



Criterion 3 – Research, Innovations and Extension

3.3 Research Publication and Awards

3.3.1 Number of research papers published per teacher in the Journals as notified on the UGC CARE list during the last five years

3.3.1.1. Number of research papers in the Journals notified on the UGC CARE list year-wise during the last five years

Year	2022 (Jan-Dec)	2021 (Jan-Dec)	2020 (Jan-Dec)	2019 (Jan-Dec)	2018 (Jan-Dec)
Number	6	16	10	2	1

3.3.2 SUPPORTING DOCUMENTS

Number of research papers published per teacher in the Journals as notified on the UGC CARE list during the last five years

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3.3.1.1. Number of research papers in the Journals notified on the UGC CARE list year-wise during the last five years

Document Index

Sl. No.	Description of the documents	Page No.
1.	List of faculty members who published research papers in the journals notified on UGC CARE from 2018-2022	3
2.	Supporting documents of the faculty members who published research papers in the journals notified on UGC CARE from 2018-2022 - - the first page/full paper(with author and affiliation details)	12

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List of faculty members who published research papers in the journals notified on UGC CARE from 2018-2022

Sl. No.	Title of the paper	Author	Dept.	Journal	Year	Link / DOI
2018 (January - December)						
1.	Neutron skin thickness of finite nuclei with finite range effective interaction in droplet model	M. Pal, S. Chakraborty, B. Sahoo, S. Sahoo	Physics	International Journal of Modern Physics E	2018	https://doi.org/10.1142/S0218301318500490
2019 (January - December)						
1.	The fourth-order symmetry energy of nuclear matter and symmetry energy coefficients of finite nuclei using extended semi-empirical mass formula	M. Pal, S. Chakraborty, B. Sahoo, S. Sahoo	Physics	International Journal of Modern Physics E	2019	https://doi.org/10.1142/S0218301319500228
2.	Somudra Upokul Byabosthar Ruporekha	Nabendu Sekhar Kar	Geography	Bhugol Swadescharcha	2019	https://impactfactorforjournal.com/wp-content/uploads/2022/06/UGC-

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Sl. No.	Title of the paper	Author	Dept.	Journal	Year	Link / DOI
2020 (January - December)						
1.	First comprehensive characterization of osumilite from India (Eastern Ghats Province): Physicochemical characteristics, stability of the mineral and its breakdown products	E.Das, S.Karmakar, S.Chatterjee, S.Karmakar, P. Sengupta	Geology	Lithos	2020	https://www.sciencedirect.com/journal/lithos
2.	Nanotailored hyaluronic acid modified methylcellulose as an injectable scaffold with enhanced physico-rheological and biological aspects	B. Das, A. Basu, S. Maji, K. Dutta, M. Dewan, A. Adhikary	Chemistry	Carbohydrate Polymers	2020	https://www.sciencedirect.com/journal/carbohydrate-polymers
3.	Effect of tamarind seed polysaccharide on thermogelation property and drug release profile of poloxamer 407-based	M. Dewan, K. Dutta, D. Rana, A. Basu, A.	Chemistry	New Journal of Chemistry	2020	https://pubs.rsc.org/en/journals/journalissues/nj#

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	ophthalmic formulation	Bhattacharya				!recentarticles&adv
4.	Abohaoar Purbabhas	Nabendu Sekhar Kar	Geography	Bhugol Swadescharcha	2020	https://impactfactorforjournal.com/wp-content/uploads/2022/06/UGC-CARE-List-of-Journals-Social-Science-2022.pdf
5.	Urban heritage tourism in Chandernagore, India: revival of shared Indo-French Legacy	N.S. Kar, A.Basu, M. Kundu, A. Giri	Geography	GeoJournal	2020	https://www.springer.com/journal/10708
6.	Cyclone Amphan and its impact on the Lower Deltaic West Bengal: a preliminary assessment using remote sensing sources	S. Das, A.Das, N.S.Kar, S. Bandyopadhyay	Geography	Current Science	2020	https://www.currentscience.ac.in/
7.	An $O(n)$ -time algorithm to compute minimum k -hop connected dominating set of interval graphs	S.C. Barman, S.Mondal, M.Pal	Mathematics	Malaya Journal of Matematik	2020	https://www.malayajournal.org/index.php/mjm

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8.	An optimal algorithm for computing minimum k-hop dominating set of permutation graphs	S.C. Barman, S.Mondal, M.Pal	Mathematics	Serdica Mathematical Journal	2020	http://www.mat.h.bas.bg/serdica/n1_20.html
9.	An Optimal Algorithm to Find Minimum k -Hop Dominating Set of Interval Graphs	S.C. Barman, S.Mondal, M.Pal	Mathematics	Discrete Mathematics Algorithms and Applications	2020	https://www.worldscientific.com/worldscinet/dmaa
10.	Synthesis, structure elucidation and dft study of a new thiazole–pyridine anchored nnn donor and it’s cobalt(II) complex: In-vitro antitumor activity against U937 cancer cells, dna binding property and molecular docking study	P. Bera, A. Aher, P. Brandao, S.K. Manna, I. Bhattacharyya, C.Pramanik, B. Mandal, S. Das	Chemistry	Journal of Molecular Structure	2020	https://www.sciencedirect.com/journal/journal-of-molecular-structure

2021 (January - December)

Sl. No.	Title of the paper	Author	Dept.	Journal	Year	Link / DOI
1.	Overcoming the Trauma of Homelessness: A Study of the Diasporic Poems of Mona Dash, Kavita A. Jindal, Usha Kishore and	Aditi Jana	English	Literary Oracle	2021	https://literaryoracle.com/


