceme, many-flowered, pendent, 15-18 cm long, thin, 1-2 mm thick, 7-8 ridges, flowers spirally arranged when young and in verticillaster when old. Bract 1 mm long, greenish-yellow, smaller than bud, lanceolate, acute, fimbriate. Flower bud globose, orange. Flower 1 x 1 mm, highly scented, yellow-orange, arranged rounded on ridges, pedicellate. Dorsal sepal ovate, acute. The lateral sepal is acute, broader at the base and larger than the dorsal sepal. Petal narrower, ovate-oblong, bent backwards. Labellum 1 mm long, 3-lobed, lateral lobes rounded; midlobe with 2-3 ridges, front lobe divided into two lobes; each lobe with lower margin dentate, gland-dotted, nerved. Column orange, with a sack for pollinia, two ends of column are hooked. Anther cap with 2 sacks, white. Pollinia 1 pair, pear-shaped, light yellow Figure 1-3.

**Habit:** Pendulous epiphytes.

**Habitat:** Epiphytic on *Gardenia gummifera* L. f. at 1000 meters altitude in association with *Bulbophyllum sterile* (Lam.) Suresh, *Dendrobium macrostachyum* Lindl. and *Pholidota imbricata* Hook.

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## Study on leaf venation of four *Nervilia* (Orchidaceae) from the state of Karnataka, India

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### Abstract

In this article we discuss the leaf veining of four *Nervilia* found in Karnataka, India: *Nervilia concolor*, *Nervilia infundibulifolia*, *Nervilia plicata* and *Nervilia simplex*. The campylodrome or brochidodrome primary veins of species of this genus are accompanied by many diverse secondary, and tertiary veins. They are discussed here and accompanied by illustrations. A determination key, based on leaf venation, is also proposed.

### Résumé

Dans cet article nous discutons de la nervation des feuilles de quatre *Nervilia* trouvés au Karnataka, en Inde : *Nervilia concolor*, *Nervilia infundulifolia*, *Nervilia plicata* et *Nervilia simplex*. Les nervures primaires campylodromes ou brochidodromes des espèces de ce genre sont accompagnées de nombreuses nervations secondaires et tertiaires diverses. Elles sont ici discutées et accompagnés d'illustrations. Une clé de détermination, basée sur la nervation foliaire, est également proposée.

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## WILD MEDICINAL PLANTS OF RANEBENNUR BLACKBUCK SANCTUARY, HAVERI DISTRICT, KARNATAKA, INDIA

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### Introduction

India is a mega biodiversity country that provides rich and varied habitats holding the life of a significant diversity of angiosperms of about 20,000 species, of which 7,500 are medicinally important species (ENVIS, 2022). Over 90% of medicinal plants used in the country are from the wild and only a few are obtained from cultivated sources (Bidayan & Balachandran, 2011). The WHO estimated that about 80% of the population in the developing nations still rely on these herbal medicines as the first defense in healthcare for treatment of diseases due to easy availability, economical importance and less side effects, compared to allopathic system of medicines (Ghatapanadi *et al.*, 2011). In the recent decades, due to their local reliability, collection and documentation of Associated Traditional Knowledge (ATK) has gained prominent importance in drug development from novel or lesser known medicinal plants (Tripathi, 2000; Ragupathy *et al.*, 2008). ATK about the medicinal plants is in decline due to lack of interest by younger generation. Therefore, before such information is lost, proper documentation of traditional knowledge is necessary for the conservation and sustainable utilization of biological wealth (Muthu *et al.*, 2006).

The survey and documentation of medicinal plants of sanctuaries in Karnataka state have been conducted in (Bhadra wildlife Sanctuary: Parinitha *et al.*, 2004; Muthathi wildlife Sanctuary: Suresha *et al.*, 2018; Yadahalli Chinakara wildlife sanctuary: Koti & Kotresha, 2021). The medicinal flora and documentation of ATK in Haveri district of the state (Kotresha, 2002; Kanti & Parashurama, 2014; Shiddamallayya *et al.*, 2015; Vastrad & Lalitha, 2015) reveals that there was no documentation of ATK from Ranebennur blackbuck sanctuary, and hence it was attempted in the present study.

### Study area

Ranebennur blackbuck sanctuary is located in Ranebennur taluka of Haveri district of Karnataka (Fig. 1A). It was established for the protection of Black bucks (*Antelope cervicapra*) and Great Indian Bustard (*Ardeotis nigriceps*) along with other native flora and fauna. The sanctuary stretches over 119 sq km and located in between 14°-34'-00" to 14°-46'-00" N and 75°-30'-00" to 75°-47'-21" E. The sanctuary was declared in the year 1974 (Singh, 2011). The vegetation of the sanctuary is a mixed scrub, dry deciduous forest and savannah. The elevation of the study area ranges from 531 to 762 m AMSL, with an average rainfall 620 mm (Mamatha & Hosetti, 2018).

### Data Collection

The medicinal plant survey study was conducted from September 2020 to April 2022 confined to the limits of the Ranebennur blackbuck sanctuary. It includes ten villages of Ranebennur taluka. Traditional knowledge was collected with help of semi-structured questionnaire and discussions (Martin, 2008) from the traditional medicinal practitioners/*Natuvidyus/Hakims* and with the elder community. Most heard and familial descendent traditional medicine practitioners (TMP) were selected and interviewed. Field visits were conducted with TMPs and medicinal plant specimens were collected. The data gathered/noted was about the medicinal plants and local names, growth form, parts used, ailment treated, and dosage and mode of administration. Identification of plant was done with the aid of standard regional floras (Gamble & Fischer, 1915-1936; Saldanha, 1984, 1996). The plant specimens collected were pressed and processed following the dry methods (Jain & Rao, 1977). Botanical names were updated as per IPNI. Voucher specimens were deposited in the Herbarium of Botany Department, Karnatak Science College, Dharwad (HKCD).





SCAN ME

*Research Paper*

**RIPARIAN VEGETATION OF TUNGABHADRA RIVER IN KOPPAL DISTRICT, KARNATAKA: NEED FOR CONSERVATION**

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**Abstract**

The Tungabhadra river basin of Kalyana Karnataka has a unique floristic wealth due to its dry deciduous and scrub vegetation composition. The aim of the study was to document the flora in the riparian zone of Tungabhadra river in Koppal district. A random quadrat survey was laid down in thirteen study stations with co-ordinates, along the riverine stretch. All the stations about 156 plants species, belonging to 127 genera and 54 families were recorded. The dominant family is Fabaceae with 21 species (13.46%), followed by Euphorbiaceae with 10 species (6.41%) and Asteraceae 8 species (5.12%). They are 77 herbaceous species (49.3%), followed by 35 shrubs (22.43%), 28 trees (17.94%), 17 climbers (10.87%). As per IUCN categories, 50 (32.05%) are least concerned, 3 are vulnerable (1.92%) and 1 is near threaten. The riparian ecosystem structure has been negatively impacted by an increase in anthropogenic activity within the river basin and neighboring landscape. Invasive species such as *Pontederia crassipes* Mart., *Lantana camera* L. have also dominated the native flora, hence there is an urge for conservation of the native species.

Key words: Floristic, anthropogenic, NTFP, IUCN status, conservation.

**INTRODUCTION**

The riparian vegetation, mainly described as the vegetation growing along the banks of rivers, streams, etc., is considered to be unique and important because of its interface between the land and water. The riparian zone is believed to comprise of dynamic environment owing to the strong energy regimes, substantial habitat heterogeneity, diverse ecological processes and multidimensional gradients [21].

The riparian vegetation plays numerous ecological functions such as providing shelter and food for terrestrial and aquatic animals, obstructing and isolating various

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***Chiloschista confusa* M. J. Mathew, J. Mathew, P.M. Salim & Szlach. (Orchidaceae): A New Addition to Karnataka, India**

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**Abstract**

Orchidaceae is one of the diverse groups in monocots with advanced characters adapted to various habitats. *Chiloschista* Species was collected during our field study in Belgaum district Karnataka. The species was morphologically identified with *Chiloschista confusa* which is newly discovered epiphytic orchid in 2021, and is new addition to Karnataka State.

**Keywords:** Cream yellow, Epiphytic orchid, Flat viscidium, Pubescent, Stem less, Without dots.

**Introduction**

Orchidaceae is most diversified group with around 26,000 species in the world related to 762 genera (Mabberley, 2017). In India there are around 1256 species of 156 genera; in that 307 species are endemic to India, it includes 5 species of *Chiloschista* L. (Jalal, et al., 2019). The Genus *Chiloschista* Lindl. comprises 20 known species distributed in Indian sub-continent and Himalaya Eastward to China and Taiwan, southeastwards through Thailand to Indonesia, Australia, New Guinea, Fiji and Micronesia; Highest species diversity of the genus is observed so far from Indochinese peninsula with 9 species in Thailand, 3 species from Vietnam and 2 in Laos (Averyanov, et al., 2018). The species was included in the genus was *Epidendrum usneoides* D. Don. It was described and published by David Don in *Prodromus Florae Nepalenses* (1825), a publication based primary on Nathaniel Wallich's and others plant collections from Nepal. John Lindley transferred this species to new Genus called *Chiloschista* in *Edwards Botanical Register* (Lindley, 1832). Karnataka Biodiversity Board has recorded 197 species of wild orchids in that *Chiloschista lunifera* (Rehb.f.) J. J. Sm. and *Chiloschista glandulosa* Blatt. & McCann. (Sringshwara & Sanjappa, 2019). Flora of Karnataka Monocotyledons includes two species of *Chiloschista* that is *Chiloschista fasciata* (F. Muell.) Seidenf. &

Ormerod, and *Chiloschista glandulosa* Blatt & McCann. (Laxminarasimhan, et al., 2019).

During our field survey in Western Ghats, Belgaum region specimen was collected which is similar to *Chiloschista glandulosa* but absence of glands and brown dots on petals, so after examining and concluding its morphological characters it turned to be *Chiloschista confusa* M. J. Mathew, J. Mathew, P.M. Salim & Szlach which was newly discovered in Kerala (Mathew, 2021). The above article tells about new record to Karnataka state and few confusions regarding *Chiloschista* species.

***Chiloschista confusa* Mathew, M. J. Mathew, J., Salim, P. M., & Szlachetko, D. L. (2021, September). *Chiloschista confusa* (Orchidaceae), a new species from the southern Western Ghats, Kerala, India. In *Annales Botanici Fennici* (Vol. 58, No. 4-6, pp. 347-353). Finnish Zoological and Botanical Publishing Board.**

Epiphytic small stemless herb up to 8 × 7 cm across. Photosynthetic roots numerous adhere to the tree, 0.1–0.2 mm thick. Stem absent. Leaves 2–3, coriaceous like, entire apex acute, 1.5 × 0.8 mm across. Inflorescence 2, unbranched, arise in between the roots, greenish with blackish dots, less glabrous, 2–8 cm long, 2–3 or 5–8 flowers. Bract 3–4 nerved,

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# Ethnomedicinal Plants Used in the Treatment of Gynecological Disorders by the Traditional Health Practitioner in Bagalkot District, Karnataka, India

## Research Article

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### Abstract

Gynecological disorder is one of the most severe conditions under reproductive health. So, we investigate and collect information from traditional practitioners on the use of medicinal plants for treatment of gynecological disorder in Bagalkot district, Karnataka. The field study was carried out during January 2021 – October 2022. The indigenous knowledge of local traditional healers about the plant species used for medicinal purposes was collected using a questionnaire by personal interviews during field visits. In the present investigation, 15 plant species, belonging to 15 genera and 12 families used by the local healers against gynecological problems of the women are documented. Leaves (5) were the most frequently used plant parts and most of the medicines were prepared in the form of juice and administered orally. On the basis of fieldwork, it is revealed that the traditional health practitioners use the plant medicine commonly for white discharge (leucorrhoea) and irregularly periods (Metrorrhagia) in women's. The scientific name, family, local name, habit, part used and mode of their administrations are provided in the table.

**Keywords:** Medicinal plants, Gynecological disorder, Traditional health practitioner, Bagalkot district

### Introduction

Gynecology is a branch of medicine that deals with the condition of the female reproductive system. An emerging specialty called ethno-gynecology uses local medicinal plants to treat gynecological conditions such as abortion, menstruation disorders, leucorrhoea, infertility, and delivery issues. Menstrual disorders, despite playing a significant role in women's lives, are sometimes overlooked as serious health problems that can interfere with women's daily activities. The restrictions on analgesics and sanitary facilities lead Indian women to prefer household spice cabinets or traditional medications [1]. This study concentrated on the traditional remedies that indigenous women used to manage menstrual discomfort. The traditional health practitioners in Karnataka's Bagalkot District are highly known for

having a thorough understanding of medicinal plants. This paper attempts to compile useful information about plants used traditionally by local healers to treat gynecological diseases.

### Materials and Method

**Study Area:** Bagalkote is a city situated in the northern part of the Indian state of Karnataka. Geographically, it is located at the coordinates 16.18°N 75.7°E, and situated along the banks of the River Ghataprabha, it lies at an average elevation of 533 meters above sea level. It is the head-quarters of Bagalkote district. The district consists of nine C.D. blocks namely Badami, Bagalkote, Bilagi, Humnagund, Jamakhandi, Mudhol, Bkal, Guledgudd, and Rabbakavi Banahatti. (Figure 1).





## Vascular plants of Bankapura Peacock Conservation Reserve, Karnataka, India

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### ARTICLE INFO

#### Keywords

Angiosperms, Checklist, Flora, Medicinal, Peacock Conservation Reserve

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### ABSTRACT

We made an inventory of vascular plants of Bankapura Peacock Conservation Reserve, located in the Haveri district of Karnataka. The study area covers ca 140 acres of land known for the high density of Indian Peafowl. Altogether we recorded 141 plant species belonging to 118 genera and 43 families. These include 116 dicotyledons and 23 monocotyledons, 1 pteridophyte and 1 gymnosperm. Fabaceae is the most dominant family as it contributes about 17% of the total flora.

### INTRODUCTION

Biodiversity refers to variety and variability within and among living organisms, their associations and habitat-oriented ecological complexes. India is one of the 12 mega-biodiverse countries of the world. It has varied biogeography and consists of about 18,500 plant species, which is almost 11% of total species in the world (ENVIS, 2022; Singh et al., 2015). The forts are constructed at peculiar locations due to their high altitude and topography, they serve as reservoirs of plant gene pools. Forts vegetation isolated them from rest of surrounding area. Due to different geographical locations, there is possibility of different vegetation patterns in the forts (Mungikar, 2011). Previously in India, fort flora were documented from different parts, namely, Udayagiri Fort (Sukumaran & Parthiban, 2014); Torna Fort (Nandikar, Giranje & Jadhav, 2018); Salher Fort (Jadhav, 2020). In Karnataka, Raichur Fort (Shrishail et al., 2020), Gulbarga Fort (Shrishail & Prashathkumar, 2019) and Ballari Fort (Siddeshwari, 2021).

Daroji Sloth Bear Sanctuary has suitable habitat for protection of Indian sloth bear (*Melursus ursinus*), due to rock-strewn hillocks and vast stretches it spreads over an area of 5,587 hectares, study revealed a total of 98 species belonging to 85 genera and 37 families (Harisha & Hosetti, 2013). Barnadi Wildlife Sanctuary for the protection of the hispid hare (*Caprolagus hispidus* Hoffmann and Smith) and Pigmy hog (*Porcula salvania* Hodgson), revealed the occurrence of 454 species of angiosperms (Deori & Talukdar, 2015). Great Indian Bustard Wildlife Sanctuary to protect the critically endangered and endemic bird, the Great Indian Bustard. A total of 436 plants belonging 67 families were recorded (Janakiraman & Jalal, 2015).

Bankapura Peacock Conservation Reserve is located on the premises of Bankapura Fort, Ruins of fort houses, Shri Nagreshwara (66 pillared) temple and Khillari Cattle Breeding Centre (Hiriyanna, 2015). The population of Peafowl is estimated to be ca 1000. The mounds and channels have provided a perfect home for these birds. The ditch is about 30 km long, 10-15 meters wide and covered with *Acacia*, *Azadirachta* and *Ficus* fruits are the major food for peafowl. Understanding the presence of peacocks (*Pavo cristatus*), Government of Karnataka declared the fort as Bankapur Peacock Conservation Reserve with Notification No. FEE.237 FWL 2005 dated 09.06.2006 by subsection (1) of Section 36(A) under Wildlife Protection Act, 1972 (MPBPCR, 2023). Plant diversity of the Conservation Reserve has not been studied so far. This study was undertaken to know the flora of Bankapura Peacock Conservation Reserve, which may



## Orchids of Yellapur taluk, Uttara Kannada district, Karnataka

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### ARTICLE INFO

#### Keywords

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### ABSTRACT

The paper enumerates 59 species of orchids collected from the Yellapur taluk, Uttara Kannada district of Karnataka state.

### INTRODUCTION

Orchidaceae is a specialized family of monocots differing from other families in having gynostemium and labellum. It is represented by about 26000 species under 762 genera in the world (Mabberley, 2017). The orchids have flowers of ornamental value and are sought after for hybridization and setting as cut flowers. In India, the family is represented by about 1256 species under 155 genera (Singh et al., 2019), while Western Ghats support 307 species of orchids (Nayar, Beegam & Sibi, 2014). Cooke (1906) recorded 77 species of orchids in his Flora of Presidency of Bombay covering states of Gujarat, Maharashtra, Goa and Karnataka. From Karnataka, he included Uttara Kannada, Belagavi, and Dharwad district and recorded 49 species of orchids, out of which 33 are from Uttara Kannada district alone. Rao and Sridhar (2007) reported 176 species from Karnataka state. Anand Rao recorded 95 Wild orchids from Uttara Kannada district, mainly from Dandeli and Sirsi taluk areas. Sachin A. Puneekar and P. Lakshminarasimhan recorded 30 genera belonging to 54 species of wild orchids from Anshi

National Park in the year 2011. In Karnataka the family has about 197 species (Sringshwara & Sanjappa, 2019). G.R. Rao in his study "Wild orchids of Sharavathi River Basin and parts of Uttara Kannada" has recorded 36 wild orchids from localities in Bhatkal, Honnavar, Joida and Siddapur taluks.