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	Yogesh Patel					
2.	Zircon and monazite geochronology from the Rengali-Eastern Ghats Province: Implications for the tectonic evolution of the eastern Indian terrane	S. Bose, G. Ghosh, K. Kawaguchi, K. Das, A.K. Mondal, A. Banerjee	Geology	Precambrian Research	2021	https://www.sciencedirect.com/science/article/abs/pii/S0301926820306690
3.	Synthesis of Fused Pyran and Tetracyclic Pyran Rings by Intramolecular Palladium-catalyzed β -H elimination and C-H bond Functionalization	R. Jana, M. Dewan, G. Roymahapatra	Chemistry	ES Materials and Manufacturing	2021	http://dx.doi.org/10.30919/esmm5f455
4.	Synthesis of 9,10 - dihydrophenanthrene, phenanthrene, mono- and Dialkyl Phenanthrene and Octa-hydro Phenanthrene by Palladium-catalyzed Heck Reactions	R. Jana, M. Dewan, G. Roymahapatra	Chemistry	ES Materials and Manufacturing	2021	http://dx.doi.org/10.30919/esmm5f477
5.	Synthesis of Fused Pyran and Tetracyclic Pyran Rings by Intramolecular Palladium- catalyzed β -H elimination and C-H bond	M. Dewan, Gourisankar Roymahapatra, R. Jana*	Chemistry	ES Materials and Manufacturing	2021	http://dx.doi.org/10.30919/esmm5f455

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	Functionalization					
6.	Synthesis of 9,10-dihydrophenanthrene, phenanthrene, mono- and Dialkyl Phenanthrene and Octa-hydro Phenanthrene by Palladium-catalyzed Heck Reactions	Mitali Dewan, Gourisankar Roymahapatra, R. Jana*	Chemistry	ES Materials and Manufacturing	2021	http://dx.doi.org/10.30919/esmm5f477
7.	Bioactive Metal Complexes of Schiff Base Derived from 2,3-Dioxobutane, Ethane-1,2-diamine and 4-Chloro-2-formylphenol: Spectral Studies and in vitro Antimicrobial Activity	Sayanwita Panja	Chemistry	Asian Journal of Chemistry	2021	https://doi.org/10.14233/ajchem.2021.23478
8.	Rabindra Bhabnay adhatmabad o mrituychetana	Atasi Mahapatra	Philosophy	Rabindra Bharati Patrika	2021	ISSN 0975-0037
22.	Quasielastic backscattering and barrier distribution for the weakly bound projectile Li 6 on Tb 159	P. Biswas, et al.	Physics	Physical Review C	2021	https://doi.org/10.1103/PhysRevC.104.034620
9.	Large back-angle quasielastic scattering for 7Li+159Tb	P. Biswas, et. al	Physics	Physical Review C	2021	https://doi.org/10.1103/PhysRevC.103.014606

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10.	Avulsion of the Brahmaputra in Bangladesh during the 18th–19th century: A review based on cartographic and literary evidence	S. Bandyopadhyaya, S. Das, N.S. Kar	Geography	Geomorphology	2021	www.sciencedirect.com/science/article/abs/pii/S0169555X21001045?via%3Dihub
11.	Minimum r -Neighbourhood Covering Set of Permutation Graphs	A.S. Adhya, S. Mondal, S.C. Barman	Mathematics	Discrete Mathematics Algorithms and Applications	2021	https://doi.org/10.1142/S1793830921500816
12.	An Optimal Algorithm to Find Minimum k -hop Connected Dominating Set of Permutation Graphs	A.S. Adhya, S. Mondal, S.C. Barman	Mathematics	Asian-European Journal of Mathematics	2021	https://doi.org/10.1142/S1793557121500492
13.	Instigating the In Vitro Anticancer Activity of New Pyridine - Thiazole - Based Co(III), Mn(II) and Ni(II) Complexes: Synthesis, Structure, DFT, Docking and MD simulation studies.	P. Bera, A. Aher, P. Brandao, S.K. Manna, A. Jana, C. Pramanik, B. Mandal,	Chemistry	Journal of Chemical Information and Modeling	2021	https://doi.org/10.1021/acs.jcim.1c01280
14.	Samajtantrik Andoloner Prakshapote Marxio Nareebader Unmesh	Souti Basu	Philosophy	Tobu Ekalabya	2021	NA
15.	Asymmetric exclusion processes with fixed resources: Reservoir crowding	Astik Haldar, Parna Roy and	Physics	Physical Review E	2021	https://doi.org/10.1103/PhysRev

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	and steady states	Abhik Basu				E.104.034106
2022 (January - December)						
Sl. No.	Title of the paper	Author	Dept.	Journal	Year	Link / DOI
1.	Interrogating Gender and Empowering Women: A Study of Selected Poems of Rupri Kaur and Tishani Doshi	Aditi Jana	English	Literary Oracle	2022	https://literaryoracle.com/wp-content/uploads/2022/08/II.-1.-Interrogating-Gender-and-Empowering-Women..-By-Aditi-Jana.pdf
2.	Theoretical Study of the Role of Symmetry Energy as Well as Its Density Slope and Curvature on Neutron Star Core Crust Transition Density Using Finite Range Effective Interaction	M. Pal, S. Chakraborty, B. Sahoo & S. Sahoo	Physics	Physics of Particles and Nuclei Letters	2022	https://link.springer.com/article/10.1134/s154747712202008x
3.	Disclosing	A. Maiti, B.J	Chemistry	Chemistry–A	2022	https://doi.org/1