### MATERIALS AND METHODS

Yellapur taluk is located in the Uttara Kannada district of Karnataka state. Being located in the central part of Western Ghats, it has evergreen and semi-evergreen forests. It receives the highest (3554.6 mm annual) rainfall during the monsoon season. It has an elevation ranging between 150 m to 600 m and is spread over 1313 km<sup>2</sup>. It includes three semi-evergreen forests, i.e., Angoda to the north-west, Telgeri to the north-east, and Sahasrahalli to the south-east. During field surveys between 2019 to 2022, 59 wild orchid species were collected, photographed and identified with the help of flora (Hooker, 1875; Cooke, 1906; Gamble, 1928; Singh, 1988; Rao, 1998; Rao & Sridhar, 2007; Jalal, 2018). The specimens were pressed and dried as per the standard herbarium preparation methods (Rao & Jain, 1977) and deposited in the Herbarium of Karnatak Science College Dharwad (HKSCD).

### RESULTS

The orchids collected from Yellapur Taluk have been enumerated in Table 1.

The specimens were collected by Shreyas Betageri and K. Kotresha. Collector number and date with localities are mentioned.





# *Limnocharis* Bonpl. (Alismataceae): A new generic record to Karnataka state, India

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## लिम्नोकेरिस बोन्यल (एलिस्मेटेसी): भारत के कर्नाटक राज्य के लिए एक नवीन वंशीय अभिलेख

निगाराज एस. माकनूर एवं के. कोटेशा

### सारांश

लिम्नोकेरिस बोन्यल (एलिस्मेटेसी) कुल के एक अंगुष्ठा (एल) वृक्षों को छोड़ते जिसे वे स्थित तुंगभद्रा नदी के तटवर्ती वन्यजीवों में से शिरोरुप, बाण्ड के अरण्य या कर्नाटक राज्य के लिए एक नए अभिलेख के रूप में प्रस्तुत किया गया है। इस प्रजाति को सामान्यतः 'जल गोबी' या 'जले बर्हे' के नाम से जाना जाता है। विवरण, रंगमंडित एक प्रजाति के विवरण प्लेट और वितरण के अलावा एक प्रस्तुत की गई है।

### ABSTRACT

The genus *Limnocharis* Bonpl. (Alismataceae) is reported here as a new record for Karnataka state based on a collection of *L. flava* (L.) Buchenau, a species commonly known as water cabbage or yellow burrhead, from the riparian vegetation of Tungabhadra river in Haveri district. Description, photo plate and details on the distribution of the species are provided here.

**Keywords:** Haveri, Karnataka, *Limnocharis*, Ranebennur, Riparian and Tungabhadra

### INTRODUCTION

The cosmopolitan monocot family Alismataceae Vent., also known as water-plantain family, by comprises c. 100 species in 16 genera (Mabberley, 2017). In India, this family is represented by c. 20 taxa in seven genera (Mastakur, 2020). In Karnataka, the family has five species belong to four genera, namely *Caldesia* Patf., *Limnophyton* Miq., *Sagittaria* L. and *Wismaria* Michx. (Sanjappa & Sringsawara, 2019). The genus *Limnocharis* Bonpl. with native range of distribution from Mexico to tropical America comprises two species, namely *L. flava* (L.) and *L. laforetii* Duchass. ex Griseb. (Mabberley, 2017). The occurrence of the genus *Limnocharis* in India was first reported from Kerala (Kammathy & Subramanyam, 1967) and later it was recorded from the state of Tripura (Bhowmik & al., 2009). The present collection of *L. flava* (L.) Buchenau from the riparian vegetation of river Tungabhadra in Somalapura and Makanur villages in Ranebennur taluk of Haveri district forms a new generic record to the flora of Karnataka

state. Description, distribution and a colour photo plate of the species are provided here.

### TAXONOMIC TREATMENT

*Limnocharis flava* (L.) Buchenau, Index Crit. Batum. Alism. Juncag.: 13. 1868; Kammathy & Subr., J. Bombay Nat. Hist. Soc. 64: 389. 1967; S. Bhowmik & al., Phytone 3(1): 96. 2009. *Alisma flavum* L., Sp. Pl.: 343. 1753. *Dumacassium flavum* (L.) Mill., Gard. Dict., ed. 8. n. 2. 1768; Mastakur in A.A. Mao & S.S. Dash, Fl. Pl. India Annot. Checkl. Monocot. 3: 178. 2020. *Limnocharis emarginata* Bonpl. in Humb. & Bonpl., Pl. Aequinoct. 1: 116. 1808. (Fig. 1)

Aquatic or marshy erect herb, 30–50 cm high with fibrous roots. Leaves simple, 6–10 × 4–8, ovate-obovate base rounded, apex acute, with 7–9 prominent veins; petioles trigonous, 10–25 cm long. Scapes trigonous, upto 30 cm long. Inflorescence terminal, umbels, 4–10-flowered; bracts broadly elliptic, c. 1.5 × 1 cm, green; pedicels

## *Zeuxine reflexa* (Orchidaceae-Goodyerinae), a new addition to Peninsular India

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**Abstract:** *Zeuxine* Lindl. (Orchidaceae: Cranichdeae: Goodyerinae) is a terrestrial orchid genus comprising about 79 species, of which 19 species are reported from India. A recent floristic survey in and around Anshi National Park in Uttara Kannada district in Karnataka resulted the collection of *Zeuxine reflexa* King & Pantl. Since this species was not recorded from Peninsular India previously, it forms a new record. A detailed description, photographs, drawing and a key for the identification of species occurring in Karnataka are provided for its easy identification.

**Keywords:** Jewel orchid, Terrestrial orchid, Threatened species, Uttara Kannada district.

### Introduction

Orchidaceae are the most diverse of all angiosperm families globally with about 26,000 species in 762 genera (Mabberley, 2017). There are 1,256 orchid species in 155 genera in India, with 307 species endemic (Singh *et al.*, 2019). Nineteen species of *Zeuxine* Lindl. have been reported from India (Bhattacharjee & Chowdhery, 2018). Ananda Rao and Sridhar (2007) reported 176 species of orchids in Karnataka state while the Karnataka Biodiversity Board (2019) documented 197 species, including three *Zeuxine* species, i.e., *Z. gracilis* (Breda) Blume, *Z. longilabris* (Lindl.) Trimen and *Z. matematica* (L.) Schltr. During a scientific survey in Anshi National Park (N 14°54'-15°07', E 74°15'-74°30') in Uttara Kannada district in Karnataka state, a fourth species of *Zeuxine* was collected. Based on a scrutiny of the relevant literature (Punekar &

Lakshminarasimhan, 2011; Kumar *et al.*, 2013; Bhattacharjee & Chowdhery, 2018), it is identified as *Z. reflexa* King & Pantl., a species previously reported from Assam, West Bengal and Sikkim (Singh *et al.*, 2019) which forms a new record to Peninsular India.

### Taxonomic Treatment

*Zeuxine reflexa* King & Pantl., Ann. Roy. Bot. Gard. Calcutta 8: 291. 1898; P. Bruhl, Guide Orchids Sikkim 170. 1926; Bose *et al.*, Orchids India 470. 1999; N. Pearce & P. J. Cribb, Orchids Bhutan 114. 2002; S. Z. Lucksom, Orchids Sikkim N.E. Himalaya 119, t. 79. 2007; Xinqi *et al.*, Fl. China 25: 75. 2010; Bhattacharjee *et al.*, *Taxonomia* 56: 153. 2011; Singh *et al.*, Orchids of India 517. 2019. **Lelectotype:** INDIA, Sikkim, Munghoo, 3500 ft, April 1895, R. Pantling 361 (CAL [CAL0000000604], designated by Bhattacharjee *et al.*, 2011); **isolelectotype** [K000942793 digital image!] **Figs. 1 & 2**

Terrestrial herbs, 20–24 cm high. Stem rhizomatous, nodes with root hairs, greenish-brown, 4–5 × c. 0.4 cm across; stem erect, unbranched, sometimes decumbent at base, 4–7 cm long, pale green, glabrous with sheathing leaf bases. Leaves 3–5, spirally clustered around stem, 3–3.5 × 2 cm across, green with reticulations, senescence at flowering, base obtuse, narrowly ovate-lanceolate, apex acute. Flowers 10–14 in racemes, pubescent, 0.8–1.0 cm long with ovary, resupinate; scape pubescent, peduncle 18–20 cm long. Bracts hairy, brownish-

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SCAN ME

*Research Paper*

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India.

**Abstract**

A floristic survey was conducted in the year 2021 for the documentation of floristic diversity in Krishna Tunga Campus Yagera, Raichuru. In the present study the survey reveals about 295 plant species belonging to 233 genera and 70 families of angiosperms. Among them, dicotyledons are representing 59 families, 205 genera and 265 species, in that 35 polypetalae, 19 gamopetalae and 5 monochlamydae. Whereas, monocotyledons are represent with 11 families, 24 genera and 30 species. An analysis of the habit composition of plant species of the study area, herbs are predominant with 186 species followed by tree with 54 species, shrubs with 35 species, climbers with 18 species, each Liana and twiner with 1 species respectively. As per the IUCN conservation status showed that, they are 233 species are Not Evaluated, 2 Valnerable and Near Threatened represent 1 species, 58 are Least Concern, 1 species Data Deficient. In Bryophyte *Riccia* species only recorded. Fabaceae family is the top most, comprises 28 genera and 45 species, followed by Asteraceae (24 genera 25 species), Euphorbiaceae (8 genera and 21 species), Apocynaceae (11 genera and 14 species) and Amaranthaceae (9 genera and 13 species).

Key words: Floristic diversity, Krishna Tunga Campus, Raichuru, Yaragera.

**INTRODUCTION**

The Raichuru district also known as "Raichuru Doab" because the triangular region of land in the southern Indian states of Telanagana & Karnataka lying between the Krishna & the Tungabhadra river and also considered to be very fertile land because of sediments carried by these rivers. The district is bounded by on the North of Gulbarga district, West of Bijapur and Dharwad district, East of Mahiboobnagar of

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# Ecological Impacts of Invasive Alien Flora in Devarayanadurga Reserve Forest, Tumakuru District, Karnataka

## Research Article

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### Abstract

An alien plant also referred to as exotic, introduced, foreign, non-indigenous or non-native, is one that has been introduced by humans intentionally or otherwise through human agency or accidentally from one region to another. Those naturalized aliens that become so successful as to spread in the flora and displace native biota or threaten valued environmental, agricultural, or personal resources by the damage it causes are considered invasive. Devarayanadurga Reserve Forest (DRF) in Tumakuru District is a tropical dry deciduous type, comparatively dense forest with predominant tree species. It is known for harboring varieties of medicinal plants. During the present study a total of 144 Invasive Alien Species (IAS) belonging to 130 genera of 51 families were recorded. Fabaceae is the dominating invasive family with 27 species followed by Asteraceae and Malvaceae with 11 and 8 species respectively. 105 IAS were reported to be affecting ecosystem functions and services, 56 IAS to be causing biodiversity loss and 81 IAS to be causing economic loss and health hazards of either human or wildlife or both. 111 IAS shows continuous spread in DRF with range extension. IAS affects the ecosystem of the region, the economy of the surroundings, habitat destruction, biodiversity loss, human health, and livelihood. Hence timely monitoring of the phenology and distribution pattern studies of IAS should be undertaken to successfully eradicate them and re-establish native species.

**Keywords:** Alien species, Biodiversity, Invasive flora, Ecological impact, Tumakuru

### Introduction

Invasive Alien Species (IAS) is one of the major threats to global and local biodiversity. In forest ecosystems, the threats caused by IAS include hybridization, transmission of diseases and species competition [1]. An alien plant also referred to as exotic, introduced, foreign, non-indigenous or nonnative, is one that has been introduced by humans intentionally or otherwise through human agency or accidentally from one region to another. An alien plant that has escaped from its original ecosystem and is reproducing on its own in the regional flora is considered a naturalized species. Those naturalized aliens that become so successful as to spread in the flora and displace

native biota or threaten valued environmental, agricultural, or personal resources by the damage it causes are considered invasive. Monitoring is required in invasive species management to determine the location and early detection of problematic species, whether a species is likely to become a problem in an area, whether a species is responding to management efforts and the impact of alien plant control methods on native species. Monitoring of invasion can be done through qualitative approach like species inventory (seasonally) and quantitative approach using phytosociological methods and mapping by ground-based methods (Via map overlays or GPS), remotely sensed images (aerial photos, high-resolution multispectral digital data). General methods practiced for the eradication of IAS





## *Stachytarpheta cayennensis* (Rich.) Vahl (Verbenaceae): A New Record for Karnataka State, India

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### Abstract

A *Stachytarpheta* Vahl species was collected during field survey of the riparian vegetation of Tungabhadra River at Udagatti village of Ranebennur Taluk in Haveri District. It belongs to family Verbenaceae. After taxonomic investigations it was confirmed as *Stachytarpheta cayennensis* (Rich.) Vahl characters of pendent spikes and white flowers with 5-toothed calyx. It is an introductory collection for flora of Karnataka state. A detailed note on description, distribution, key and photographs are provided for easy identification of the species.

**Keywords:** Haveri, Pendent spike, Riparian, *Stachytarpheta*, Tungabhadra.

### Introduction

The family Verbenaceae is globally represented with 32 genera and 800 species (Cardoso, *et al.*, 2021). In India 105 species in 19 genera have been reported (Bala and Gupta, 2012). Karnataka have 9 genera 19 species (KBB, 2019). The *Stachytarpheta* Vahl is a genus native to Tropical America and South Mexico with ca 130 species distributed universally (Mabberley, 2017). Five species are recorded from Indian subcontinent (Rajendran and Daniel, 2002). Three species are documented from Karnataka namely, *Stachytarpheta jamaicensis* (L.) Vahl, *Stachytarpheta mutabilis* (Jacq.) Vahl and *Stachytarpheta urticifolia* Sims (KBB, 2019). The present collection *Stachytarpheta cayennensis* (Rich.) Vahl from 'The Riparian Vegetation of Tungabhadra River at Udagatti Village of Ranebennur Taluk, in Haveri District' is a new addition to the Flora of Karnataka State, India.

### Taxonomic Treatment

*Stachytarpheta cayennensis* (Rich.) Vahl  
Enum. Pl. Obs. 1: 208. 1804; Rajendran and Daniel, Indian Verbenaceae, 2002.

Under-shrubs up to 1.5 m tall. Stem branched, branches terete, pale green-brown coloured, slightly pubescent. Leaves simple, opposite, ovate-elliptic 2.0-5.0 x 1.5-3.0 cm. long, pale green beneath densely pubescent on the nerves, dark green on the upper surface sparsely pubescent. apex acute often prolonged in to petioles, cuneate at leaf base petiole 0.5 cm long, crenate to serrate along margins. Spikes terminal and axillary up to 25.0 cm long, pubescent, slender, pendulous. Bracts linear-lanceolate 4 mm long, aristate, hyaline ciliate along the margins. Flowers white 7 mm long. Calyx tubular with acuminate apex, densely hirsute 5-toothed 4 mm long, tooth unequal. Corolla hypocrateriform 5-lobed, white, lobes suborbicular 2 mm broad, corolla 6-7 mm tube 4-6 mm long hairy at throat. Stamens 2, epipetalous, anthers 2 mm filaments very short included pubescent. Pollen grains are tricolpate in shape. Ovary oblong, 1-2 mm long, 2-loculed, Style filiform, 4 mm long, stigma capitate. Fruits oblong 4 mm long, glabrous with persistent calyx and style. (Fig. 1).

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## *Dendrobium panduratum* Lindl. (Orchidaceae): Two Subspecies Additional Record to Karnataka, India

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### Abstract

The current survey reporting the two new sub species from Karnataka region, which are collected from Chikmagalur district, Karnataka, India and based on some evidences, got to know that *Dendrobium* species which are little bit confused with another species *Dendrobium heymannum* Lindl. through other reported lists. Based on morphological keys, which are motives for two sub species called *Dendrobium panduratum* Lindl. subsp. *panduratum* and *Dendrobium panduratum* Lindl. subsp. *villosum* Gopalan & Henry. This article will clarify the species and sub species based on article sources from Tamil Nadu and Kerala Report.

**Keywords:** Epiphytic Orchid, Green veins, Karnataka, Pink labellum, Subspecies.

### Introduction

The Orchidaceae are the most diverse of all angiosperm families with estimated number 26000 species in the world related to 762 genera (Mabberley, 2017). There are around 1256 species under 155 genera, of these 307 are endemic to India. *Dendrobium swartz* is the second largest genus in Orchidaceae having 114 species distributed throughout India (Jalal, J.S. et al., 2019). In Karnataka there are around 176 species has been recorded, in that 15 *Dendrobium* species has been recorded (Rao, T.A. & S. Sridhar, 2007). Nayar, et al., recorded *Dendrobium panduratum* subsp. *panduratum* from Kerala and *Dendrobium panduratum* subsp. *villosum* from Tamil Nadu and Kerala in the year 2014. Endemic Flowering (Plants of India has recorded *Dendrobium panduratum* subsp. *villosum* is endemic to Tamil Nadu (Singh, et al., 2015). Flora of Karnataka, Volume 3 Monocotyledons has recorded 175 species with 16 *Dendrobium* species in it (Laxminarasimhan, P. et al., 2019). Flora of Karnataka by Karnataka Biodiversity Board includes around 197 species of Wild Orchids,

in that they have recorded 18 *Dendrobium* species (Karnataka Biodiversity Board, 2019).

During our field survey in Devarmane, Mudigere, Chikmagalur district, Karnataka, got some *Dendrobium* species those have been collected and studied with morphological characters give some evidences for confirmation of the species as *Dendrobium panduratum* Lindl. Based on the Karnataka listing with lot of confusions in morphological keys with *Dendrobium heymannum* Lindl (Karnataka Biodiversity Board, 2019), which is different from *Dendrobium panduratum* Lindl. with flower size, pinkish-white flowers, labellum panduriform, glabrous within labellum, and reddish-green veins on side lobes of labellum and conformed this as a *Dendrobium panduratum* Lindl. subsp. *panduratum* (Sulaiman, M. 2021). Than after few days another flowered fully opened and have characters similarly about flower size, colour, labellum panduriform, villous within labellum, and green veins on side lobes of labellum. Then we studied some literatures, based on that, got to know that species as

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## Distribution of *Shorea roxburghii* G. don (Dipterocarpaceae) in tropical dry deciduous forests of Tumakuru district, Karnataka

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### Abstract

*Shorea roxburghii* G. Don is also called the lac tree, and the lac insect is propagated on it and the tree species is endemic to peninsular India. Besides, a kind of dammar is obtained from the tree. Devarayanadurga reserve forest hosts '*Shorea*' groves (SG) with *Shorea roxburghii* species in single spot with 8 large trees. *Shorea roxburghii* G. Don was previously listed as an Endangered (EN) species in 1998 but now it is listed as Vulnerable (VU) species in the IUCN Red List of Threatened Species 2017. The tree is prone to timber logging and threatened due to habitat loss as forests are cleared for agricultural purposes. The dispersal of winged fruits takes place much more efficiently by wind since the forest is of the open, seasonal, dry deciduous type. The function of a pollination system involving both wind and insects as vectors of pollen transfer is referred to as 'ambophily' and hence *S. roxburghii* is functionally ambophilous. Flowering is for a very short period only. Seeds mature quickly and seed dormancy is absent. This species is recorded from protected areas only. Hence this tree species must be conserved in *ex situ* conservation, harvesting should be monitored to reduce population decline. Newer and even more effective propagation methods need to be designed to increase the population in natural habitats and forestry.