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	Cyclic(Alkyl)(Amino)Carbenes as One-Electron Reductants: Synthesis of Acyclic(Amino)(Aryl)Carbene-Based Kekulé Diradicaloids	Elvers, S.Bera , F. Lindl, P.Ghosh, A.Jana		European Journal		0.1002/chem.202104567
4.	Oxo transfer reaction: Dioxido and monooxidovanadium(V) complexes.	M. Shit, S. Mukherjee, S. Maity, S. Bera , P. Ghosh	Chemistry	Journal of the Indian Chemical Society	2022	https://doi.org/10.1016/j.jics.2022.100518
5.	Computation of minimum d-hop connected dominating set of trees in $O(n)$ time	A. Samanta Adhya, S. Mondal, S. C. Barman	Mathematics	Journal of algebra combinatorics discrete structures and applications	2022	https://jacodesmath.com/index.php/jacodesmath/issue/view/26
6.	Computation of diameter, radius and center of permutation graphs	S. Nandi, S. Mondal, S.C. Barman	Mathematics	Discrete Mathematics Algorithms and Applications	2022	https://doi.org/10.1142/S1793830922500392

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the Journal Publications

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Neutron skin thickness of finite nuclei with finite range effective interaction in droplet model

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We analyze the relation between the symmetry energy coefficient $a_{\text{sym}}(A)$ of finite nuclei with mass number A in the semi-empirical mass formula. The nuclear matter symmetry energy $E_{\text{sym}}(\rho_A)$ at reference density ρ_A in the subsaturation density region can be determined by the symmetry energy $E_{\text{sym}}(\rho_0)$ and its density slope L at the saturation density ρ_0 . From this relation, the neutron skin thickness ‘ S ’ in finite nuclei with droplet model are correlated to the various symmetry energy parameters. A prominent role of the bulk symmetry energy $E_{\text{sym}}(\rho_0)$ to the so-called surface stiffness coefficient Q is observed in deriving the size of the neutron skin. Two types of neutron skins are distinguished: the “surface” and the “bulk”. The linear dependence of the neutron skin thickness for different stable nuclei ($40 \leq A \leq 238$) on the slope L of the symmetry energy as well as on the relative neutron excess $I = \frac{N-Z}{A}$ is observed. Though the value of the surface width is found to be limited within 0.1 fm, its contribution should not be neglected to measure neutron skin thickness.

Keywords: Neutron skin thickness; nuclear symmetry energy; droplet model; semi-empirical mass formula.

PACS Number(s): 21.65.Cd, 21.65.Ef, 21.65.Mn, 21.30.Fe

1. Introduction

The nuclear symmetry energy $E_{\text{sym}}(\rho)$ is a fundamental quantity in nuclear physics and astrophysics, as it governs important properties of very small entities like atomic

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The fourth-order symmetry energy of nuclear matter and symmetry energy coefficients of finite nuclei using extended semi-empirical mass formula

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An extended nuclear mass formula has been used by considering the bulk, surface and coulomb contributions to the nuclear mass. In this mass formula, the fourth-order symmetry energy coefficient $a_{\text{sym},4}(A)$ of finite nuclei and fourth-order symmetry energy $E_{\text{sym},4}(\rho_0)$ of nuclear matter (NM) are related explicitly to the characteristic parameters of NM equation of state (EOS) using finite range effective interaction. The calculations are carried out with Yukawa form of exchange interaction having the same range but with different strengths for interaction between like and unlike nucleon. In this extended mass formula, by approximating $a_{\text{sym},4}(A)$ to a constant $c_{\text{sym},4}$ an explicit relation between $a_{\text{sym},4}(A)$ and fourth-order symmetry energy $E_{\text{sym},4}(\rho_0)$ is obtained, which provides the possibility to extract information on $E_{\text{sym},4}(\rho_0)$.

Keywords: Symmetry energy coefficient; finite nuclei; finite range effective interaction.

PACS Number(s): 21.65.Ef, 21.65.Mn, 21.30.Fe, 31.15.bu

1. Introduction

The study of equation of state (EOS) of isospin asymmetric nuclear matter (ANM) is currently an active field of research in nuclear physics.¹⁻¹² The nuclear matter (NM) EOS describes its energy per nucleon $E(\rho, \beta)$ as a function of density

[¶]Corresponding author.

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ইঙ্গ-মার্কিন বিশেষজ্ঞ
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Research Article

First comprehensive characterization of osumilite from India (Eastern Ghats Province): Physicochemical characteristics, stability of the mineral and its breakdown products



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K-feldspar + cordierite + orthopyroxene +

quartz intergrowth

Eastern Ghats Province

ABSTRACT

A rare occurrence of osumilite has been reported from a metapelite from parts of the Eastern Ghats Province, India. Incidentally, this is the first report of osumilite along with its composition and textural description from any Indian rock. The presence of osumilite has been confirmed by electron microscopy (BSE images), electron microprobe analyses (and X-ray intensity maps) as well as Raman spectroscopy. In the studied sample, osumilite occurs as rare anhedral relicts (~300–350 μm) that are surrounded by a variety of extremely fine-grained symplectitic intergrowths namely cordierite + K-feldspar, cordierite + K-feldspar + orthopyroxene and cordierite + K-feldspar + orthopyroxene + quartz. The symplectites partially to completely pseudomorph the early formed osumilite grains. An isochemical pressure-temperature phase diagram has been calculated in the Na₂O-K₂O-FeO-MgO-Al₂O₃-SiO₂-H₂O system in order to model the breakdown of osumilite and formation of such symplectitic mineral assemblages, using the average micro bulk compositions calculated with the XMapTools software. The calculated P-T phase diagram suggests that osumilite was formed during ultra-high temperature metamorphism (at P~8.5 kbar and T~1110°C) in an Mg-Al-rich pelitic assemblage and subsequently broke down to produce the symplectitic mineral assemblages during isobaric cooling.