**Keywords:** *Shorea*, vulnerable, distribution, propagation

### Introduction

Tumkur belongs to the group of districts called the *maidan* (plains) districts and is situated in the east – central part of the Karnataka State and to the south and south – east of Chitradurga district. It is situated between 12° 45' and 14° 20' north latitude and between 76° 20' and 77° 31' east longitude. The forests in the district are confined mostly to the lower slopes of the hill ranges and are spread over the entire district in small blocks. The forests are mostly open and consist of mixed species varying from dry deciduous to thorny bushes. Because of the scanty rainfall, which is about 70cm per year, the tree growth in the dry – belt zone never attains a height more than 25 feet. The forest consists mostly of fuel trees, providing fuel throughout the year. Characteristic of the zone to which the forest region belongs, the vegetative growth is of the dry deciduous type, typical of the *maidan* tracts [1]. Classified technically according to the champion method, the area of forests in the district comes under the southern tropical thorn forest series [2]. *Shorea roxburghii* G. Don (Kannada name – '*Jalari*') is also called the lac tree, and the lac insect is propagated on it. Besides, a kind of dammar is obtained from the tree. The wood of this species is yellowish in color and is capable of taking polish. Mostly, its timber is used for building purposes [3].

### Materials and Methods

**Study area:** Devarayanadurga reserve forest is comparatively dense forest with predominant tree species. It is known for harboring varieties of medicinal plants. This RF is in district headquarters under Tumakuru subdivision. It is elevated at a height of 1188m above mean sea level.

Table 1

Range	Notified Forest Area (In Ha.)						Decmed forest	Total
	Reserved Forest	Protected Minor Forest	Village forest	Private forest	Section – 4 Forest	Other		
Tumkur (Devarayanadurga)	6194.57	82.17	-	-	65.58	-	4581.62	10923.94

### Soil and Climatic conditions

The average annual rainfall in the district is about 680 mm. The soil type here is Red loamy with neutral pH of 7.2, Electrical conductivity being normal of 0.22. Available Nitrogen is 156.6 kg per acre, P<sub>2</sub>O<sub>5</sub> is 26.3 kg per acre and K<sub>2</sub>O is 44.83 kg per acre which is moderate.



SCAN ME

**Research Paper**

**CARBON SEQUESTRATION AND TREE DIVERSITY OF DAROJI SLOTH BEAR WILD LIFE SANCTUARY, VIJAYANAGARA DISTRICT, KARNATAKA**

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**Abstract**

The study area is a rock strewn hillock that stretches between Daroji of Sandur Taluka and Ramasagara of Hospet Taluka in Vijayanagara District of Karnataka. It is located between 15°14' to 15°17' N latitude and 76°31' to 76°40' E longitude. Daroji Sloth Bear wildlife sanctuary is dry deciduous scrubby forest; the vegetation of whole area is xerophytic, sparse and dominated by spiny thorny shrubs, bushes and few tree species. It includes almost stunted trees and shrubs. Present study was conducted to determine the Carbon Sequestration capacity and tree diversity of Daroji wild life sanctuary. The average carbon assimilation of study area is around 14.964g of carbon per tree with a total carbon assimilation of 1271.98g. *Phoenix sylvestris* (L.) Roxb., has the highest amount of carbon assimilation (9221.82g/sp) as compared to other species like *Acacia leucophloea* (Roxb.) Willd. (12.4479g). *Ficus amplissima* J.E.Sm. (16.1506g) *Annona reticulata* L. (16.1506 g) accumulates lowest carbon of g/tree. Above ground biomass constitutes major part of the biomass. Among the 85 species studied, *Cassine glauca* (Roxb.) O.Ktze. 323.2, *Dalbergia sissoo* Roxb. ex DC. 334.7, *Phoenix sylvestris* (L.) Roxb. 5031, has highest biomass as compared to other species. The total aerial biomass of the study area is 693.932g with average biomass of 8.164 g/tree. Lowest Biomass (g tree<sup>-1</sup>) having species are *Acacia leucophloea* (Roxb.) Willd. 6.79 g, *Ficus amplissima* J.E.Sm. 8.811g and *Annona reticulata* L. 8.812g.

Key words: Daroji wild life sanctuary, Daroji wild life sanctuary, Afforestation, Diversity index, Total biomass.

## Studies on the Toxic Effects of Synthetic Pyrethroid Insecticide, Cyphenothrin on Protein Metabolic Profiles of Indian Major Carp, *Cirrhinus mrigala*

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### ABSTRACT

Pyrethroids are used in almost all agricultural crops, nurseries, various urban structural and landscaping sites, construction sites (pre-construction termiticides), the pyrethroids is their efficacy against a broad range of insects, pests and mites, low mammalian and avian toxicity, low potential to contaminate ground water, and relatively low application rates like several desirable characters to contribute. Cyphenothrin is the synthetic pyrethroid insecticide widely used throughout the world to control domestic pests, public health and industrial location. Cyphenothrin is more toxic to insects and mammals and last longer in the environment. Freshwater fish, *Cirrhinus mrigala* were exposed to sublethal concentration one fifth of  $LC_{50}$ , 30  $\mu\text{g/L}$  (6  $\mu\text{g/L}$ ) of cyphenothrin for 10, 20, 30 and 40 days to analyze various parameters of protein metabolism in functionally different tissues. Total, structural and soluble proteins showed decrease; whereas free amino acids and the activities of protease, aspartate aminotransferase and alanine aminotransferase significantly increased in cyphenothrin exposed fish. Interestingly, ammonia content decreased but urea and glutamine increased at all periods of exposure. It was also observed that alterations steadily increased with the period of exposure and exhibited tissue specificity. Thus variation in the protein metabolism of the fish exposed to cyphenothrin indicates its toxic effect on the cellular metabolism thereby leading to impaired protein synthetic machinery.

**Key words:** Cyphenothrin toxicity; Protein metabolism; *Cirrhinus mrigala*

### INTRODUCTION

Water contamination is normally brought about by different human sources, regularly modern offices and agrochemicals particularly in aquatic biological system, has turned into a genuine natural issue now a days. These agrochemicals and industrial wastes releases may diverted successfully by rains, winds, streams and floods into the huge water bodies and change their physico-chemical properties with high harmfulness. The water pollution make harms aquatic life particularly to fishes which are extremely sensitive to wide scope of toxins in the water (Herger et al. 1995).

Various types of fish show dynamic take-up and aggregation of numerous toxic chemicals like herbicides, pesticides, heavy metals and polychlorinated biphenyls from water bodies. Among every one of these agrochemicals, pesticides viewed as very poisonous to species and furthermore to the established pecking order of aquatic environments. The amassing of pesticides delivers some physiological, biochemical and as well as morphological reactions in the freshwater fauna by

impacting a few activities of metabolites and compounds shown by Ramamurthy et al. (1987).

The presence of xenobiotic, synthetic compounds and their subsidiaries in the aquatic water bodies and biological system due to their agrarian and modern applications are well documented. Most of these chemical compounds in the type of toxins and their subsidiaries are not degradable and have the chance of endogenous restricting particles as they enter the natural water bodies may prompt ominous harmful impacts (Amdur et al. 1991). The presence of these chemicals in a natural system can achieve bothersome changes in a cell which might be flowed to the tissue or the organ (Bernet et al. 1991). The possibility of these metals to amass in the aquatic biological system, especially fish, adversely affects the order of things. Human populaces who consume fish as an essential wellspring of food are additionally important for the food chain, consequently producing a reason for worry in broad daylight wellbeing (Di Giulio and Hinton 2008). The effect and bioaccumulation of toxins and their subordinations in the organs of aquatic species like fish rely upon an assortment of variables like closeness of the species





## Studies on the Physico-chemical Parameters of Soil Samples at the Vicinity of Sugar and Fertilizer Industries in Karnataka

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### ABSTRACT

Soil analysis provides an important information about physical nutrient conditions and chemical properties that influence the soil health. In the present investigation the physico-chemical studies of soils are carried out for the various soil samples viz of has shown in graph S1, S2, S3, S4 collected from North and South regions of Karnataka at the vicinity sugar and fertilizer industries. The results have indicated that soil sample S1 has Shown Heavy clay soil texture, lowest electrical conductivity, available Nitrogen, Potassium, Sulphur and Iron content and also showed maximum level of exchangeable calcium and magnesium content. Soil sample S2 has maximum water holding capacity, Highest range of EC, slightly alkaline pH, more organic carbon and organic matter, available Nitrogen, lower phosphorous and Iron content. Soil sample S3 has acidic pH, Maximum range of Phosphorous, Copper, Iron and Zinc Content. Soil sample S4 and indicates the lowest water holding capacity, Lower content of moisture, organic carbon and organic matter, lower level of exchangeable calcium and magnesium content, lowest copper content and showed maximum potassium and Sulphur content. These variations in soil physico-chemical parameter certainly influenced the distribution of soil micro-fauna and soil health.

**Key words:** Soil texture, Water holding capacity, Electrical conductivity, pH, Soil moisture, Organic carbon and organic matter, Available nitrogen, Phosphorous, Sulphur, Copper, Iron, Zinc, Exchangeable calcium, Magnesium

Soil is a dynamic entity and has complex interactions with its biological chemical and physical components. Soil plays important role in to quantify the physical, chemical and biological parameters that impacts on the agricultural productivity and sustainability. Soil physico-chemical properties influence the behavior of soil and hence, knowledge of soil property is important [1]. Soil testing is the only way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations [2]. The physical and chemical parameters influence the soil productivity. The soil is a complex organization being made up of many constituents namely inorganic matter, organic matter, soil organisms, soil moisture, soil solution and soil air. Soil contains 50-60% mineral matter, 25-35% water, 15-25% air and low organic matter [3]. A collection of Soil samples from Chamrajnagar district (S<sub>1</sub>) and Mangalore (S<sub>2</sub>) of South regions, Gadag (S<sub>3</sub>) and Koppal (S<sub>4</sub>) districts of north regions of Karnataka. The soil samples were collected by standard procedures and in polythene bags stored at 5°C in laboratory. These soil samples are analyzed to measure various physico-chemical parameters by standard methods. Soil is made of

various components; the composition of soil and proportion of these component greatly influence on the soil physical properties which is include the soil structure and porosity. These properties influence air and water movements in soil and thus the ability of soil function.

### MATERIALS AND METHODS

Soil samples, all laboratory chemical reagents, apparatus etc. were used for physical and chemical analysis of soil samples. Soil samples were collected at random at the rate of 3 samples per plot (30cmx30cm) every three months (Quarterly). Samples were drawn by stainless steel cover by quadrant method of 30cm x30cm (inner cross-section diameter 8.5 cm) from a depth of 5-10cm. Separate soil samples units (500gms) were taken from each site preserved in polythene bags for further usage as per Mandal and Suman 2014.

#### Sampling and analysis-location

The soil samples were collected from Chamrajnagar district (S<sub>1</sub>) and Mangalore (S<sub>2</sub>) of South regions Gadag (S<sub>3</sub>) and Koppal (S<sub>4</sub>) of North regions of Karnataka. All the chemicals and reagents used for analysis are A R Grade from S. D. Fine and Sigma chemicals, Mumbai. Analysis of physico-chemical parameters of the soil samples were suspended in distilled water (1:4 w/v) and allowed to settle down the particles [4]. The physico-chemical analysis of soil samples S<sub>1</sub>,

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RESEARCH ARTICLE

## Inhibition of Na<sup>+</sup>-K<sup>+</sup>, Ca<sup>2+</sup> and Mg<sup>2+</sup> -ATPase in Different Tissues of Freshwater Fish *Cirrhinus mrigala* (Hamilton)

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### ABSTRACT

Pyrethroids are normally used round the home and in agricultural production to control insects. Human contact to one or a lot of pyrethroid pesticides is probably going. various medical specialty studies have evaluated the association between health outcomes in humans and pyrethroid exposure. In the present investigation, an effort has been created to quantify the cyphenothrin accumulated in different tissues (gill, kidney and liver) and observe changes concerned within the levels of Na, K and Ca ions and Na<sup>+</sup>-K<sup>+</sup>, Mg<sup>2+</sup> and Ca<sup>2+</sup> nucleoside triphosphatase (ATPase) activities within the fresh water fish, *Cirrhinus mrigala* on long term exposure to the sub lethal concentration of cyphenothrin. In sublethal concentration (6 mg/l), excretory organ kidney accumulated highest amount followed by gill and liver, which could flow from to the very fact that Cyphenothrin is very lyphophilic. The ion concentration and ATPase activity were found effected in fish exposed to sublethal concentrations of cyphenothrin concentration of Na<sup>+</sup>, K<sup>+</sup> and Ca<sup>2+</sup> ions minimized in gill, muscle and liver on being exposed to sub lethal concentration to a significant level. Whereas the changes weren't extremely seen at sub lethal level indicating low concentration of cyphenothrin and its non-toxic result at chronic exposure. Na<sup>+</sup>-K<sup>+</sup>, Mg<sup>2+</sup> and Ca<sup>2+</sup> ATPases activity were additionally found minimized in correspondence to the ionic change under sub lethal concentrations in target tissues. This might need behavioral activity changes and build wide-spread disturbance within the physiology, ultimately inflicting the death of the fish. The results suggest that in biomonitoring programmes, ions and associated ATPases is a decent diagnostic tool for cyphenothrin toxicity.

**Keywords:** Cyphenothrin accumulation, ions and associated ATPases, *Cirrhinus mrigala*





## ACUTE CYPHENOTHIRIN INDUCED TOXICITY ON RESPIRATION AND BEHAVIOURAL RESPONSES OF FRESHWATER EDIBLE FISH CIRRIHINUS MRIGALA.

### Toxicology

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### ABSTRACT

Pyrethroids are the third most applied group of insecticides worldwide and are considerably used in agrarian and non-agricultural uses. Pyrethroids parade low toxin to mammals, but have extremely high toxin to fish and non-target species. Their high hydrophobicity, on with pseudo-persistence due to nonstop input, indicates that pyrethroids will accumulate in deposition, pose long-term exposure enterprises to aquatic species and eventually beget significant threat to benthic communities and aquatic environments. The present investigation was undertaken to study the acute toxicity of the insecticide Cyphenothrin and the resulting behavioral alterations in the Indian major carp, freshwater fish *Cirrhinus mrigala*. The experimental fish were divided into groups of 10 (n=10) and exposed to different concentrations of the test pesticide for 24, 48, 72, and 96 hours. The 96-hour LC50 was found to be 30µg/l. Sub-lethal concentration was fixed based on LC50 value is 6µg/l (1/5th of LC50) of the insecticide Cyphenothrin for a period of 10, 20, 30 and 40 days. Behavioral patterns and oxygen consumption were studied in sub-lethal concentrations. Regular observation was made throughout the exposure period to determine the long-term behavioral changes in the test fish. The fish displayed erratic swimming behavior that increased over the days of exposure. Behavioral anomalies such as whirling cork movement, altered opercular movement, altered fin movement and physiological changes such as dyspigmentation and altered mucus secretion were observed. Dissolved oxygen content was measured at 24, 48, 72 and 96 h to assess the impact of toxicant exposure on oxygen consumption. Oxygen consumption of exposed fishes showed significant decrease at sub-lethal concentrations. It is concluded that cyphenothrin is highly toxic to fingerlings of *Cirrhinus mrigala* and severely affects their physiology and behaviour.

### KEYWORDS

cyphenothrin toxicity, oxygen consumption, behaviour, *Cirrhinus mrigala*

### INTRODUCTION

The current time of the revolution, seeing a fast increase in human population across the world, portrays the reliance of individuals on accessible traditional assets. The present state of affairs has prompted endeavors for innovative progressions to adapt to the necessity of social orders. This, thusly, is bonded by developing forever increasing disintegration of varied combined artificial substances within the setting, that initiate contamination, expressly in aquatic bodies used as unloading destinations in several areas of the earth Jabeen F. *et al.*, 2015. Contamination is that the basic widespread objectionable issue, that is deteriorated by the overhasty development of human peoples and quick industrial enterprise Stehle S. *et al.*, 2015. The impure aquatic setting may be a dangerous overall issue, and therefore the ooze of rural, modern, and artificial compounds into the aquatic water bodies has initiated some harmful impacts on aquatic species and living organisms. Also, these toxins might foursquare roll up fish tissue and defile the natural organic phenomenon, which can therefore influence human consumption Naiel *et al.*, 2020.

A pesticide to a rat, nematode, weed, parasite, or another sort of terrestrial or amphibian, plant or species infection, microscopic organisms, or completely different microorganisms that destroys the crops, garden plants or trees, as a vector of sicknesses. For ranchers, pests incorporate insects that kill crop and aquatic plants, and cause animal and plant infections, like growths, infections, microscopic organisms, snails, nematodes, and rodents Liu W. X *et al.*, 2016. Then again, pesticides square measure alluded to as various substances intensifies that have completely different organic activities and artificial qualities, that square measure clustered along to make their ability to destroy Marigoudar S. R *et al.*, 2013. On these lines, as a good definition, pesticides square measure on the entire those substances or their combination utilized for neutralization, annihilation, repulsing, stopping, opposing, or dominant insects Dawood M.A.O *et al.*, 2020.

Water contamination with pesticides could be direct utilization of those artificial compounds for controlling aquatic foliage likewise as outflow from rural grounds through farming overflows Ozkara *et al.*, 2016. These are generally distributed in each metropolitan and farming Fetoui, H. *et al.*, 2010; this is the main impacts of pesticides as important supporters of water contamination Hau J. *et al.*, 2014, Molina-Ruiz *et al.*, 2015. Across the world, variety forms of pesticides measure being utilized in numerous proportions, like bug sprays, that

form up roughly eightieth of all pesticides, herbicides (15%), and fungicides (1.46%). Chemical applications are often supported for important stretches within the fields once application to their weakened biodegradation properties Biswas S. *et al.*, 2019, that may be consumed by aquatic species, like fish, prompting negative impacts on their health and meat quality, which is able to contrarily influence human health. Besides, they need a quick biodegradation rate within the aquatic environment wherever inexperienced growth and macrophytes exist Balint T. *et al.*, 1997. These pesticides over one hundred times a lot of toxicants for fish to the multiplied affectability of fish to harmful toxins to their immediate impact to water through gills and the deficient hydrolytic catalysts for pyrethroids Aydin R. *et al.*, 2005. These chemical compounds are modified within the hepatocytes, bile, and platelets to sulfates and glucuronides, inflicting unfortunate impacts on meat quality and also the endurance pace of fish Gautam P. *et al.*, 2008.

Pyrethroids are inferiors of normal Pyrethrins derived from the flowers of pyrethrum plant (*Chrysanthemum cinerariaefolium* and *C. coccineum*) P.K. Gupta 2018. They include esters of chrysanthemum acid (ethyl, 2- dimethyl- 3-( 1- isobutenyl) cyclopropane-1- carboxylate) and halogenated inferiors of their acids and alcohols L.G. Costa 2015. Despite the fact that Pyrethroids and Pyrethrins are synthetically and toxicologically similar, deterioration when exposed to heat, light, and moistness R.E. Gosselin 1984. Pyrethrins with inferiors (Pyrethroids), originally allowed for people J. Skolarczyk *et al.*, 2017. These pesticides were acquainted due with their lower position of determination when varied with organo chlorine, organophosphate and carbamate fungicides which are related with long haul natural pitfalls. Pyrethroids as a rule break down within the sight of daylight and terrain in a couple of days S.M. Bradberry *et al.*, 2005. Also, they do not basically impact ground-water quality making them favored backups to conventional further persisting pesticides.

Pyrethroids' depend on sodium channels and the investiture of delayed depolarization in neurons in the sensory system K.S. Silver *et al.*, 2014. WHO believed that pyrethroids are neuro-damages following up on the axons in the supplemental and central nervous system sodium diverts in warm blooded species for by S.M. Bradberry *et al.*, 2005 to be multiple times more dangerous to insects than to advanced species. This is because of bugs having further sodium channels, a more modest construction, and lower internal heat position just as





## Blood Glucose and Glycogen Levels as Indicators of Stress in the Freshwater Fish, *Cirrihinus mrigal* under Cyphenothrin Intoxication

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### Abstract

Pesticides are non-biodegradable substances used to control bugs, weeds, snails, and plant diseases. They are widely utilized in forestry, farming, and veterinary practices and are of incredible general well-being significance. Pesticides can be ordered by their utilization into three significant sorts (in particular insect sprays, herbicides, and fungicides). Water contamination by these pesticides is known to prompt harmful effects on the creation, proliferation, and survivability of aquatic life forms, like green growth, amphibian plants, and fish (shellfish and finfish species). The information presented in this study is used to assess the negative effects of exposing fish species to pesticide concentrations. Pyrethroids are regularly utilized around the home and in agricultural production to control bugs. Human contact with at least one pyrethroid bug spray is reasonable. These synthetic substances cause serious harm to aquatic biological systems, particularly fish. The principle points and objective of the present investigation are to assess the effect of cyphenothrin on carbohydrate metabolism in the fish. *Cirrihinus mrigal* is a monetarily significant Indian major carp. A freshwater fish, *Cirrihinus mrigal*, was exposed to bug spray, i.e., cyphenothrin a manufactured pyrethroid. The LC50 for cyphenothrin at 96 hrs was 6 µg/L by probit analysis. One-fifth of LC50 (1.20 µg/L), was chosen as the sublethal focus. The fish were subjected to sub-lethal concentrations for 10, 20, 30 and 40 days, and the changes in starch digestion, for example, absolute glycogen, as well as the activities of catalysts Lactate Dehydrogenase (LDH) and Succinate Dehydrogenase (SDH) in critical organs, such as the gill, kidney, and liver, were studied.

**Keywords:** Carbohydrate Metabolism, Cyphenothrin, LDH, SDH

### 1. Introduction

The contemporary era of the 'green transition', which is characterized by a rapid rise in the human population worldwide, illustrates how dependent people are on readily available everyday resources. Innovative developments have been motivated by the current circumstances to adjust to the

requirements of social orders. Thus, this is ensured by the environment's gradually expanding breakdown of various synthetic substances that have been introduced there. This causes contamination, especially in aquatic bodies used as disposal sites in many parts of the world<sup>1</sup>. The primary general hazardous component, contamination, is caused by human development and rapid industrialization<sup>2</sup>. Water

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## A new class of almost continuity in topological spaces

Jagadeesh B. Toranagatti\*

### Abstract

In this paper, we apply the notion of  $\delta g\beta$ -open sets due to Benchalli et al. [Benchalli et al., 2017] to present a new class of functions called almost  $\delta g\beta$ -continuous functions along with its several properties, characterizations and mutual relationships.

**Keywords:** almost continuity, almost  $\beta$ -continuity,  $\delta g\beta$ -continuity, almost  $\delta g\beta$ -continuity.

**2020 AMS subject classifications:** 54A05, 54C08. <sup>1</sup>

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## VARIOUS POLYNOMIALS ASSOCIATED TO GRAPHS INVOLVING SPLICE AND LINK STRUCTURES

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**ABSTRACT.** Cones are the graph structures involving an universal vertex, which is adjacent to all other vertices. Splice and link structures of graphs involving cones, which are formed by using regular graphs, can be viewed in terms of joined union of graphs. The current work is about polynomials associated to adjacency, Laplacian and signless Laplacian matrix for graphs involving cones. Significantly it is noted that, results due to adjacency polynomial of splice and link structure of cones are generalizations of those due to structures involving complete graphs, which are available in the literature.

## 1. INTRODUCTION

One of the methods of studying a particular type of graph structures is the study related to graph operations. T. Došlić in 2005 [1], defined two new graph operations called splice and link of two graphs, which involve vertex identification among two graphs and linking two graphs with an edge, respectively. These structures are prominent, as they are observed in many chemical compounds. For example, splice of cycles serve as models of spirane molecules and models of complex molecules are built from simpler binding blocks by iterating and/or combining splice and link operations. The spectral approach to splice and link of two graphs in terms of characteristic polynomials was due to F. Celik et al. in [2]. Recently, Ramane et al. [3] extended the concept of splice and link (include symmetric structures) of two graphs to any number of graphs, which is due to the fact that spiro compounds can have more than two molecular rings. Hence, study spectra and energy of these structures for certain class of graphs.

The present work is intended to study splice and link structures of graphs involving cones (can be viewed in terms of joined union), which includes the study of adjacency polynomial, Laplacian polynomial, signless Laplacian polynomial and construction of certain class of equienergetic graphs. Notable significance is

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*Key words and phrases.* Splice of graphs, link of graphs, joined union, vertex set partition, quotient matrix.



## An upper bound for difference of energies of a graph and its complement

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MSC:  
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### ABSTRACT

The  $A$ -energy of a graph  $G$ , denoted by  $E_A(G)$ , is defined as sum of the absolute values of eigenvalues of adjacency matrix of  $G$ . Nikiforov in Nikiforov (2016) proved that  $E_A(G) - E_A(\bar{G}) \in \mathbb{Z}$ , and  $E_A(G) - E_A(\bar{G}) \leq 2\alpha$ , for any graph  $G$  and posed a problem to find best possible upper bound for  $E_A(G) - E_A(\bar{G})$ , where  $\alpha_1$  and  $\alpha_2$  are the largest adjacency eigenvalues of  $G$  and its complement  $\bar{G}$  respectively. We attempt to provide an answer by giving an improved upper bound on a class of graphs where regular graphs become particular case. As a consequence, it is proved that there is no strongly regular graph with negative eigenvalues greater than  $-1$ . The obtained result also improves some of the other existing results.

### 1. Introduction

All graphs considered here are simple and undirected. The order  $n(G)$  and size  $m(G)$  of a graph  $G$  is the number of vertices and the number of edges in it respectively. The degree of a vertex  $v$  in a graph  $G$  is the number of edges incident to it and is denoted by  $d_v$ . A graph  $G$  is said to be regular if all its vertices have same degree. An  $r$ -regular graph means it is a regular graph with all its vertices have same degree equal to  $r$ . The complement  $\bar{G}$  of a graph  $G$  has same vertices that of  $G$  but two vertices are adjacent in  $\bar{G}$  if and only if they are not adjacent in  $G$ . The  $A$ -eigenvalues of a graph  $G$  are the eigenvalues of its adjacency matrix  $A(G)$ . The  $A$ -eigenvalues of a graph  $G$  with  $n(G) = n$  and its complement  $\bar{G}$  are denoted by  $\mu_1 \geq \mu_2 \geq \dots \geq \mu_n$  and  $\bar{\mu}_1 \geq \bar{\mu}_2 \geq \dots \geq \bar{\mu}_n$ , respectively. The number of negative, positive and zero eigenvalues of  $G$  and  $\bar{G}$  are denoted by  $n_+^G, n_-^G, n_0^G$  and  $n_+^{\bar{G}}, n_-^{\bar{G}}, n_0^{\bar{G}}$ , respectively. An  $A$ -eigenvalue  $\mu$  of a graph  $G$  is called main if an eigenvector corresponding to  $\mu$  is not orthogonal to all one's vector  $\mathbf{j}$  and otherwise  $\mu$  is called non main  $A$ -eigenvalue. The  $A$ -energy [1] of a graph  $G$  is defined as  $E_A(G) = \sum_{i=1}^n |\mu_i|$ . Two graphs  $G_1$  and  $G_2$  with  $n(G_1) = n(G_2) = n$  and  $E_A(G_1) = E_A(G_2)$  are called equienergetic graphs [2]. A graph with  $n(G) = n$  is said to be borderenergetic if its  $A$ -energy is equal to  $E_A(K_n) = 2n(n-1)$ , where  $K_n$  is a complete graph of order  $n$  [3]. The line graph  $L(G)$  of a graph  $G$  is the graph with vertex set same as that of edge set of  $G$  and two vertices in  $L(G)$  are adjacent if the corresponding edges in  $G$  have a common incident vertex. The  $k$ th iterated line graph of  $G$  for  $k = 0, 1, 2, \dots$  is defined as  $L^k(G) = L(L^{k-1}(G))$ , where  $L^0(G) = G$  and  $L^1(G) = L(G)$ . A strongly regular graph with parameters  $(n, r, \lambda, \mu)$  is an  $r$ -regular graph ( $0 < r < n-1$ ) of order  $n$  in which any two adjacent vertices have exactly  $\lambda$  common neighbors and any two non-adjacent

vertices have exactly  $\mu$  common neighbors. For other terminology and notation we follow [4].

**Lemma 1.1** ([5]). Let  $G$  be a graph with  $n(G) = n$ . Then

$$\mu_j + \bar{\mu}_{n-j+2} \leq -1 \quad \text{for } j \in \{2, 3, \dots, n\} \quad (1)$$

Equality in (1) holds for all  $j \in \{2, 3, \dots, n\}$  if and only if  $G$  is a regular graph.

**Lemma 1.2** ([6]). Let  $G$  be a graph with  $n(G) = n$ . Then

$$n-1 \leq \mu_1 + \bar{\mu}_1 \leq \sqrt{2}(n-1) \quad (2)$$

Equality in left side of (2) holds if and only if  $G$  is a regular graph.

**Lemma 1.3** ([7]). Let  $G$  be a strongly regular graph with  $n(G) = n$ . Then  $\alpha_1^+ + \alpha_1^- = n-1$ .

**Proposition 1.4** ([8]). A graph  $G$  has exactly one main  $A$ -eigenvalue if and only if  $G$  is regular.

**Theorem 1.5** ([9]). If  $\mu$  is an  $A$ -eigenvalue of a graph  $G$ , then  $-1 - \mu$  is an  $A$ -eigenvalue of  $\bar{G}$  if and only if  $\mathbf{j}^\top \mathbf{y} = 0$  for some eigenvector  $\mathbf{y}$  of  $A(G)$  corresponding to the  $A$ -eigenvalue  $\mu$ .

**Proposition 1.6** ([10]). In the line graph  $L(G)$  of a graph  $G$  the eigenspace of the  $A$ -eigenvalue  $-2$  is orthogonal to the vector  $\mathbf{j}$ .

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## On families of graphs which are both adjacency equienergetic and distance equienergetic

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**Abstract** Let  $A(G)$  and  $D(G)$  be the adjacency and distance matrices of a graph  $G$  respectively. The adjacency energy or  $\mathcal{A}$ -energy  $\mathcal{E}_A(G)$  of a graph  $G$  is defined as the sum of the absolute values of the eigenvalues of  $A(G)$ . Analogously, the  $\mathcal{D}$ -energy  $\mathcal{E}_D(G)$  is defined to be the sum of the absolute values of the eigenvalues of  $D(G)$ . One of the interesting problems on graph energy is to characterize those graphs which are equienergetic with respect to both the adjacency and distance matrices. A weaker problem is to construct the families of graphs which are equienergetic with respect to both the adjacency and distance matrices. In this paper, we find the explicit relations between  $\mathcal{A}$ -energy and  $\mathcal{D}$ -energy of certain families of graphs. As a consequence, we provide an answer to the above open problem (Indulal in <https://icgc2020.wordpress.com/invitedlectures>, 2020; <http://www.facweb.iitkgp.ac.in/rkannan/gma.html>, 2020)

**Keywords** Graph energy · Distance energy · Equienergetic graphs · Distance equienergetic graphs

**Mathematics Subject Classification** 05C50 · 05C76

### 1 Introduction

In the spectral graph theory, the concept of graph energy has emerged as one of the interesting directions due to its applications in molecular chemistry, see for instance [11, 21]. For a connected graph  $G$  of order  $n$ , Indulal et al. [20] defined the distance energy as  $\sum_{i=1}^n |\xi_i|$ , where  $\xi_i$ ,  $1 \leq i \leq n$ , are the distance eigenvalues of  $G$ . In the literature, there are many energy variants defined on graphs from which the distance energy has also

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ENERGY OF COMPLEMENTS OF CERTAIN DOUBLE GRAPHS

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**Abstract:** The energy of a graph is that the total of absolute values of its eigenvalues. In this paper, we investigate the energy of complement of extended bipartite double graphs, complement of strong double graphs and complement of double graphs in terms of energy of underlying graph or its complement. As a consequence of energy of these graphs, various energy types are discussed. The obtained results generalize some of the existing results on equienergetic graphs. Moreover, some new class of equienergetic graphs are characterized.

**Keywords and Phrases:** Extended bipartite double graph, Strong double graph, Double graph, Equienergetic graphs, Orderenergetic graphs, Hyperenergetic graphs.  
**2020 Mathematics Subject Classification:** 05C50, 05C76.

**1. Introduction and Preliminaries**

All of the graphs considered throughout the paper are simple and undirected. The order  $\sigma(\Gamma)$  and size  $s(\Gamma)$  of a graph  $\Gamma$  are the number of vertices and edges in  $\Gamma$ , respectively. The degree  $d_i$  of a vertex  $x_i$  is the number of edges incident to  $x_i$ . The



## Factors Influencing on Transmission of Malaria in India: Application of Negative Binomial Regression Model

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**Abstract-**Malaria is the life threatening parasite disease which has different effect on different regions. The aim of this study is impact of climatic and non-climatic factors such as annual average rainfall, minimum temperature, maximum temperature, humidity, percentage of migrants and forest cover growth rate as predictors on the number of annual malaria cases occurred in India. The information about malaria cases of India from 1990 to 2015 were collected from National Vector Borne Diseases Control Board (NVBDC), Government of India. Spearman's correlation has been shows relation between the malaria cases and all other variables and Negative Binomial (NB) Regression model is used to estimate the relation between malaria cases and all the variables. Study concludes annual average rainfall is positively correlated with malaria cases while remaining variables shown negative correlation. Negative Binomial Regression shows impact of percentage of migrants more than the other variables on the transmission of malaria.

**Keywords-** Malaria, Transmission, climatic factors, Forest cover, Spearman's Correlation, Negative Binomial Regression etc

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### I. INTRODUCTION

Malaria is a life threatening parasite disease which has different effect on different regions. Mainly to the developing countries, malaria is still being severe public health issue. It is caused by primarily four parasites of Plasmodium species i.e. P. Vivax, P. Ovale, P. Malariae and P. Falciparum. According from WHO (2015), it is estimated that 262 million cases and 8,39,000 deaths occurred in the year 2000. But malaria cases and deaths got declined by 18% and 48% respectively from the year 2000 to 2015 i.e. 214 million cases and 4,38,000 deaths in the year 2015. Of this African region, South East Asia region and Eastern Mediterranean region reported 90%, 7% and 2% malaria deaths respectively in the year 2015.

India's contribution of the malaria cases to the South East Asia region is 58%. One fifth of the India's population lives in high transmission areas and more than half of the population lives in the low transmission areas (World Malaria report, 2014). P. Falciparum and P. Vivax are the most common parasites in India and these two parasites are unevenly distributed across the country (Sharma et al., 2006). According to WHO 2016, India accounted for half of the global total of estimated malaria deaths due to P. Vivax parasite.

Malaria is mainly considered as a sensitive disease to climatic changes. The climatic factors like rainfall, temperature and humidity are the main reasons behind the transmission of malaria because these factors influence parasite life cycle in vectors (Gubler et al., 2001). Non climatic factors like population density, population movement and deforestation have also caused for malaria transmission.

In the development of life span of the malaria parasites, temperature variable leads very crucial rule. A change of only 1<sup>o</sup> C temperatures in the range of 18<sup>o</sup> C-26<sup>o</sup> C that can add a week of life span and some temperature not less than 18<sup>o</sup> C or 19<sup>o</sup> C can keep malaria parasites alive for a month (Jepson et al., 1947). It was reported that humidity > 60% and temperature 20<sup>o</sup> C- 30<sup>o</sup> C are optimal for Anopheles to live long enough to attain and spread the parasite (McMicheal et al., 1995).