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1. Introduction

Osumilite is a rare silicate mineral having a general formula (K,Na)(Fe²⁺,Mg)₂(Al,Fe³⁺)₃(Si,Al)₁₂O₃₀ and belongs to the Milarite group (Miyashiro, 1956). This mineral is commonly found in volcanic rocks (Miyashiro, 1956) and also in shallow (Chinner, 1973) and deep seated (Berg and Wheeler, 1976) contact metamorphic aureoles and regionally metamorphosed ultra-high temperature (UHT) pelites (Adjerid et al., 2013; Arima and Gower, 1991; Blereau et al., 2019; Ellis et al., 1980; Grew, 1982; Harley, 2008; Holder et al., 2018; Kawasaki et al., 2011; Sajevee and Osanai, 2004). Osumilite is a key indicator of ultra-high temperature (UHT) metamorphism, but is rarely preserved because of its decomposition (to cordierite + K-feldspar + orthopyroxene ± quartz) during cooling with or without enhancement of the activity of H₂O (Lal et al., 1987; Bhattacharya and Kar, 2002; Adjerid et al., 2013; Korhonen et al., 2013; Bial et al., 2015; Kelsey and Hand, 2015 and reference therein). In this communication, we present the compositional characteristics of osumilite (~300–350 μm) and its relations with other

minerals in an Mg-Al rich metapelitic assemblage from part of the Eastern Ghats Province (Dobmeier and Raith, 2003). Integrating the compositional characteristics of minerals and the textures it has been demonstrated that the exotic osumilite-bearing assemblages developed in the realm of UHT metamorphism. A textural-modelling study and the computed phase diagram suggest breakdown of osumilite (into a fine symplectite of orthopyroxene + K-feldspar + cordierite + quartz) in a closed system during a phase of isobaric cooling.

2. Geological framework

This osumilite bearing assemblage belongs to an Mg-Al-rich metapelitic rock, which consists of vividly heterogeneous mineralogical assemblages in different microdomains. One such domain is characterized by the presence of fine symplectitic intergrowths of cordierite + K-feldspar ± orthopyroxene ± quartz with or without the presence of relict osumilite grains. The rock-sample was collected from Bandavid village (N 18°03.296' / E 82°33.434'), which is situated south of Paderu (Fig. 1). Geologically, Bandavid is situated within Eastern Ghats Province (EGP, after Dobmeier and Raith, 2003), India. Several studies have reported UHT metamorphism, recorded in Mg-Al granulites from different parts of the EGP (reviewed in Dasgupta et al., 2013; Bhattacharya

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Nanotailored hyaluronic acid modified methylcellulose as an injectable scaffold with enhanced physico-rheological and biological aspects



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ABSTRACT

The collaborative endeavor in tissue engineering is to fabricate a bio-mimetic extracellular matrix to assist tissue regeneration. Thus, a novel injectable tissue scaffold was fabricated by exploring nanotailored hyaluronic acid (nHA) and methylcellulose (MC) (nHAMC) along with pristine HA based MC scaffold (HAMC). nHA with particle size $\sim 22 \pm 5.3$ nm were obtained and nHAMC displayed a honeycomb-like 3D microporous architecture. Nano-HA bestowed better gel strength, physico-rheological and biological properties than HA. It creditably reduced the high content of salt to reduce the gelation temperature of MC. The properties ameliorated with increased incorporation of nano-HA. The addition of salt showed more prominent effect on gelation temperature of nHAMC than in HAMC; and salting-out effect was dependent on nHA/HA content. Biocompatible nHAMC assisted adequate cell adherence and proliferation with more extended protrusions with better migration rate than control. Thus, biomodulatory effect of nanotailored glycosaminoglycan could be asserted to design an efficient thermo-responsive scaffold.

1. Introduction

One of the most fascinating bio-invention is the technology to replace or repair the non-functional organs or damaged tissue. Though, organ transplantation is one of the widely explored technology, but the organ shortage, immunological issues and high rejection rate curb its practical utility (Das et al., 2013; Das, Mandal, Upadhyay, Chattopadhyay, & Karak, 2013). Therefore, the innovative technology of tissue engineering (TE) has emerged as an effective remedy to assist the native cells to repair the lost/damaged organs by providing an artificially design extracellular matrix (ECM). The artificial ECM termed as “scaffold” which acts as a bio-chemical and physical stimulant that urges and supports the native cells to regenerate in a damaged site (Das et al., 2015). Further, a paradigm shift is acknowledged towards the development of injectable scaffold for being easily administrable without surgery into the injured space by using a syringe push (Tan, Chu, Payne, & Marra, 2009). In this vein, smart hydrogel i.e. “in-situ hydrogel” has gained a profound research thrust to develop injectable scaffolds for TE.

Bioresponsive ‘smart’ hydrogel is the most alluring biomaterial attributing to its phase transition properties from liquid to solid under the

influence of physiological parameters (Ito et al., 2007; Tan et al., 2009; Tan, Rubin, & Marra, 2010). Thermo-sensitive hydrogel is the widely endeavored and safe, as temperature escorts fast gelation with mild solidification process, and without any chemical initiator system (Ito et al., 2007; Klouda & Mikos, 2008; Tan et al., 2010). Further, methylcellulose (MC) is one of the thoroughly researched carbohydrate polymers as it is biocompatible and thermo-sensitive due to the hydrophobic interactions among molecules with methoxy substitutes. The high gelation temperatures (GT) of low viscous aqueous solution MC (for being injectable) is lowered by the addition of salts, especially NaCl or by chemical or physical modifications (Bhowmick et al., 2015; Bhowmik, Bain, Ghosh, & Chattopadhyay, 2011;). However, sincere attempts have been undertaken to avoid harmful crosslinkers or to diminish the high salt content, which could hamper the cellular iso-osmolarity and may elicit allergic reactions. Thus, innovative methods are deployed to bring down the GT, to cite structural modification of polymers, co-polymer formation or by reducing additives (salts) contents (Bhowmick et al., 2015; Ito et al., 2007; Klouda & Mikos, 2008).

The fabrication of scaffold is a difficult task owing to the complex architecture and bio-chemical nature of tissues. Thus, nanotechnology has opened a wider window of opportunities to engineer the physico-

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Effect of tamarind seed polysaccharide on thermogelation property and drug release profile of poloxamer 407-based ophthalmic formulation

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Herein, the potential impact of tamarind seed polysaccharide (TSP) on the gelation nature and *in vitro* release of a particular drug, pilocarpine hydrochloride, from different poloxamer 407-based ophthalmic formulations were evaluated. The combination of TSP (0.5–1.5 wt%) and 18 wt% poloxamer (PM) solutions resulted in a significant improvement in gel elasticity under physiological conditions. The introduction of TSP to PM not only enhanced the viscosity of the gel, but also stimulated the gelation procedure. Due to the inclusion of TSP, the gel dissolution rate of the PM-based formulation was greatly reduced. The FTIR spectral analysis revealed the interaction between –OH groups of both polymers, resulting in a decline in the gelation temperature of the PM–TSP-based formulations. It was also detected in the cryo-SEM analysis that the pore size of the PM gel decreased and the depth of its pores increased with the inclusion of TSP. Furthermore, the *in vitro* release analysis indicated that the retention capacity of PM–TSP-based formulations was superior to that of the only PM-based formulation. The SEM study and the cell viability data demonstrated the biocompatibility and non-toxicity of TSP. Therefore, the designed formulation is fairly promising to be utilized as an *in situ* ophthalmic drug carrier.

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1. Introduction

The development of reliable ophthalmic drug delivery formulations is highly challenging due to efficacious shielding protocols of the eye, such as persistent tearing and blinking reflex, which induce intense prohibition of an implemented dosage.¹ The minimal duration of precorneal interaction results in an ocular bioavailability of below 10%.^{2,3} Thus, in an effort to achieve the optimal therapeutic level, occasional instillation of medication is prescribed or a high drug content solution is essential to enter the ophthalmic vehicle, although this enhances the risk of ocular and systemic side effects.⁴ To increase the drug residence time and hence improve the poor ocular bioavailability, several polymeric solutions, specifically *in situ* gels have been developed recently for various types of eye diseases.^{2,5–9} *In situ* gel-forming ophthalmic drug delivery systems is a liquid dosage form comprised of polymers that undergo a reversible sol–gel phase transition as a result of certain specific

physical or chemical alterations mediated by the physiological environment.^{2,7,10,11} These delivery frameworks are engineered such that they likely stay in the fluid state during instillation, but promptly change to a gel on entering the eye environment, delaying the precorneal contact time of the medication and improving its visual bioavailability.^{12–15}

Recently, several methyl cellulose and poloxamer 407-based *in situ* gel ophthalmic formulations have been tailor-made and show thermoreversible gelation properties at physiological temperature. These delivery frameworks have been demonstrated to have potential feature of expanding the ocular bioavailability and monitoring the discharge level of drugs.^{2,10,14–22}

Poloxamer 407 is a useful engineered polymer and is thermo-sensitive in nature. It is a triblock copolymer consisting of a hydrophilic polyoxyethylene (PEO) unit (70%) and hydrophobic polyoxypropylene (PPO) unit (30%).^{1,10,23} It has a molecular weight of around 13 000 Da.²³ Generally, poloxamer 407 is more soluble in cold water at 4 °C, and the transition from an aqueous solution to the gel phase occurs at a particular temperature, depending on its concentration. At lower temperatures, its molecules stay solvated through hydrogen bonding in aqueous solution.²⁴ With an increase in temperature, the hydrogen bonds between the polymer and water molecules are broken and a micelle structure with a hydrophobic core is formed due to the agglomeration of the copolymer molecules.^{23,25–27}

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ভূগোল স্বদেশ চর্চা

প্রথম সর্বভারতীয় বাংলা ভূগোল পত্রিকা



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Bay of B



IHO

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Organization

উদ্ভূত ঘূর্ণিঝড় বাংলায় প্রবেশের সময়কার উপগ্রহ চিত্র, ২০শে মে, ২০২০

শতবর্ষে পদার্পণ (১৯২১-২০২২)

50 km



Urban heritage tourism in Chandernagore, India: revival of shared Indo-French Legacy

Nabendu Sekhar Kar · Anindya Basu · Moumita Kundu · Arpan Giri

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Abstract Heritage tourism offers authentic value-addition to homogenized experiences providing authentic, one-of-a-kind take-away. Apart from popular world heritage sites there are little-exposed gems which can offer novelty and hedonics together. Chandernagore, located on the western bank of river Hugli, 40 km north of Kolkata, India, germinated during the medieval period, later became a thriving French Colony in Bengal displays brilliant prospect for urban heritage tourism. A detailed spatio-temporal inventory of shared heritage legacies both tangible and intangible is prepared using old literatures, oral interviews, GPS plotting and GIS mapping which offers a great platform for promoting urban heritage tourism. Chandernagore is at interesting cross-roads – bridging the infrastructural gaps and garnering involvement of the locals, for ascertaining true

potentiality – the strength, weakness, opportunities and threats (SWOT) are identified to prepare a blueprint for heritage tourism revival strategy for the shared Indo-French *mélange*. Empirical study is conducted for tourist profiling along with usage of descriptive statistics and to carry out perception analysis of locals and tourists. The SWOT analysis leads to a comprehensive strategy formulation which aims to act as base for the revival of Indo-French cultural *mélange* through sustainable, robust tourism emphasizing the core and innovation capitals, tourism development strategies and management, tourism outcomes and resource sustainability.