Many studies have been carried out in India and also globally to know the relationship between climatic variables (such as humidity, rainfall, minimum and maximum temperature) and malaria cases. The study carried in Assam, in which polynomial regression model have been developed to reveal the impact of climatic variables on transmission of malaria and it was resulted that main population, rainfall, humidity and temperature plays key role in predicting the malaria cases (Saikia et al., 2015). Another study in Uttaranchal revealed that rainfall and malaria cases have highest significant positive correlation when lag of one-month was considered (Devi et al., 2006) but in Madhya Pradesh it was completely reverse i.e., insignificant negative correlation (Singh et al., 2002).

## Forecasting of Demographic and Economic Variables in India using Fuzzy Time Series Model

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**Abstract:** Forecasting of demographic and economic variables is an essential component of research that will help society and the government plan for the best or worst in the future. The data on Demographic variables are collected from Census of India and economic variables are gathered from Economic survey of India from 1971 to 2020. The goal of this study is to predict the magnitude of all the selected variables for next ten years using the Abbasova and Mamedova (AM) model, in which the parameters are evaluated through the AM model algorithms to obtain appropriate results for each set of data. Findings of the study reveals that except for GDP all the selected variables were AM model fitted well and comparison shows rural population is best fitted as compared to the entire demographic and economic variable by using Mean Absolute Percentage Error (MAPE).  
**Keywords:** Demographic variable, Economic variable, Fuzzy time series, Abbasov-Mamedova and MAPE.

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### I. INTRODUCTION

In 2019, the world's population had a life expectancy of 72.6 years, an increase of more than 8 years since 1990. According to World Population Prospect (2019), further advancements in survival are expected to result in a global average life expectancy of roughly 77.1 years in 2050. Current age structures will drive two-thirds of the anticipated global population growth until 2050. It would happen even if childbirth in today's high-fertility countries dropped to roughly two births per woman during her lifetime. Global fertility falls from just under 2.5 births per woman in 2019 to roughly 2.2 in 2050, and then to 1.9 in 2100, according to the medium-variant prediction. China, which has 1.43 billion people, and India, which has 1.37 billion, has long been the world's two most populated countries.

Forecasting is the process of creating future predictions based on a combination of past experiences, knowledge, and analysis of connected issues. It is regarded as the foundation process, the initial stage in the development of policies and objectives for both organizations and government agencies. Forecasting has gotten a lot of attention from scientists because of its importance in so many fields. Time series and regression models play essential roles in statistical forecasting, but they have a number of drawbacks in reality. The issues of predicting have not yet been completely solved, despite various discussions in the literature. The main technique of statistics is to search for principles and rules to establish an appropriate forecasting model based on previous data. When there are irregular changes or the time series is non-stationary, a regression model Galton (1888); Pearson (1896) requires several inadequate assumptions, whereas a time series model, such as ARIMA Box and Jenkins (1976), performs badly. Many studies have suggested various models to solve the disadvantages of these two models, including Zecchin et al. (2011); Wang and Fu (2006); Wang et al. (2001); Ren et al. (2016); Gupta and Wang (2010); Zhu and Wang (2010); Park (2010); Teo et al. (2001); Ghazali et al. (2009). These approaches are significant additions to the forecasting problem since they have produced positive results in the data sets studied. However, we were unable to attain optimal results in all situations.

The fuzzy time series (FTS) established by Song and Chissom (1993) can close the gap indicated above, based on Zadeh (1965) fuzzy theory. FTS has since been studied and proven to be more efficient than traditional statistical techniques Song and Chissom (1993); Tseng and Tzeng (2002)). Abbasov and Mamedova (AM) proposed a model to anticipate the population of Azerbaijan using data fluctuations indicated by language level (Abbasov and Mamedova, 2003). The AM model has been used in a variety of applications due to its superior performance for certain types of forecasting issues; for example, Sasu used the AM model to forecast Romanian population Sasu (2010). Other important FTS research includes the models in Chen (2004), Huang (2001), and Singh (2008). Ha Che-Ngoc, Tai Vo-Van, Quoc-Chanh Huynh-Le, Vu Ho, Thao Nguyen-Trang, (2018) developed an enhanced Fuzzy Time Series forecasting model based on approaches for determining the





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## Estimation of HIV/TB Co-infection and HIV/AIDS in India: Application of truncated distributions

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### Abstract

This paper intends to study the general trend and distribution of deaths in the working-age population due to HIV-TB co-infection and HIV/AIDS. The data is collected from Institute for Health Metrics and Evaluation from 1991 to 2015 (GBD 2015). An attempt is made to fit the Doubly Truncated Normal Distribution, Doubly Truncated Lognormal Distribution and Doubly Truncated Weibull Distribution to the working-age population of five year block periods. Doubly Truncated Lognormal Distribution will fitted as compare to other distributions and its mean increased from one block period to next block periods in both the diseases. Lognormal distribution is consistent as compare to others and its probability curve indicates improvement in the life span of the people who live with HIV.

**Keywords:** HIV/AIDS, TB, Co-infection, doubly truncated probability distributions, MLE, measures of dispersion

### 1. Introduction

HIV and TB can individually be the major causes for public health threats and the combination of the two has proven to have a far greater impact on the epidemiologic progression and consequently on the global health scene. Due to this relationship there has been a dramatic increase in the incidence of tuberculosis in countries with a high prevalence of HIV and TB. TB is one of the most common causes of death from infectious disease is the world being second only to HIV/AIDS. Most deaths occur in developing countries, affect the young people in their productive years (Pande, J. N., 2004)<sup>[1]</sup>.

Human Immunodeficiency Virus (HIV) infection has become a pandemic far more extensive than what was predicted even a decade ago. The global spread has been so swift that no country has been spared and the pace of the epidemic is increasing in India (Kumariswamy, N. *et al.*, 2003)<sup>[2]</sup>. Tuberculosis remains the most common opportunistic infection and is the commonest cause of death in HIV infected patients. Clinical presentation of TB in early HIV infection resembles that observed in immune-competent persons but in a later stage, the clinical presentation of TB can be atypical. Co-infection with HIV leads to challenges in both the diagnosis and treatment of tuberculosis. Diagnosis of TB in HIV infected patients may be delayed because of atypical clinical presentation and involvement of inaccessible sites and low sputum smear positivity (Sharma, S. K., & Mohan, A., 2004)<sup>[3]</sup>.

TB is one of the symptoms of AIDS in more than 50% of cases in developing countries. TB reduces the survival of patients suffering from HIV infection, speeding HIV progression and causing death in one-third of AIDS worldwide. Due to the increase in viral replication of Mycobacterium Tuberculosis, the highest deaths have led to AIDS progression rather than TB (Swaminathan, S., & Narendran, G., 2008)<sup>[4]</sup>. According to the UNAIDS 2009 estimate, 33.4 million people living with HIV / AIDS, one-third of which also infect TB. HIV seropositivity has a vast difference in the TB patients in India, which is about 30% in Mumbai from 9.4% in Delhi (Narain, J. P., & Lo, Y. R., 2004)<sup>[5]</sup>.

Co-infection of HIV and TB is severely associated with malnutrition, drug abuse, alcoholism, unemployment, refugee, poverty and illiteracy (Ghiya, R. *et al.*, 2009)<sup>[6]</sup>. Among the risk factors for co-infection, heterosexual sexuality and occasional sexuality were seen by some Indian observers as the most important; others noted that most people were abusers of intravenous drugs (Bhagyabati, D. S. *et al.*, 2005)<sup>[7]</sup>.

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### Prediction of India's demographic and economic variables using the neural network auto-regression model

Bhramanath and MN Megeri

#### Abstract

Forecasting demographic and economic variables is an essential component of research that will help society and the government plan for the best or worst in the future. The data on demographic variables are collected from the Census of India and SRS publications, and economic variables are gathered from the Economic Survey of India from 1971 to 2020. The goal of this research is to forecast demographic and economic factors using the NNAR approach. Because statistical approaches such as the least RMSE training and testing values are used in the process of identifying this method, this research is expected to contribute to the neural network method coupled with the statistical method. The results of this study should be able to predict accurate demographic and economic characteristics. A Neural Network Auto-regression (NNAR) model is used to predict demographic and economic variables for the next ten years, with the best forecasting model being the NNAR (4,4), (4,4), (4,4), (11,6), (10,6), (10,6), (10,6), (15,6), (10,6), (6,4) models. The study's findings show that, except for GDP, all of the selected variables fit the NNAR model well and a comparison shows that the rural population is best fitted when using Mean Absolute Percentage Error (MAPE) when compared to the entire set of demographic and economic variables. The Rural population is the best-fitting model of the three populations; under-five mortality is well-fitting among vital rates; and age dependency ratio is the best forecasting in economic variables using mean absolute percentage error (MAPE).

**Keywords:** Artificial neural network, economic variables, population dynamics

#### 1. Introduction

Time series forecasting is an important field of forecasting in which historical observations of the same variable are gathered and examined to construct a model that explains the underlying relationship. The model is then utilized to forecast the future time series. This modeling method is especially beneficial when insufficient information about the underlying data generation process is available or when no suitable explanatory model exists that tie the prediction variable to other explanatory factors. Over the last several decades, much work has been put into developing and improving time series forecasting models.

Artificial neural networks (ANNs) are some of the most accurate and commonly used forecasting models, with several applications in forecasting social, economic, engineering, foreign currency, and stock market problems, and others. Given the benefits of artificial neural networks, it is not unexpected that this technology has inspired widespread interest in time series forecasting. Artificial neural networks (ANNs) have recently been extensively researched and employed in time series forecasting. The main benefit of neural networks is their capacity to do flexible nonlinear modeling. There is no need to define an exact model form while using ANNs. Rather, the model is developed adaptively based on the features offered by the data. This data-driven technique is suited for many empirical data sets when there is no theoretical guidance to propose an acceptable data generation procedure.

Artificial neural networks are a feasible alternative to some standard time series models (Chen, Yang, Dong, & Abraham, 2005; Giordano, La Rocca, & Perna, 2007; Jain & Kumar, 2007) [1-4]. [5]. Lapedes and Farber (1987) [7] describe the first attempt to use artificial neural networks to represent nonlinear time series. De Groot and Wurtz (1991) [8] provide a thorough examination

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## Growth and distribution of Socio-Demographic and Economic Variables in India using Time Series Trend Models

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### ABSTRACT

*The study of growth pattern of population is a very important phenomenon for framing population policy. The study of socio-demographic and economic variable plays an important role in population policies. In this paper, an attempt is made to study the growth and distribution of socio-demographic and economic characteristics for India. The selected socio-demographic and economic variables viz; Demographic indicators: Total, urban and Rural populations, Birth and Death rates, Infant Mortality rate, Under 5 mortality and Life expectancy at Birth and economic variables: Gross Domestic Product and Age dependency Ratio and Sociological characteristics are Sex ratio and Literacy rate in India from 1971 to 2020 are processed and analyzed by using the different time series trend models. The result of the analysis shows all three populations and Life expectancy at birth shows an increasing trend, vital rates are decreasing, socio-economic variables show an increasing pattern except age dependency ratio. The polynomial trend is best fitted to demographic variables except Rural population and CBR, economic variables and sociological variables.*

**Keywords:** Demographic, Economic, Sociological, Least Square Estimation, MAPE.

**Journal of Economic Literature (JEL) Classification System:** P25, Q56, J11, J13, E01, C32, C13.

### 1. INTRODUCTION

The study of the growth and distribution of the Socio-demographic and Economic variables is an important phenomenon to create infrastructure and basic needs of people. According to World Population Prospects (2019), the world's population continues to grow, although at a slower pace than at any time since 1950, due to reduced levels of fertility, an estimated 7.7 billion people worldwide in 2019, the projection indicates that the global population could grow around 8.5 billion by 2030, 9.7 billion by 2050, and 10.9 billion by 2100. Two-thirds of the projected growth of the global population through 2050 will be driven by current age structures and would occur even if childbearing in high-fertility countries falls immediately around two births per woman over a reproductive period.

## Estimation and Forecasting of Urban Population of Male and Female for Different Regions of India Using Growth Models

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### ABSTRACT

*The region wise study of urbanization of India is an important phenomenon to understand the urbanization with socio-demographic characteristic of the nation. In the present study, India is divided into five regions viz. Northern, Southern, Eastern, Western and Central regions with respect to gender. The data for the study is collected from census of India from 1901 to 2011 census. For estimation of urban population for male and female two growth models are used- Modified Exponential and Gompertz models, the parameters of the models are estimated by using Method of Partial Sums and testing of accuracy and bias, MALPE and MAPE is calculated. The analysis of the study shows Western region shows highest level of urbanization whereas Eastern region has lowest level, estimation and forecasting results of the model demonstrates that modified exponential model good fit compared to Gompertz model for all the regions except male and total urban population in eastern region, measure bias shows Modified exponential shows underestimates and Gompertz shows overestimates for all regions of India except Eastern Region as this region shows overestimate for both the curves.*

**Keywords :** Urbanization, Regional development, Growth models, Estimation and Forecasting, MAPE & MALPE.

**Journal of Economic Literature (JEL) Classification System :** P25, P48, O41, C53, C13 and C32.

**Mathematics Subject Classification :** 34L15, 11D68.

### 1. INTRODUCTION

Urbanization is a process of shift of labour and capital predominantly from rural to urban activities during the process of development. It is predominantly the process by which towns and cities are formed and become larger as more people live and work in central areas. Globally, according to World Urbanization Prospect (2018), about 55 per cent of the population lives in urban area. The World's urban population has grown rapidly from 751 million to 4.2 billion in the year 1950 to 2018. About 68 per cent of the population is expected to increase by 2050. The world's urban population got further increased in the size accounting for 35 per cent of the projected growth between 2018 and 2050 and is expected to be highly concentrated in few countries of the World viz, India, China, and Nigeria.

**IDENTIFICATION OF REGIONAL DISPARITIES IN NORTH KARNATAKA: A SPATIO-TEMPORAL ANALYSIS**

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**Abstract**

Disparity is not merely rooted in developing countries but also in the most advanced countries of the world. The degree of disparity is highly is from region to region, society to society, sector to sector and the like. Since, some regions are developed economically, but backward socially, whereas some other are developed socially and backward economically, therefore, becomes essential to study the level of socio-economic development over different regions so as to ensure the removal of regional imbalances effectively. In the developed economics all the inhabitants have an assured minimum level of subsistence, and the problem of in front of lagging regions of such economics is just to catch up the leading one, but in the developing countries the basic problem is that how to provide minimum level of subsistence to their teeming millions (Chand, M. & Puri, V. K., 1990). In the present study the regional disparities in the north Karnataka is carried out with the aiming that to identify the backward blocks of the North Karnataka and an attempt is also made to find out the correlation between different factors which lead to regional disparity. The study is based on secondary data collected from Census handbook, (2001 and 2011), Dr. D M Nanjundappa Committee Report, and Economic Survey of Karnataka etc. The comprehensive composite index has applied to find the region into four groups viz, areas of developed, Backward, more backward and most Backward. Out of 60 taluks thirty taluks have been identified as developed with CI > 0.99, 21 taluks fall in this in 2000 which accounts 21 (26.25%) of the of the taluks in the study area and in 2015, 16 taluks reported. 16 taluks named as Backward taluks with CI Value between 0.89 and 0.99. There were Seventeen taluks noticed under areas of more Backwards with CI value from 0.79 to 0.88 and twenty-six taluks have been observed under areas of Most Backward with CI value < 0.79, correlation matrix calculated to see the association of different indices for the year 2000 and 2015 accordingly there exists a strong positive statistically significant association with all the indices in both selected time periods and Social infrastructure index also has strong positive association with all the indices except, except agriculture all the indices are inter linked. It means development in one sector contribute for the development of other sector.

**Keywords:** Agriculture and allied, Regional Disparity, Areas, Developed, Backward, Spatial, CCDI, Correlation

**Introduction**

It is worth noting fact that the process of development is gradually taking place in the world. In fact, it is low of nature that each and every phenomenon of development cannot be equalized with one another, therefore the rate and state of development varies from region to region, society to society, sector to sector etc. As the rate of development varies from region to region that is why large scale regional disparities in the levels of development can be seen. Regional disparities in development countries have reached to a greater extent that the state of "global disparities between rich and poor is becoming central issue of our time" (English, P.W. 184). Regional disparities have become one of the most important glaring and growing problems not only in developing countries but also in most advanced country of the world. Since, some regions are developed economically but backward socially, whereas some other are developed socially and backward economically, therefore, it becomes essential to study the level of socio-economic development over different regions so as to ensure the removal of regional imbalances effectively. Here, question is to know that what differentiates the problem of regional disparities in between developing and developed countries.



# Concentration of Settlement in Vijayapura District Using Quadrats Technique

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**Abstract:** India is a country where nearly two-third of the population lives in rural areas and enlightens the rural areas is the lifeline of India. Before going to achieve this goal and utilize the full potentiality of village resources it is essential to explore rural areas in terms of their size, distribution and pattern of rural settlement. This paper examines the spatial point pattern settlements of rural communities in the Vijayapura District. The study consists of 698 villages with 10,498 Sq Kms area. Spatial analysis was performed by using quadrat analysis and spatial autocorrelation of points. The associated physical environment was integrated with GIS to identify the patterns in the relationship of household locations affected by a particular facility. 42 quadrats with one square inch map have been prepared by using the GIS software for the analysis of settlement concentration, in addition to this, Settlement concentration index and Average distance of settlements (spacing) have been found. The result of quadrats method shows the settlements variance mean ratio (VMR). If VMR value is  $< 1.0$ , the distribution pattern is regular, If VMR value is  $= 1.0$ , the distribution pattern is random, If VMR value is  $> 1.0$  the distribution pattern is clustered, the result of VMR value of study area is 8.73. Since the calculated value of the study area is greater than 1.0 this shows that the distribution of settlement is clustered in space. The concentration index values have been grouped under five categories. The first group values range between 0.01 and 2.50 where none of the settlements exists in this group, the second group range 2.51 to 5.00 which consists 6 quadrats which includes 66 settlements from different taluks. This group stands fifth rank in Concentration Index ranking. The third group range 5.05 to 7.50 which contains 4 quadrats, which 105 settlements of different taluks of the Vijayapura district and it falls under fourth rank. The third range value is 7.51 to 10.00 comprises of 15 quadrats, which includes 346 settlements of different taluk and it stands third rank in the concentration index groups. The fifth and sixth group value 10.01 to 12.50 and 12.51 to 15.00 having 3 quadrats, each and includes 84 and 89 settlements respectively and stands second and first ranks respectively. Although the spatial pattern of settlements in the Study Area is generally clustered, but in some taluks per square settlement densities kilometers is low for example the density of Tikotataluk is 0.036/sq. kms where as Muddabihal and Nidagundi taluks have greater settlement density i. e., 0.109/sq. kms. As quadrats like Q-21, Q-30, Q-34, Q-35, Q-40 and Q-41 are high density quadrats which cover Vijayapura, part of Talikoti, small area of RsavanaHagrowal, equal portion of Nidagundi and Muddabihal. The analysis shows that Vijayapura Tahsil having the highest concentration index and has the highest occupied area as well (42.27 Sq Km), with an index value of 4.723, which accounts 28.63 percent of the total occupied area. The lowest concentration index has been recorded in Tikota taluka with 7.57 sq. km and the index value is 0.867 which contributes 5.127 percent of the total occupied area. Therefore, settlements are largely concentrated in favored sites where easy availability of ground water, rail and road tracks, fertile soil and accessibility to trading centers.