Keywords Chandernagore · French colony · Urban heritage tourism · Inventory · SWOT

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Cyclone *Amphan* and its impact on the Lower Deltaic West Bengal: a preliminary assessment using remote sensing sources

Amphan, the first super cyclone to form in the Bay of Bengal since the 1999 Odisha Super Cyclone, left a devastating impact on the Lower Deltaic West Bengal (LDWB), coastal districts of Odisha and some parts of Bangladesh^{1,2}. It made its landfall as a very severe cyclonic storm close to the Saptamukhi Estuary of West Bengal coast (21.65°N, 88.30°E), 100 km south of Kolkata, during 15:30–17:30 IST on 20 May 2020 (ref. 3). Despite the evacuation and other safety measures taken by the administration based on accurate forecast of its movement by the India Meteorological De-

partment (IMD)³, the *Amphan* caused massive damages in the aforementioned regions (123 deaths^{4–6} and about US\$ 13 billion of property damages in West Bengal only⁷), surpassing most past records from the North Indian Ocean region¹. In India, the area worst hit was the LDWB, which is delineated on the basis of northern limit of tidal intrusion through estuaries and streams, and includes the districts of Purba Medinipur, South 24 Parganas, North 24 Parganas, Kolkata, Howrah and Hugli. The southern parts of the adjacent Purba Bardhaman and Nadia districts were also

affected. The Government of West Bengal reported severe damages of 2.9 million houses and 1.7 million ha of farmland; some 450,000 electric poles were also grounded⁷. More than 15,000 trees were uprooted in the Kolkata Municipal Corporation area alone⁸ and 158,000 ha of mangroves were severely damaged in the Sundarban region⁷.

Cyclogenesis of the *Amphan* ensued with the formation of a convective low-pressure system in the southeastern Bay of Bengal on 13 May 2020 that showed potential for development of a mighty tropical cyclone^{3,9}. It rapidly turned into