**Keywords:** Spatial point patterns, Quadrats Analysis, GIS, GPS, Geospatial Database, Superimposed

## 1. Introduction

The geography of rural settlements is a recent sprout of the vulnerable trunk of Geographical Science (Majid Hussain 1998). Although the scientific methodology on various aspects of habitations was not developed until the present century. Its antecedents may be traced in important writings which developed gradually increasing attention to human habitations from geography first began its modern moorings in the 19<sup>th</sup> and 20<sup>th</sup> century.

Settlements are a concrete expression of human occupation of the earth's surface and they form an essential element of the landscape (Hagerstrand, 1957). These settlements are noted to exhibit certain distribution pattern over space. Several evolution and distribution models advanced by Bylund (1960), Morrill (1962), Chisholm (1962), Hudson (1969) and Christaller (1933) have explained how settlements evolved over time, space and the principles/factors behind their distribution pattern. The

theoretical advancement of these models, coupled with the empirical findings of authors like Dacey (1962) and Rayner and Golledge (1972), help establish three major settlement distribution patterns in the literature-regular, random and clustered.

The emergence of a given spatial pattern of settlements is ascribed to both physical and human factors. The physical factors have to do with the terrain and the distribution of natural resources – soil, water and mineral wealth that attract and influence settlement location. On the other hand, the human factors include cultural dictates and warfare, which influence cluster or disperse living as well as the rise, fall and migration of settlements respectively. Whatever the factors of location and pattern, analysis of spatial distribution of settlements is of great importance to both the geographers and planners. This is because the exercise gives an insight into the spatial character of settlements as important landscape elements and provides ample data for their planning and management.

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SPATIAL PATTERN OF MARGINAL WORKING POPULATION IN KARNATAKA (INDIA)

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ABSTRACT

The total working population of Karnataka state can be divided into main workers and marginal workers. For this study the total marginal workers has been selected. During 1991 census, Karnataka state had 15,94,681 total marginal workers which was 8.44% of total working population. During 2001 census, this number increased to 41,70,032 which was 17.72% of the total marginal working population.

KEYWORDS : Karnataka, Marginal Worker, Talukwise, Total Workers

Introduction

The marginal workers are those who work any time of the year. Preceding the date of enumeration but did not work for a major part of the year. In other words those who worked for less than 183 days or 6 months were classified as marginal workers.

Study Area

Karnataka state is located between 11°35' North Latitudes to 17°30' North Latitudes and 74°50' East Longitudes to 78°35' East Longitudes. The state is bounded by Maharashtra state and Goa state in the North and North West respectively; Kerala and Tamil Nadu states in the South; Andhra Pradesh state in the East while Arabian Sea in the West. (Fig. 1)

LOCATION MAP OF STUDY AREA



Fig.1

Objectives

The main objective of the present study is to deal with marginal workers, the talukwise analysis of marginal working population data of 1991 and 2001 census.

Methodology

The present study is based on secondary data. The data is collected from Census of India, Karnataka State and District at a Glance. By using LQI, Mean and S.D. method five classifications are done for marginal workers. The Karl Pearson's correlation method is used.

Total Marginal Working Population

According to 2001 census the marginal workers are those who worked any time in the year. Preceding the date of enumeration but did not work for a major part of the year. In other words those who worked for less than 183 days or 6 months were classified as marginal workers. The marginal workers might have worked in different capacities or had different economic activities during the year and the time spent in performing each different spells of a economic activity might not be the same and there could even be breaks in between different types of work performed. The details

regarding marginal workers are explained in the beginning of chapter three.

During 1991 census Karnataka state had 15,94,681 total marginal workers, which was 8.44% of total working population (Table-1 & Fig. 2). During 2001 census this number increased to 41,70,032 which was 17.72%. The increase of marginal worker is a natural feature due to increase in total population (Table-2 & Fig. 3).

1. Very High Range of Total Marginal Working Population

During 1991 census very high range of marginal workers in the range of 20.29% and above were noticed in 5 taluks namely Bellary in the Tungabhadra basin, while Chikkanayakanahalli, Krishnarajpet, Turuvikere, Holenarasipur and Channarayapattana in south Karnataka. During 2001 period in very high range of 31.99% and above 4 taluks are noticed in the total marginal workers category. These 4 taluks are Devadurg and Lingasur in north Karnataka, Siddapur in the north western ghat and Yalander in the southern most boundary of Karnataka.

Table-1: Karnataka State - Total Marginal Working Population Percentage to the Total Working, as per the data of 1991 Census (Total Marginal Working Population = 15,94,681)

Taluk	Total Marginal Working Population	Total Working Population	Percentage (%)
Bellary	2,10,000	1,035,000	20.29
Chikkanayakanahalli	1,50,000	1,800,000	8.33
Krishnarajpet	1,20,000	1,400,000	8.57
Turuvikere	1,00,000	1,200,000	8.33
Holenarasipur	80,000	950,000	8.42
Channarayapattana	70,000	830,000	8.43
Other Taluks	12,44,681	1,48,000,000	8.44
<b>Total</b>	<b>15,94,681</b>	<b>1,89,000,000</b>	<b>8.44</b>

Table-2: Karnataka State - Total Marginal Working Population Percentage to the Total Working, as per the data of 2001 Census (Total Marginal Working Population = 41,70,032)

Taluk	Total Marginal Working Population	Total Working Population	Percentage (%)
Devadurg	1,20,000	375,000	31.99
Lingasur	1,00,000	312,500	31.99
Siddapur	80,000	250,000	31.99
Yalander	70,000	218,750	31.99
Other Taluks	40,50,032	2,31,000,000	17.72
<b>Total</b>	<b>41,70,032</b>	<b>2,33,000,000</b>	<b>17.72</b>



TALUKAWISE ANALYSIS OF MAIN HOUSEHOLD INDUSTRIAL WORKING POPULATION IN KARNATAKA STATE (INDIA)

Geography

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ABSTRACT

Main household workers were those who had worked for the major part of the year preceding the date of enumeration i.e. those who were engaged in any economically productive activity for 183 days or more, or six months or more during the reference period of one year. Main Household Industry is defined as an industry conducted by one or more members of the household at home or within the village in rural areas and only within the precincts of the house where the household lives in urban areas. The larger proportion of workers in the household industry consists of members of the household. The industry is not run on the scale of a registered factory which would qualify or has to be registered under the Indian Factory Act.

KEYWORDS

Karnataka, Talukawise, Main Household, Industrial, Working Population

Introduction

Household industry related to production, processing, servicing, repairing or making and selling (but not merely selling) of goods.

Some of the typical industries that can be conducted on a household industry basis are - Foodstuffs: such as products of flour, milking, grinding of herbs, production of pickles, etc. Beverages: such as ice cream, soda, water, etc. Tobacco products: such as beedi, cigars, etc. Textile: such as cotton, jute, wool or silk, manufacture of wood & wood products, paper & paper products, leather products, petroleum & coal products, chemical products, etc.

Study Area

Karnataka state is located between 11°35' North Latitudes to 18°30' North Latitudes and 74°30' East Longitudes to 78°35' East Longitudes. The state is bounded by Maharashtra state and Goa state in the North and North West respectively; Kerala and Tamil Nadu states in the South; Andhra Pradesh state in the East while Arabian Sea in the West (Fig. 1)

LOCATION MAP OF STUDY AREA



Fig. 1

Objectives

The present research paper is to make talukawise analysis of total main household industrial workers of Karnataka state with its five classifications such as rural and urban main household industrial working population.

Methodology

The talukawise total main household industrial workers are based on secondary data collected from census of India and Karnataka state at a glance. By using Mean and S.D. method five classifications are done. The correlation method is used.

Total Main Household Industrial Workers

The household industry as defined in the beginning pages of this third chapter includes all such industries as defined.

In the household industry in rural areas is confined to the house of an

industrial worker and are within the premises of that village. In urban areas also, it is confined to a house. It can include one or more workers in urban area if the household industry is located outside the house then it is not considered as household industry.

During 1991 census, the total household industrial main workers Karnataka were 3,22,151 (1.86%) (Table-1 & Fig. 2). During 2001 census, the total number of total household industrial main workers increased to 7,95,212 (4.11%) (Table-2 & Fig. 3).

Table 1. Karnataka State - Total Main Household Industrial Workers (Percentage of the Total Working Population in all the States of 1991 Census)

State	Total Main Household Industrial Workers (1991)	Percentage of Total Working Population (1991)
Andhra Pradesh	1,12,000	1.25
Assam	1,00,000	1.10
Bihar	1,20,000	1.30
Chhattisgarh	1,30,000	1.40
Goa	1,40,000	1.50
Gujarat	1,50,000	1.60
Haryana	1,60,000	1.70
Karnataka	3,22,151	1.86
Kerala	1,70,000	1.80
Madhya Pradesh	1,80,000	1.90
Maharashtra	1,90,000	2.00
Madhya Pradesh	2,00,000	2.10
Rajasthan	2,10,000	2.20
Tamil Nadu	2,20,000	2.30
Uttar Pradesh	2,30,000	2.40
West Bengal	2,40,000	2.50

Table 2. Karnataka State - Total Main Household Industrial Workers (Percentage of the Total Working Population in all the States of 2001 Census)

State	Total Main Household Industrial Workers (2001)	Percentage of Total Working Population (2001)
Andhra Pradesh	1,20,000	1.30
Assam	1,10,000	1.20
Bihar	1,30,000	1.40
Chhattisgarh	1,40,000	1.50
Goa	1,50,000	1.60
Gujarat	1,60,000	1.70
Haryana	1,70,000	1.80
Karnataka	7,95,212	4.11
Kerala	1,80,000	1.90
Madhya Pradesh	1,90,000	2.00
Maharashtra	2,00,000	2.10
Madhya Pradesh	2,10,000	2.20
Rajasthan	2,20,000	2.30
Tamil Nadu	2,30,000	2.40
Uttar Pradesh	2,40,000	2.50
West Bengal	2,50,000	2.60



1. Very High Range of Main Household Industrial Workers During 1991 period, in the very high range of household industrial





**ORIGINAL RESEARCH PAPER**

**Geography**

**ANALYSIS OF RURAL MALE MAIN AGRICULTURAL LABOURERS IN KARNATAKA (INDIA)**

**KEY WORDS:** Karnataka, Rural, Male, Agricultural, Labourers.

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**ABSTRACT** During 1991 census the rural total main agricultural labourers was 46,42,907 (35.93%). During 2001 census rural main agricultural labourers decreased to 35,50,388 (26.37%). During 1991 census, Karnataka state had 26,12,301 total male main agricultural labourers. This was 80.25% to the total main agricultural labourers. During 2001 census, this number was 19,61,368 i.e. 51.84% of the total main agricultural labourers. During 1991 census the total rural male main agricultural labourers in Karnataka were 23,03,813 (49.62%), while during 2001 census their number decreased to 18,27,634 (51.48%).

**Introduction**

The rural main agricultural labourers are not marginal workers, instead they are doing labour works in the agricultural lands of other owners, yet they can work throughout the year. He has no risk in the cultivation, but merely works on another person's land for wages. An agricultural labourer has no right of lease or contract on land on which he works.

**Study Area**

Karnataka state is located between 11°35 North Latitudes to 18°30 North Latitudes and 74°50 East Longitudes to 78°35 East Longitudes. The state is bounded by Maharashtra state and Goa state in the North and North West respectively, Kerala and Tamil Nadu states in the South, Andhra Pradesh state in the East while Arabian Sea in the West. (Fig. 1)

**LOCATION MAP OF STUDY AREA**



**Fig. 1**

**Objectives**

1. Working population provides bread and butter to the entire population.
2. The present data deals with working population data of Karnataka.
3. The talukewise analysis of male main agricultural labourers population data of 1991 and 2001 census.

**Methodology**

The secondary data required for the study were collected from Census of India and Karnataka State at a Glance. By using Mean and Standard Deviation Method five classifications are done. The data of total 175 taluks were collected.

**Rural Male Main Agricultural Labourers**

During 1991 census the total rural male main agricultural labourers in Karnataka were 23,03,813 (49.62%) (Table-1 & Fig. 2), while during 2001 census their number decreased to 18,27,634 (51.48%).

**I. Very High Range of Rural Male Main Agricultural Labourers**

There were 4 taluks during 1991 census in very high range of rural male main agricultural labourers with 83.81% and above. Out of these 4 taluks, 3 taluks viz. Balihangadi, Bantaval and Futur are in south-western parts of western ghats, while one taluk i.e. Chamarajnagar is located in down south of Karnataka. During 2001 census in very high range with 67.62% and above, 7 taluks are noticed. These are located in south-west part of southern most part and one taluk i.e. Kunta in the north-west coast (Table-2 & Fig.3).

**Table 1. Karnataka State - Rural Male Main Agricultural Labourers**  
Percentage in the Total Male Main Agricultural Labourers to the State of 1991 Census  
Rural Male Main Agricultural Labourers - 1991 (1991 Census)

Taluk	Number of Labourers	Percentage (%)
Balihangadi	1,80,000	83.81
Bantaval	1,50,000	65.14
Futur	1,20,000	52.17
Chamarajnagar	1,00,000	43.43

**Table 2. Karnataka State - Rural Male Main Agricultural Labourers**  
Percentage in the Total Male Main Agricultural Labourers to the State of 2001 Census  
Rural Male Main Agricultural Labourers - 2001 (2001 Census)

Taluk	Number of Labourers	Percentage (%)
Kunta	1,50,000	67.62
Balihangadi	1,20,000	52.17
Bantaval	1,00,000	43.43
Futur	80,000	35.54
Chamarajnagar	60,000	26.65







### Locational Pattern Of Slums In Haveri District: A Geographical Analysis

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#### ABSTRACT:

The growth of slums in urban area is one of the major issues for urban development authority. In Haveri district, slums are located in private, government, municipal and local government land. Slums dwellers are living near the workplace and are found near the market place, Bus stand, Railway station and industrial area etc., in Taluks like Haveri, Ranebennur and Byadagi. In Haveri district there are 8 taluks, 9 urban local bodies and 19 revenue circles. In the district there are 86 slum areas which are found in notified and non-notified areas. In the present study an attempt has been made to know the locational pattern and distribution of slums in Haveri district.

*Key words:* Slum, Notified, Non-notified, Locational patter

#### Introduction:

There are various causes which led to the growth of cities/towns like industrialization, migration, modernization, social, economic, religious and political factors. Migration of unskilled and uneducated people are the main reason for overcrowding in an urban area. An urban area has limited amenities. Due to overcrowding, migrants, suffer from lack of affordable housing with basic facilities, which creates problem of poverty among them. The poverty stricken people start to reside in congested, unhygienic and less basic infrastructure of settlements, which promotes the proliferation of urban slums.

"Slums are the areas or pockets within or outside municipal limits where poverty stricken rural migrants finds shelter and search for their work and livelihood make necessary adjustment with urban life and gets minimum life supporting conditions at affordable rate. Sometimes such areas are also termed as urban poverty pockets. This definition encompasses a wide variety of low-income settlements and poor human living conditions and includes old residential areas" (Un-Habitat, 2002). "The process of slum formation also appears to have global community. Rural-urban migration, change in urban land use pattern, local zones or residence, variations in rental values, proximity to work place, housing shortage, maintenance problem and slum clearance policies in certain areas have been referred as factors leading to the theories of slum formation" (Cinard, 1966).

#### Study Area:

Haveri district emerged as a new district in Karnataka, which came into existence on 24-08-1997 consisting 08 taluks. It covers an area of 4823 sq.km. The district is located between 14 19 to 15 09 North latitude and 75 01 to 75 05 East longitude and it has an average elevation of 592 metre. It has a length of 39 km from East to West and North to South about 19 km. It has total population of 15,97,668 as per 2011 census. The district is bounded on the north by the districts of Dharwad and Gadag, on the south by the districts of Davanagere and Shimogga and in the west by the district of Uttara Kannada.



## "LAND-USE UNDER MAJOR FOOD CROPS AND THEIR PRODUCTIVITY IN DHARWAD DISTRICT OF KARNATAKA STATE: A GEOGRAPHICAL ANALYSIS"

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**ABSTRACT** India is rich in Agricultural resources and yet, has remained poor because of stagnation in the substance agricultural economy and undue reliance upon it. Agriculture is not only an important economic activity but also a form of social heritage and a way of life for the millions of Indian farmers. In some parts of India, progress in irrigation and farm practices have touched the basic problems of low agricultural productivity and rural poverty. Climate is one of the major physical factors influencing an Indian agriculture. Due to uncertainty of monsoonal rains, agriculture in India is not developing uniformly besides other constraints like quality of soil and infrastructural facilities. Therefore, Geographers can certainly play their role in understanding the problems of land use and agriculture of all the regional level like macro, meso and micro. In this regard Dharwad district, which is agglomeration of wet and dry weather features and also the mixture of different soils and irrigated and dry cropping system represents a typical region to study the agricultural geography in general and agricultural productivity in particular.