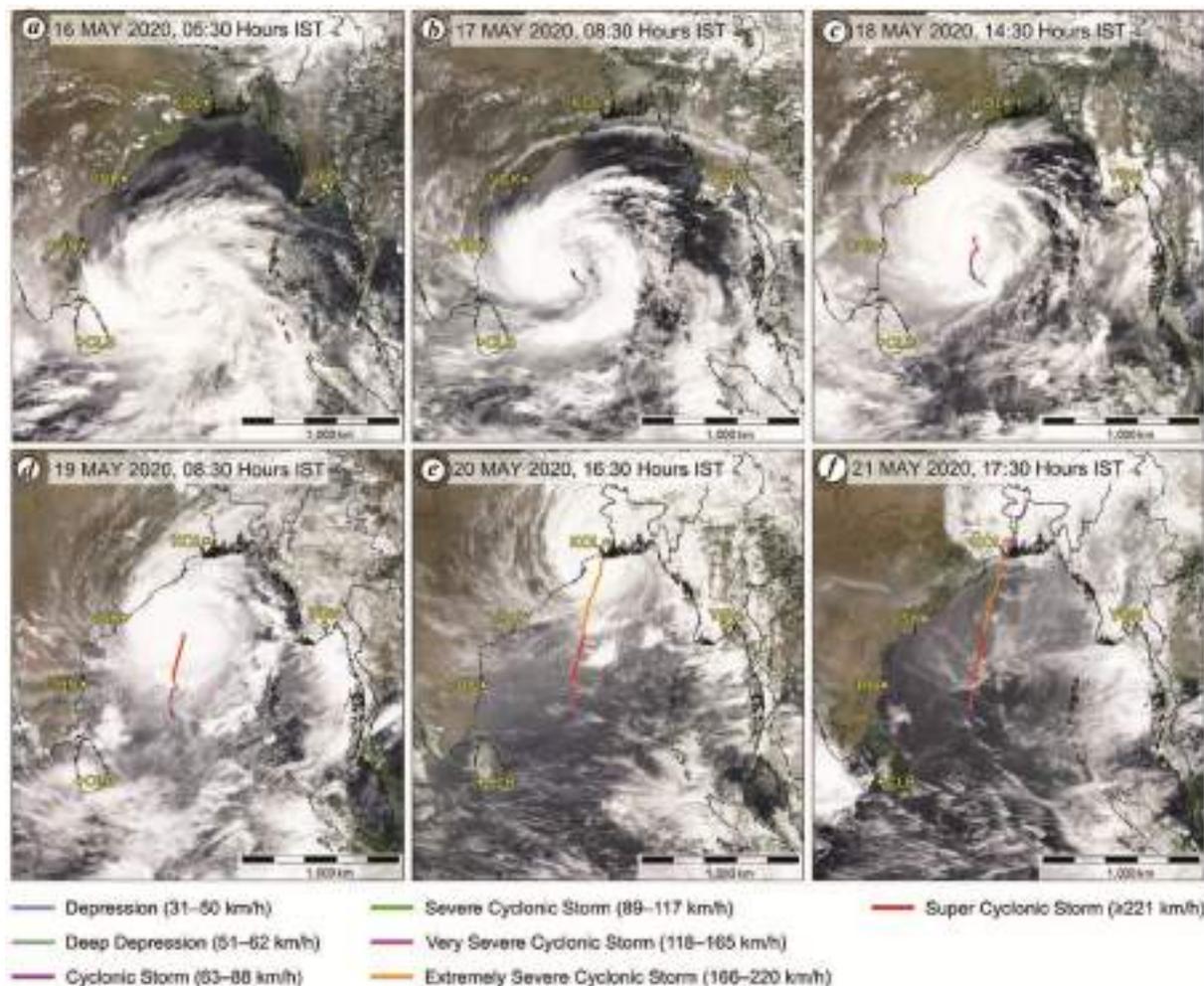


Figure 1. The track of the *Amphan* from initiation to decay (16–21 May 2020). The multicoloured trail represents the movement of the ‘eye’ of the cyclone and category of the storm as it evolved. Date and time in the panels indicate ‘eye’ position at the northern end of the storm track; images represent storm configuration close to that time. CHN, Chennai; CLB, Colombo; KOL, Kolkata; VSK, Visakhapatnam; YGN, Yangon. Storm track source: IMD³. Image source: Aqua–Moderate Resolution Imaging Spectroradiometer (MODIS) and Suomi–National Polar-orbiting Partnership (NPP) mosaicked images (a–c, e), Terra–MODIS and Suomi–NPP mosaicked images (d, f).



An $O(n)$ -time algorithm to compute minimum k -hop connected dominating set of interval graphs

Sambhu Charan Barman^{1*}, Madhumangal Pal² and Sukumar Mondal³

Abstract

For a graph $G = (V, E)$ and a fixed natural number k , a subset D_k of V is called a k -hop connected dominating set of G if every node $a \in V$ is within k -steps from at least one vertex $b \in D_k$, i.e., $d(a, b) \leq k$, and the subgraph of G induced by D_k is connected. A dominating set D_k is known to be minimal if there does not exist any $H \subset D_k$ such that H is a dominating set of G . A dominating set D_k is said to be minimum k -hop connected dominating set, if it is minimal as well as it is k -hop connected dominating set. In this paper, we propose an optimal algorithm to obtain a minimum k -hop connected dominating set of connected interval graphs having n nodes that runs in $O(n)$ time.

Keywords

Design and analysis of algorithms, k -hop connected domination, interval graphs.

AMS Subject Classification

05C30, 05C12, 68R10, 68Q25.

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1. Introduction

Interval graphs are more complex than a tree but simpler than a general graph. This graph is one of the most useful mathematical structures for modeling real life problems in graph theory. This graph is a subclass of intersection graph, chordal graph and perfect graph and superclass of permutation, circular-arc and trapezoid graph. Suppose $I = \{I_1, I_2, \dots, I_n\}$, where $I_j = [a_r, b_r]$, $r = 1, 2, \dots, n$, be a family of intervals on a real line, where a_r and b_r represent respectively the left and right endpoints of the interval I_r . Also, an interval graph can be considered as an intersection graph of I . Interval graph has

lots of applications in archeology, protein sequencing [13], molecular biology, file organization [5], sociology, circuit routine, genetics, job scheduling [5], traffic planning, VLSI design, circuit routing, transportation etc. A deep study on interval graphs is available in [9].

We represent a graph by the algebraic structure $G = (V, E)$, where V and E represent respectively the node/vertex set with cardinality n and edge set with cardinality m . A subset $B \subseteq V$ is called a *dominating set* of a graph G if each node in V is either in B or adjacent with at least one node in B . A dominating set with minimum cardinality is known as minimal dominating set. A dominating set B of G is known to be a connected dominating set if the subgraph made by B is connected. In graph theory, Domination problems has several variations like connected domination, secure domination, edge domination, roman domination, weighted domination, independent domination, perfect domination, locating domination, paired-domination, k -tuple domination and k -hop domination [8, 14, 21], etc.

A set $D_k \subseteq V$ is called a *k -hop dominating set (kHDS)* of a graph G if each node $a \in V$ is within k -steps from at least one node $b \in D_k$, i.e., $d(a, b) \leq k$, where k is a fixed natural number. A brief discussion about hop domination of different

AN OPTIMAL ALGORITHM FOR COMPUTING MINIMUM k -HOP DOMINATING SET OF PERMUTATION GRAPHS

Sambhu Charan Barman, Madhumangal Pal, Sukumar Mondal

Communicated by V. Drensky

ABSTRACT. A k -hop dominating set (k -HDS) D of a graph $G = (V, E)$ is a subset of V such that every vertex $x \in V$ is within k -steps from at least one vertex $y \in D$, i.e., $d(x, y) \leq k$, where k is a fixed positive integer. A k -hop dominating set D is said to be minimal if there does not exist any $H \subset D$ such that H is a k -HDS of G . If a dominating set D is minimal as well as it is k -HDS then it is said to be minimum k -hop dominating set. In this paper, we present an optimal algorithm to compute a minimum k -HDS of permutation graphs with n vertices which runs in $O(n)$ time.

1. Introduction. Let $G = (V, E)$ be a simple and undirected graph with n vertices and m edges and let $V = \{1, 2, \dots, n\}$. G is said to be a *permutation graph* iff there exists a permutation $\pi = \{\pi(1), \pi(2), \dots, \pi(n)\}$ on V such that for all $i, j \in V$, $(i, j) \in E$ iff $(i - j)(\pi^{-1}(i) - \pi^{-1}(j)) < 0$, where for each $i \in V$, $\pi^{-1}(i)$ denotes the position of the number i in π [26]. We assume that the graph is connected. Permutation graphs is a sub-class of intersection graphs [26].

2020 *Mathematics Subject Classification:* 05C30, 05C12, 68R10, 68Q25.

Key words: Design & analysis of algorithms, k -hop domination, permutation graphs.