**KEYWORDS** † Agriculture, land-use, net sown area, production, productivity, taluka.

### Study Area:

Dharwad District is an administrative district of the state of Karnataka in southern India. Dharwad is the cultural heritage of the headquarters of south Karnataka. The administrative headquarters of the district is the town of Dharwad. Dharwad district is extending between 14°-45' North to 17°-33' North Latitudes and 74°-45' East to 75°-30' East Longitudes with an area about 4,249 Sq km which accounts 2.22 per cent of the total area of the state. The district is bound on the north by the district of Belagavi, on the east by the district of Gadag, on the south Haveri and on the west by Uter Kannada district. All these districts, which surround Dharwad district, belong to Karnataka state itself (Fig 1). The district lies approximately about 800 meters above the Mean Sea Level that is why it enjoys a moderate and healthy climate. Geologically most of the rocks of the peninsular part of India are very old and complex, and possess a large variety of rock formation of different geological ages. The western extremities are characterized by Dharwad shale. The district may be divided into 3 natural regions, viz., the Malnad, Kanni-Malnad and Maidan. These regions, on an average, receive moderate to heavy rainfall and have dense vegetation. Alnavar, Dharwad, and Kalghatgi taluka in particular receive more rainfall than other taluka of the district. Administratively it consists of 8 taluka viz. Alnavar, Anargoti, Dharwad, Hubballi Nagar, Hubballi, Kalghatgi, Kamdagol and Navalgund, 6 urban agglomerations, 127 village panchayats, and 379 inhabited villages. As per the 2011 census the total population of the district is 1846993, out of which 939127 male and 907866 is the female population, while 45.02% of rural and 54.97% urban population, the density of the population of Dharwad district is 434 persons/per sq km. The literacy rate in Dharwad district is 80.50%, while sex ratio is 971 females per 1000 males. The district is a place for people belonging to various religions like Hinduism, Islam, Jainism and Christianity. The study area is distributed to three important river tributaries viz. the Honnaihalla basin which covers Navalgund, Anargoti and Hubballi taluka, and Bedti and Yantihalli covers Dharwad and Kalghatgi taluka. These three tributaries drain about 27 per cent of the total area under study, and play an important role in the irrigation facilities of the area. On the agricultural front, the presence of black soil helps in raising crops like cotton, wheat, sugr, jowar, pulses and oilseeds and that of red soil is more suitable for paddy.

### OBJECTIVES:

1. To study the taluka wise general land use in Dharwad district during 2020-21.
2. To examine the taluka wise selected cropping system in Dharwad district during 2020-21.
3. To examine the M. G. Kowal's ranking method applied to productivity of allias and/or food crops.

### DATABASE AND METHODOLOGY:

The above objectives have been analyzed with the help of categorization of maps by using mean and standard deviation method, Kowal's ranking method pie charts and choropleth method have been used in this paper. The secondary data collected from

District Statistical office, Dharwad and Agriculture Department published by the Directorate of Economics and Statistics, Government of Karnataka.

### DISCUSSION:

As our country is located in the tropical latitudes, rainfall is the dominant parameter that influences plant growth, crop production, and socio-economic activities. The distribution of rainfall is uneven and is generally influenced by its relief features. The average annual rainfall ranges from 787 mm in the Malnad region to 1319 mm in the Malnad. Though the study region is exposed to both the monsoon, it receives more of the rainfall from the south-west monsoon. The monsoon usually starts from the first week of June. It clearly exhibits that Alnavar (1319mm), Kalghatgi (1221mm) and Dharwad (1081mm) taluka get highest rainfall from the south west monsoon. The other taluka have got less than district average rainfall (1009 mm) in 2020-21. The district has only small tributaries and non-perennial rivers like Shalmoia, Honnaihalla and Tapparihalli these streams which flow mainly in rainy season. An evaluation of the aspects of irrigation in Dharwad district has been made in detail in order to understand the role and impact of irrigation on development of agriculture and its efficiency. According to 2020-21 statistics, the district has 323330 hectares (76.18%) of land as net sown area, and out of which 62403 hectares of land under irrigation i.e. 19.16%, in this district, the two sources of irrigation have been experiencing by the farmers, namely the Canal irrigation and the Tube well irrigation. Navalgund is the leading taluk under net irrigated area with 37.74 % of land under irrigation out of 61536 hectares of its net sown area. The river Malavahalli right bank canal flows in this taluk and thereby it has good chance to get more water from this canal. Alnavar and Dharwad taluka also gives their good facility of Tube well irrigated area with 40.62 % and 24.77 % respectively. Land under irrigation out of 5340 hectares and 10699 hectares of their net sown area, these two taluka are coming under Malavahalli and heavy rainfall zones. Remaining taluka viz. Kalghatgi (10.00%), Hubli 8.31%, Anargoti 3.04%, Kamdagol 2.00%, and Hubballi Nagar 1.33%, have their lands under irrigation.

### General Land Use:

Land use is the surface utilization of all developed and vacant lands on a specific space at a given time. Lands are used for crops, forest, pasture, mining, transportation, garden, residential recreational, industrial and commercial. Whereas uncultivable wasteland, barren and fallow land are unused land. Land use is also related to conversion of land from one major use to another general use. The use of land changes according to the changing needs of man. The district has total geographical area of 427329 hectares. Out of which 8.24% of land under forest. The net sown area accounts for 76.18% the non-agriculture land is 6.96%, the fallow land is 7.10% and uncultivable waste land is 0.02%, permanent pasture and trees and groves is 0.04%. From the above data it reveals that, the district has good percentage of land under agriculture. The forest land is more concentrated in these taluka viz. Alnavar (38.37%), Kalghatgi (28.10%), and Dharwad (18.27%) taluka respectively.



ORIGINAL RESEARCH PAPER

Geography

"SPATIAL ANALYSIS OF IRRIGATION AND MAJOR OILSEEDS PRODUCTION AND PRODUCTIVITY IN DHARWAD DISTRICT OF KARNATAKA STATE."

KEY WORDS: Agriculture, Irrigation, Oilseeds, Emen Area, Taluka, Production, Yield.

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ABSTRACT

Agriculture is not only an important economic activity but also a form of social heritage and a way of life for the millions of Indian farmers. Irrigation is playing an important role on growing the oilseeds sector, there is an urgent need to find out ways to increase water supply. In this regard Dharwad district, which is aglomeration of wet and dry weather features and also the mixture of different soils and irrigated and dry cropping system represents a typical region to study the agricultural geography in general and major oilseeds in particular. Edible oilseeds cultivation in India is an integral part of agricultural system, as edible oilseeds are part of food item for the human population. The cultivation of oilseeds are found in all taluks of Dharwad district where annual rain fall to extent of 78 cm is available, besides the availability of irrigation in some parts, coupled with availability of black and red soils that have favored the cultivation of oilseeds.

INTRODUCTION:

Agriculture without irrigation is areas having less than fifteen centimeters rainfall, is a suicidal uneconomic venture. The increasing demand of water for agriculture may be met by intensive and extensive use of the available water resources. Thus, one of the major purposes of enquiry of the available water resources is to define the regional pattern of their quality, quantity and utilization. In fact, there are three sources of water available to men i.e. surface water, ground water and ocean water. Thus, the surface water in the form of rivers, streams, and lakes are the most important sources to be used for irrigation purpose. The uses of irrigation are conditioned by several variables. "While low rainfall and its variable nature necessitates the development of artificial means of moisture supply, the increasing use of fertilizers and to some extent of improved variety of seed make timely needs of water prerequisite."

Study Area:

Dharwad District is an administrative district of the state of Karnataka in southern India. Dharwad is the cultural headquarters of north Karnataka. The administrative headquarters of the district is the town of Dharwad. Before 1997 the district had an area of 13738 Sq km. In 1997, the Dharwad district was bifurcated and new districts of Gadag and Haveri were created out of Dharwad's former territory. It is claimed that Dharwad is second-most advanced district in Karnataka. Dharwad district is extending between 14°-45' North to 15°-35' North Latitudes and 74°-45' East to 75°-30' East Longitudes with an area about 4,249 Sq km which accounts 2.22 per cent of the total area of the state. The district is bound on the north by the district of Belgaum, on the east by the district of Gadag, on the south Haveri and on the west by Uter Karnataka district. All these districts, which surround Dharwad district, belong to Karnataka state itself (Fig 1).

The district lies approximately about 800 meters above the Mean Sea Level that is why it enjoys a moderate and healthy climate. Geologically most of the rocks of the peninsular part of India are very old and complex, and possess a large variety of rock formation of different geological ages. The western extremes are characterized by Dharwad shale. The district may be divided into 3 natural regions, viz. the Malnad, Semi-Malnad and Maidan. These regions, on an average, receive moderate to heavy rainfall and have dense vegetation. Kalghatagi, Anavar, and Dharwad taluks in particular receive more rainfall than other taluks of the district. Administratively it consists of 8 taluks viz. Anavar, Anzigeri, Dharwad, Hubballi Nagar, Hubballi, Kalghatgi, Kandgol and Navalgund, 6 urban agglomerations, 127 village panchayats, and 375 inhabited villages. As per the 2011 census the total population of the district is 1846393, out of which 839127 male and 907866 is the female population, while 45.02% of rural and 54.97% urban

population, the density of the population of Dharwad district is 434 persons/per sq km. The literacy rate in Dharwad district is 80.30%, while sex ratio is 971 females per 1000 males. The district is a place for people belonging to various religions like Hinduism, Islam, Jainism and Christianity. The study area is distributed in three important Malaprabha river tributaries viz. the Sennihalla basin which covers Navalgund, Anzigeri and Hubballi taluks, and Bedri and Tamhall covers Dharwad and Kalghatgi taluks. These three tributaries drain about 37 per cent of the total area under study, and play an important role in the irrigation facilities of the area. On the agricultural front, the presence of black soil helps in raising crops like cotton, wheat, ragi, jowar and oilseeds and that of red soil is more suitable for paddy.

OBJECTIVES:

- i) To study taluka wise intensity of irrigation in Dharwad district.
ii) To study the taluka wise net sown area, Production and productivity of total oilseeds in Dharwad district.

METHODOLOGY AND DATA BASE:

Secondary data has been collected for the district, for the year 2020-21. Simple techniques have been used to analyzed secondary data and based on the results, maps and diagrams are shown.

Dharwad District Location Map

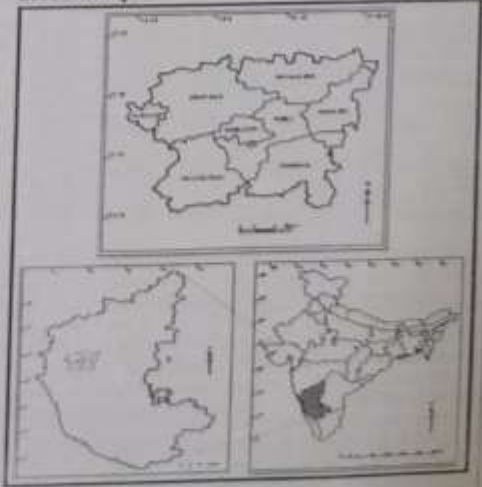


Fig-1



## Groundwater Quality Assessment in Lingasugur Taluk, Karnataka Using Water Quality Index and Geographic Information System

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The study of groundwater quality in Lingasugur taluk of Raichur district has resulted in a large hydrochemistry data which is here simplified with the water quality index (WQI) for better understanding of the overall quality parameters alongwith the categorized areal extent. A total of 116 groundwater samples have been collected in each season of pre-monsoon and post-monsoon to study the hydrochemistry as well as seasonal variation in the physico-chemical parameters. The collected groundwater samples were analyzed for physical characteristics, such as pH, EC and TDS alongwith the chemical major ions, like  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{NO}_3^-$  and  $\text{F}^-$ . The correlation analysis has been carried out to understand the geochemical processing controlling groundwater geochemistry. The water quality index (WQI) values were categorized into six classes and mentioned the statistical data accordingly. The result suggests that the overall quality of the study area is suitable for irrigation and industrial use whereas only 6% and 4% of the water samples are suitable for drinking purposes during pre-monsoon and post-monsoon seasons, respectively. This study illustrates the usefulness of WQI and understanding the water quality alongwith the extent of the contamination.

### KEYWORDS

Eastern Dharwar Craton, Lingasugur, Water quality index, Geographic information system, Inverse distance weighted, Spatial distribution

### 1. INTRODUCTION

Groundwater is a valuable natural resource and an imperative part of hydrological studies [1]. In the voluminous distribution of water in the world, groundwater constitutes only 0.75% on which the maximum population is dependent [2-5]. However, groundwater resource is facing problems as quality hazard primarily due to exposure from the intensive use of fertilizers in agriculture and uncontrolled urban discharge that makes the groundwater unfit for human consumption [6,7]. The current investigation has been undertaken to analyze the physico-chemical characteristics of the groundwater of Lingasugur taluk, Karnataka. The motto of the study is to understand the spatial and seasonal variations in the analyzed hydrochemical observation of the groundwater using water quality index (WQI) and geographic information system (GIS).

#### 1.1 Study area

The Lingasugur taluk of Raichur district is located in the Eastern Dharwar Craton (EDC) between  $16^{\circ}03'50''$  and  $16^{\circ}21'35''$  N latitude and  $76^{\circ}20'30''$  and

$76^{\circ}45'50''$  E longitudes; covers an area of 1965  $\text{km}^2$ . The study area is categorized under semi-arid climatic conditions with extended hot dry summers. The annual average precipitation in the area is 608 mm. The Basavasagar dam is located in the north-western corner of the study area and water channels are spread in the northern area; used for irrigation purposes. The rest of the area mostly depends upon groundwater for irrigation as well as drinking purposes (Figure 1).

#### 1.2 Geological framework

The study area lies in Eastern Dharwar Craton (EDC) which is mainly characterized by volcanic-dominated, sediment-improvised and gold-rich greenstone belts that are engulfed on all sides by younger granitoid. The lithounits present in the study area are metavolcanics of Hutti belt (330.7  $\text{km}^2$ ), Kushtagi belt (57.9  $\text{km}^2$ ) of Dharwar super group aging in archaean-proterozoic age. Then a variety of granitoid of closepet granitoid groups as pink granite (174.2  $\text{km}^2$ ), hornblende granite (225.26  $\text{km}^2$ ) and granodiorite/migmatite (1172  $\text{km}^2$ ) of lower proterozoic age [8].

### 2. MATERIAL AND METHOD

A total of 116 groundwater samples have been collected during May 2019 (pre-monsoon season) and December 2019 (post-monsoon season). Prior to the



## Petrography, Geochemistry and Tectonic Settings of Granitic Gneisses from Swarnagadde Plateau of Western Ghats, Karnataka

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**Abstract:** The granitic gneisses of the Swarnagadde plateau located on the southwestern margin of Uttar Kannada district forming a basement complex of peninsular gneiss, have been examined in the field, mapped and interpreted on the basis of petrological and geochemical data. This was meant to categorize the rocks and to understand the tectonic setting in order to evaluate the crustal evolution. The chemical analyses were done using inductively-coupled plasma mass spectrometer. From the results obtained, the major element contents of granitic gneisses reflect their fairly homogeneous composition. Mineralogy of rock is dominated by plagioclase (49-62%), quartz (29-42%), K-feldspar (1-5%) and/or hornblende in decreasing order. The granitic gneisses formed from medium to low grade metamorphism of granite and granodiorite witnessed at a late stage in the Precambrian records of the area. Tectonically most of the rock samples plotted in the field of volcanic arc granite+Syn-collisional granite rocks, which indicated that the protolith granite and granodiorite are volcanic arc magmas predominantly post orogenic development in island-arc to continental and collision zone.

**Keywords:** Granitic gneiss, Swarnagadde, tectonic setting, tonalitic, collision zone.

### I. INTRODUCTION

The Peninsular Gneisses covers major part of the southwest coast consisting of migmatitic grey gneisses which falls within tonalite-trondhjemite-granodiorite composition<sup>[1,2]</sup>. The general trend of gneisses is NNE-SSW in the northern parts whereas in the southern part the gneisses and other associate rock types show east westerly trend. These granitic gneisses are about 3200 Ma old<sup>[3]</sup>. Whereas younger Kanara batholith of granitoid composition (granite, granodiorite to quartz monzonite with diorite border) is dated at 2600 Ma by Rb/Sr method. The major part of the study area is granitic gneiss which occurs as subterranean rocks and comprising nearly 80 percent protolith of the investigated area. The granitic gneisses form a part of the Kanara gneisses<sup>[3]</sup> or north western/coastal continuation of peninsular gneisses<sup>[6]</sup> and occur as the most abundant rock formations of the Swarnagadde plateau<sup>[1,4]</sup>. These rocks are principally of tonalitic to granodioritic in nature<sup>[3]</sup>.

Formation of these granitic gneisses are the result of influx of tonalitic, trondhjemitic to granodioritic matter into the crust around 3000 Ma ago<sup>[6]</sup>. Excellent exposures of these rocks are found to occur at North-Western part of the Horbagh village and some outcrops are well exposed in quarry section, railway cuttings and also in recent road cuttings of the study area. Granitic gneisses are medium to coarse grained, moderate to highly foliated and dark to light grey in colour. The extent of the study of gneisses is well within the wide range covered by the peninsular gneiss and presumably has the same genetic history as the peninsular gneiss.

### II. GEOLOGICAL BACKGROUND

The granitic gneisses comprise nearly 70 to 80 per cent of the bed rocks of the study area. These are exposed at the base and along the northern and eastern scarp regions of the plateau that lies within Latitude 74° 24' to 74° 30' E and Longitude 14° 18' to 14° 24' N at the south western margin of the Peninsular region as in Fig 1. Nevertheless, excellent exposures occur about 5 km south and south-east of Chandavara village. On the other hand, exfoliation or scaling is the most common and prominent feature noticed in the relatively large exposed outcrops of granitic gneisses. These granitic gneisses appear in various shades of grey to pink, are fine to medium grained and possess a gneissic to massive texture. Locally there are coarse-grained, mineralogically similar bodies with sharp to gradational contacts. In part, the gneiss exhibits a salt and pepper texture and is mesocratic. The leucocratic variety is light grey to pink and locally possesses mafic lenses, pods and streaks as inclusions. Quartzo-feldspathic pegmatite veins and irregular bodies are common in the



# Experimental and computational study of the beta shielding properties of polycarbonate filled with lead nitrate

[Get access >](#)Manjappa Chandrappa Koramar, [Blaise Lobo](#)✉*Radiation Protection Dosimetry*, Volume 199, Issue 11, July 2023, Pages 1248–1255,<https://doi.org/10.1093/rpd/ncad171>Published: [09 June 2023](#) [Article history](#) ▼[Cite](#) [Permissions](#) [Share](#) ▼

## Abstract

The mass attenuation coefficient of lead nitrate ( $\text{Pb}(\text{NO}_3)_2$ )-filled polycarbonate (PC) composite films were determined both computationally (using Baltakmen's and Thummel empirical formulae) and experimentally using  $^{204}\text{Tl}$  and  $^{90}\text{Sr}$ - $^{90}\text{Y}$  radio-isotopes for films at different filler levels 0, 5, 15, 25, 35 and 50 weight percent (Wt. %). In comparison with Thummel empirical formula, the values obtained from Baltakmen's empirical formula is in good agreement with the experiment. The percentage decrease of half value layer values were  $(52 \pm 8)$  and  $(60 \pm 10)\%$  for  $^{204}\text{Tl}$  and  $^{90}\text{Sr}$ - $^{90}\text{Y}$ , on comparing the values for 0 and 50 Wt. % films, and so the prepared composite films shield the beta particles effectively. The PC that used to shield the low-energy beta particles of  $^{90}\text{Sr}$ - $^{90}\text{Y}$  can also moderate the higher energy beta particles; the plot of end point energy of  $^{90}\text{Sr}$ - $^{90}\text{Y}$  versus thickness of PC exhibits a decreasing trend, which confirms that PC acts as an electron moderator.





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## Methyl cellulose-based solid polymer electrolytes with dispersed zinc oxide nanoparticles: A promising candidate for battery applications

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### ABSTRACT

Novel solid polymer electrolytes based on methyl cellulose (MC) and magnesium chloride (MgCl<sub>2</sub>·6H<sub>2</sub>O) have been prepared by a solution casting technique. The best conducting polymer electrolyte system has been doped with different amounts of zinc oxide (ZnO) nanoparticles to assess their effect on its properties. Structural studies by FTIR and XRD analysis have revealed complete complexation between the polymer host and the dopant. A polymer electrolyte system with 25 wt% of the salt exhibited the highest room temperature ion conductivity of  $1.18 \times 10^{-4} \text{ S cm}^{-1}$  with excellent thermal and dielectric properties. The dispersal of ZnO nanoparticles therein served to enhance the conductivity. SEM micrographs reveal complete dispersion of the nanofiller on the electrolyte surface. A primary battery has been fabricated, and its open-circuit potential and discharge characteristics have been studied. Overall, the prepared electrolytes have excellent properties and may thus be promising candidates for energy storage devices.

### 1. Introduction

Polymers are one of the emerging fields in the present century. The application of polymers in the commercial, medical, automobile, and electronics fields has significantly changed daily life [1–5]. The invention and use of polymer electrolytes, one such application, has heralded a new era in technology. A suitable electrolyte is essential for energy storage devices such as batteries, electric double-layer capacitors (EDLCs), and solar cells [6]. Even though liquid electrolytes have been used for many years, their disadvantages, such as safety issues due to thermal expansion and leakage, high weight due to the presence of a solvent, and narrow electrochemical stability window, have pressurized the invention of other alternatives [6]. Being solvent-free, stable, and flexible, polymer electrolytes are the best alternative to liquid electrolytes [7].

Along with these properties, a broad electrochemical stability window (ESW), good thermal stability, and good electrode-electrolyte interface stability make polymer electrolytes more suitable for energy

storage devices. The last few decades have seen extensive work on the preparation and application of polymer electrolytes based on synthetic polymers such as polyethylene oxide (PEO), polyvinyl alcohol (PVA), polyvinyl chloride (PVC), polyvinylidene fluoride (PVDF), and so on. Despite their successful application in many fields, their non-biodegradability can add to environmental pollution [8]. Considering a green and clean environment, current research is focused on preparing polymer electrolytes based on natural and biodegradable polymers [8].

Surveying the research on polymer electrolytes, many reports have been concerned with the preparation and characterization of biodegradable, natural polymer electrolytes. S.S. Priya et al. [9] prepared biodegradable solid polymer electrolytes using I-carrageenan and magnesium nitrate. Their group achieved a good ionic conductivity of  $6.1 \times 10^{-4} \text{ S cm}^{-1}$  and a low activation energy of 0.175 eV. R.D. Alves et al. [10] prepared biodegradable polymer electrolyte films based on agar doped with magnesium triflate, which showed suitable ionic conductivity and high thermal stability. P. Perumal and co-workers prepared Li-ion conducting solid-polymer electrolyte films using pectin,

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## Research Article

### HUMAN MONKEYPOX DETECTED FIRST TIME IN INDIA: ROLE OF TRADITIONAL HERBAL TREATMENT

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#### ABSTRACT

This overview highlights about the recent detection of human monkeypox viral infection in India. As of December 2022, there are 20 confirmed human monkeypox virus infection cases have been reported from India. Monkeypox is caused by monkeypox virus which is an enveloped double-stranded DNA virus that belongs to the Orthopoxvirus genus of the Poxviridae family. Monkeypox is transmitted to humans through close contact with an infected person or animal, sex with an infected person, or with material contaminated with the virus. There are two distinct Genetic Clades of the monkeypox virus: the central African (Congo Basin) Clade and the West African Clade. The Congo Basin Clade has historically caused more severe disease and was thought to be more transmissible. WHO has considered monkeypox outbreak represents a public health emergency of international concern. Vaccines used during the smallpox eradication programme also provided protection against monkeypox. Monkeypox typically presents clinically with fever, rash and swollen lymph nodes and may lead to a range of medical complications. The most prominent symptoms of monkeypox, are people with monkeypox have pockmarks or vesicles or pustules on the face, palms and soles. As a precaution, India has increased surveillance, imposed travel restrictions as monkeypox reaches multiple nations in the first week of June, 2022. The herbal treatment options for controlling monkeypox virus and antiviral activities of the plants have been listed.

**Keywords:** India, Indian pitcher plant, viral infection, monkeypox, lymph nodes, rash, fever, Sarracenia purpurea, smallpox vaccine.

#### OVERVIEW

A total of 20 cases of monkeypox have been reported in India in 2022 and a national task force has been set up to monitor the development of diagnostics and vaccines (1-2). The first case of monkeypox virus in India was discovered on July 14, 2022 after a UAE traveller returned to Kerala (1-3). The patient has been confirmed the first case of monkeypox infection in India (1-2). India reported its second and third case of monkeypox in Kannur district of Kerala state (1-2). The fourth monkeypox case was reported in India with the previous three cases being reported from the state of Kerala, India (1-2). The first case of monkeypox was detected in Delhi as a 31-year-old man with no foreign travel history was diagnosed with the disease (1-2). Another foreign national has been tested positive for monkeypox in Delhi, the fourth such case in the national capital (1-2). The patient is a 31-year-old woman and it is not yet known if she travelled abroad recently (1-3). Altogether, 20 cases of monkeypox viral disease infections have been surfaced in India which were detected in Kerala and New Delhi (1-2). Currently, India has reported 20 confirmed cases of monkeypox, 12 of them in Kerala and 8 of in Delhi (25). Furthermore, eight suspected cases, one case each in Delhi and Telangana, four in Bihar and four in Uttar Pradesh. The monkeypox outbreak in India is now a global health emergency (1-2, 25). This emphasizes the significance of timely clinical and laboratory diagnosis for early detection and patient management leading to recovery without secondary complications (1-18, 25).

As of November 22, 2022, a total of 80,611 laboratory confirmed monkeypox cases and 1,519 probable cases, including 53 deaths, have been reported to WHO (96-97). Since 13

May 2022, a high proportion of these cases have been reported from countries without previously documented monkeypox transmission (1-18, 98-100). This is the first time that cases and sustained chains of transmission have been reported in countries without direct or immediate epidemiological links to areas of West or Central Africa.

Monkeypox viral outbreak was endemic restricted to African zone but now the disease is a pandemic (1-3, 98-99) Therefore, monkeypox is a serious health crisis and the World Health Organization (WHO) has called for an international response to curb the outbreak (1-18). A new report has described 6 cases of human monkeypox infection detected in New Delhi without any international travel history, suggesting under-diagnosed monkeypox infection in the community (25). Researchers from Maulana Azad Medical College in New Delhi, Indian Council of Medical Research (ICMR), National Institute of Virology in Pune and AIIMS, New Delhi, India have emphasised the need for active surveillance of monkeypox virus (MPXV) in the high - risk population such as men having sex with men and female sex workers (25).

Since early May 2022, cases of Monkeypox have been reported from countries where there was no history of monkeypox (3). The World Health Organization (WHO) has declared the ongoing monkeypox outbreak as a global health emergency (1-18). In the United States, 4,638 cases are confirmed in 44 US states and the District of Columbia, according to the Centers for Disease Control and Prevention (1-18). In New York, which has reported the highest number in the US, a total of 900 cases of monkeypox have been confirmed, with the vast majority of them (93%) detected in New York City. The US has reported 4,638 confirmed cases of monkeypox and Canada has reported 1,449 confirmed cases monkeypox (1-18). More than 1,800 people in France have caught the monkeypox virus, with most of the infections in the Paris region, representing around 10% of infections globally (1-18). The United States now leads the world in monkeypox cases where the disease has been detected, according to data from the federal Centers for Disease Control and Prevention, a leap that has risen within a few months (96-97). The

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## Research Article

### OUTBREAK OF LUMPY SKIN VIRAL DISEASE OF CATTLE AND BUFFALO IN INDIA IN 2022: ETHNOVETERINARY MEDICINE APPROACH

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#### ABSTRACT

This literature review paper highlights the recent outbreak of Lumpy Skin viral Disease (LSVD) affecting thousands of dairy cattle and domestic water buffaloes in India in 2022. Lumpy Skin Disease (LSD) was first time reported from India in 2019 and second outbreak is recorded in 2022 has emerged as a challenge for the dairy sector. A lump like nodules in the external skin and mucous membrane with fever and swollen lymph nodes are the preliminary noticeable clinical signs of this devastating disease. Lumpy skin disease (LSDV) is caused by the double - stranded DNA virus belongs to genus *Capripoxvirus* and family *Poxviridae*. Lumpy Skin Disease (LSD) is not zoonotic infecting cattle's but not humans. Lumpy Skin Disease (LSD) is a contagious vector-borne disease spread by the vectors like mosquitoes, some biting flies, and ticks. The hallmark feature of LSD is the skin lesions with nodules. Vaccination along with strict quarantine measures and vector control could be effective for preventing the spread of the disease. In India, the Goat Pox Virus Vaccine (GTPV) Uttarkashi strain is being evaluated for the level of protection against Lumpy Skin Disease (LSD) as compared to the LSDV vaccine and is already used for emergency vaccination. Ethno veterinary practices concern to animal healthcare is as old as the domestication of various livestock species. There is a rich and efficient ethno veterinary traditions exist in the villages of India. However, ethno-veterinary medicines are often not as fast-working and potent as allopathic medicines. Therefore, Ethno-veterinary medicines may be less suitable to control and treat epidemic and endemic infectious diseases. Ethno-veterinary medicines have promising potential and are widely used, many of them remain untested and their use also not monitored.

**Keywords:** Buffaloes, Cattle, Ethno-veterinary, India, Lumpy Skin Disease, medicinal plants, Skin lesions with nodules, Viral infection.

#### INTRODUCTION

Lumpy Skin Disease (LSD) is an infectious disease in cattle and Asian water buffalo caused by Lumpy Skin Disease Virus (LSDV) belongs to the family *Poxviridae* (1-26). Lumpy Skin Disease (LSD) was first time reported from India in 2019. In India, currently epidemiological status of the disease is unknown (2, 6, 10, 17, 19, 20, 21, 26). Vaccination along with strict quarantine measures and vector control could be effective for preventing the spread of the disease (2, 6, 10, 17, 19, 20, 21, 26). Lumpy skin disease (LSD) is not a zoonotic virus which means that the disease can not spread to humans (1-26). Humans are also resistant to the virus (1-26). Lumpy skin disease (LSD) is a trans-boundary animal viral disease which causes considerable financial losses to the livestock industries (2, 6, 10, 17, 19, 20, 21, 26). It is a contagious vector-borne disease spread by vectors like mosquitoes, some biting flies, ticks and usually affects host animals like cows and water buffaloes (1-26).

A lump like nodules in the external skin and mucous membrane with fever and swollen lymph nodes are the preliminary noticeable clinical signs of this devastating disease (2, 6, 10, 17, 19, 20, 21, 26). The characteristic nodular skin lesions appear on head, neck, chest, abdomen, perineum, genitalia, udder and limbs. The centre of the lesion often ulcerates with time and a scab forms on top (1-26). It is commonly an arthropod-borne contagious illness, correspondingly the non-vector spreading through body discharge

and infected fomites (2, 6, 10, 17, 19, 20, 21, 26). The incubation period ranges from one to four weeks leading to viremia (1-26). A pronounced socio-economic collapse is driven by reduced quantity and quality of milk, udder infection, thinness, low quality hides, loss of draught power, abortion, infertility, limitation to meat ingestion, higher morbidity, etc. Animals of any age and gender are susceptible to the disease (1-26).

The recent unprecedented spread of Lumpy skin disease virus (LSDV) in India and several other countries has highlighted the need for better research efforts into this rapidly emerging pathogen (2, 6, 10, 17, 19, 20, 21, 26). The disease has already spread to several Indian states viz; Karnataka, Rajasthan, Gujarat, Punjab, Haryana, Uttar Pradesh Kerala, Tamil Nadu, Andhra Pradesh, Telangana, Odisha, Jharkhand, West Bengal, Assam, Chhattisgarh, Maharashtra and Madhya Pradesh of the country and has caused considerable economic losses to the livestock industry (1-26).

#### Lumpy Skin Disease Virus (LSD): 2022- Outbreak in India

Lumpy skin disease (LSD) is caused by the lumpy skin disease virus (LSDV) is an OIE notifiable, vector-borne disease of cattle and Asian water buffalo that causes substantial economic losses (1-26). Its name originates from the clinical presentation of the disease generally associated with the appearance of skin nodules that may cover the entire body of the animal during severe infection (1-26). The recent Lumpy skin disease virus (LSD) introductions in Asia are of concern as India, China and Bangladesh have some of the world's largest bovine populations (2, 6, 10, 17, 19, 20, 21, 26).

The current outbreak of Lumpy Skin Disease Virus (LSDV) in more than 15 Indian states in 2022 has emerged as a challenge for the dairy sector (2, 6, 10, 17, 19, 20, 21, 26). India is the world's

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## Identification and Molecular Characterization of Inducible Immune Protein in *Bombyx mori* L

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### Abstract

**Introduction:** In insect immunity, antibacterial proteins are an important part of the immune system. These proteins are mostly produced by epithelial cells and released through hemolymph. Antibacterial proteins in insects belong to the five major families of cecropins, defensins, attacins-like proteins, proline-rich peptides, and lysozymes. Considering the importance of these proteins in fighting infections, the aim of this study was to evaluate and identify these proteins in silkworms (*Bombyx mori*).

**Materials and Methods:** In the present work, profiling of the proteins present in the hemolymph of control silkworms versus, those infected with bacteria was performed by SDS-PAGE, 2D gel electrophoresis, and image analysis. We also used MALDI-TOF and MS/MS to investigate novel and uncharacterized immune protein. For this aim, the silkworm hemolymph after inoculation and infection with *Staphylococcus aureus* bacteria was analyzed using SDS-PAGE, 2-dimensional gel electrophoresis, MALDI-TOF and MS/MS to identify the immune proteins. The Swiss-Prot and NCBI databases were used for protein identification.

**Results:** A novel protein with a molecular weight of 31.9 kDa was discovered on the fourth day of exposure to bacteria. The expressed protein showed effective activity against *S. aureus*, which was infected silkworms. In the MALDI-TOF/MS result and protein identification analysis, 90 numbers of mass values were searched, the mass values matched 16, the total sequence coverage was 46%, and their score was 57. According to the analyses, the expressed protein belongs to the hemolysin secretion protein (HlyD).

**Conclusions:** The results led to the identification of a new protein with antimicrobial properties in silkworm, although more information is needed.

**Keywords:** Silkworm, Antibacterial Proteins, Immunization, Electrophoresis, MALDI-TOF, MS-MS

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### Introduction

In the last five decades of research on insects, immunology has developed significantly. In general, the immune response involves cellular and humoral components. In insects this is different from vertebrates; which have very effective immune systems composed of cellular and humoral components. The humoral immune system involves the synthesis and release of several antibacterial proteins. In insects, the fat bodies are like the liver in mammalian systems; they are the site of synthesis for peptides and proteins involved in killing pathogens.<sup>1</sup>

In the past 25 years, 1500 antimicrobial peptides (AMPs) have been isolated from a wide variety of plants, invertebrates, amphibians, and mammals, as well as from bacteria and fungi.<sup>1,2</sup> Cecropin is the first identified and isolated antibacterial protein in *Hylophora cecropia* (Giant silkworm). Antibacterial proteins are classified as cecropins, defensins, attacins-like proteins, proline-rich peptides, and lysozymes;

these five major groups were isolated and identified in insects. More than 150 antibacterial proteins have been purified from the hemolymph of insects. Immune peptides belong to a large set of immune effectors with specificities for special classes of microbes that are expressed in insects in response to pathogen infections.<sup>4,5</sup> They have similar characteristics, such as low molecular weight (below 5 kDa), a positive net charge at physiological pH, and for most of them, amphiphilic  $\alpha$ -helices, hairpin-like  $\beta$ -sheets or mixed structures.<sup>6</sup>

*Bombyx mori* is the only lepidopteran insect with a whole genome sequence, as well as a proteomic database, available.<sup>2</sup> Furthermore, it is the first lepidopteran insect to have documented an almost complete genome sequence.<sup>7</sup> With 18,510 predicted genes, about 400 mutant lines, and a relatively large body size, *B. mori* serves as a good model for the genetic and biochemical study of insect immune



## Article

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### Studies on the Physico-chemical Parameters of Soil Samples at the Vicinity of Sugar and Fertilizer Industries in Karnataka

Soil analysis provides an important information about physical nutrient conditions and chemical properties that influence the soil health. In the present investigation the physico-chemical studies of soils are carried out for the various soil samples viz of has shown in graph S1, S2, S3, S4 collected from North and South regions of Karnataka at the vicinity sugar and fertilizer industries. The results have indicated that soil sample S1 has Shown Heavy clay soil texture, lowest electrical conductivity, available Nitrogen, Potassium, Sulphur and Iron content and also showed maximum level of exchangeable calcium and magnesium content. Soil sample S2 has maximum water holding capacity, Highest range of EC, slightly alkaline pH, more organic carbon and organic matter, available Nitrogen, lower phosphorous and Iron content. Soil sample S3 has acidic pH, Maximum range of Phosphorous, Copper, Iron and Zinc Content. Soil sample S4 and indicates the lowest water holding capacity, Lower content of moisture, organic carbon and organic matter, lower level of exchangeable calcium and magnesium content, lowest copper content and showed maximum potassium and Sulphur content. These variations in soil physico-chemical parameter certainly influenced the distribution of soil micro-fauna and soil health.

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