An optimal algorithm to find minimum k -hop dominating set of interval graphs

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For a fixed positive integer k , a k -hop dominating set D of a graph $G = (V, E)$ is a subset of V such that every vertex $x \in V$ is within k -steps from at least one vertex $y \in D$, i.e., $d(x, y) \leq k$. A k -hop dominating set D is said to be minimal if there does not exist any $D' \subset D$ such that D' is a k -hop dominating set of G . A dominating set D is said to be minimum k -hop dominating set, if it is minimal as well as it is k -hop dominating set. In this paper, we present an optimal algorithm to find a minimum k -hop dominating set of interval graphs with n vertices which runs in $O(n)$ time.

Keywords: Design of algorithms; analysis of algorithms; k -hop domination; interval graphs.

Mathematics Subject Classification 2010: 05C30, 05C12, 68R10, 68Q25

Synthesis, structure elucidation and DFT study of a new thiazole-pyridine anchored NNN donor and its cobalt(II) complex: In-vitro antitumor activity against U937 cancer cells, DNA binding property and molecular docking study

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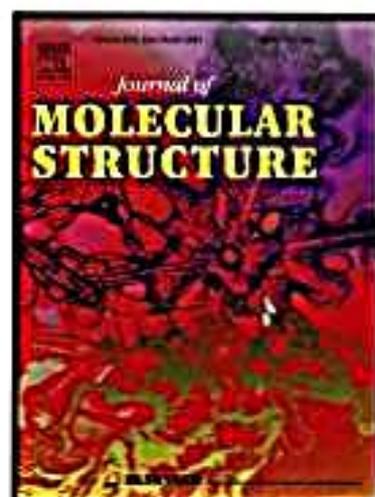
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RESEARCH PAPERS

1

Overcoming the Trauma of Homelessness: A Study of the Diasporic Poems of Mona Dash, Kavita A. Jindal, Usha Kishore and Yogesh Patel

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Abstract

In my paper, I propose to underscore the process of acculturation in the land of settlement and the formation of home in the poems of four diasporic poets. The poetry of Kavita A. Jindal, Mona Dash, Yogesh Patel and Usha Kishore is preoccupied with the question of "belongingness" in the age of globalization. The poets overcome the trauma of "homelessness" or "unhomeliness" by negotiating with the new world. Their past and the present constantly interact with each other in their process of "homemaking". I intend to show how all of them despite possessing a homing desire try to cope up with a foreign world. The appeal of their poems is truly transcultural. They resolve the agonies of deterritorialization by accepting the challenges of transplanting their roots in the adopted country. The ambiguities, differences, between here/there, homeland/ host land are beautifully resolved in their poetry. Instead of having cultural myopia, their poems speak of acculturation and participation. The trauma of dislocation is turned into a celebration of the transcultural identity.

[Keywords: Home, Diaspora, Acculturation, Identity]



Zircon and monazite geochronology from the Rengali-Eastern Ghats Province: Implications for the tectonic evolution of the eastern Indian terrane

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Singhbhum craton
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Zircon
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ABSTRACT

The tectonic evolution of the Rengali Province and its eventual juxtaposition to the Eastern Ghats Province has important bearings on the geological evolution of the Eastern Indian terrane. New zircon and monazite age data from the Rengali Province and the northern-northwestern part of the Eastern Ghats are presented in this study to trace this evolutionary history. Monazite U-Th-total Pb data from the paragneissic rocks of the eastern Rengali Province show a metamorphic age of 2775 ± 18 Ma while an older age of 2943 ± 35 Ma from the same rock probably suggests an older metamorphic/magmatic event. Zircon U-Pb (LA-ICPMS) data from the northern part of the Eastern Ghats show 1230 ± 21 Ma and 1220 ± 9 Ma ages that we interpret as a major phase of high-grade metamorphism of the basement. Paragneissic rocks from the northwestern margin of the Eastern Ghats yields monazite ages of 966 ± 21 Ma and 555 ± 12 Ma respectively from the core and rim parts of monazite grains. Similar ages of 966 ± 25 Ma and 540 ± 12 Ma are reported from paragneissic rock occurring at the contact of Rengali Province and the Eastern Ghats. This younger (~ 555 – 540 Ma) age likely correlates to the amphibolite facies reworking of the granulitic lower crust which coincides with the emplacement of nepheline syenite at 556 ± 28 Ma (zircon U-Pb data) and the contact metamorphism of the ultramafic granofels at 553 ± 18 Ma (monazite data). Nepheline monzosyenite veins intruded the gneissic nepheline syenite at 506 ± 9 Ma (zircon U-Pb data). Emplacement of the monzosyenite veins within the felsic gneiss country at the northwestern margin of the Eastern Ghats at 490 ± 3 Ma (zircon U-Pb data) marks the last thermal imprint in response to large-scale shear-induced deformation at the northern/northwestern contacts of the Eastern Ghats. We infer that the Neoproterozoic (ca. 2943–2775 Ma) events possibly resulted from the ensuing convergent tectonics driven by lithospheric peeling (peel-back convergent tectonics). The Eastern Ghats and its Antarctic counterpart juxtaposed with the Rengali Province during ca. 1000–900 Ma and become a part of the Eastern Indian terrane. The Ediacaran-Cambrian (ca. 556–490 Ma) events imply the reactivation of the deep crustal Tonian-age shear systems in a transpressional tectonic setting.

1. Introduction

The geological history of the Earth since its inception is etched in the rock records of cratons which are the only repositories of products of the early Earth processes (Condie and Pease, 2008; Cawood et al., 2013; Hawkesworth et al., 2017). Geological records suggest that cratonic cores formed mostly during the early-to-mid Archean eon (references as

above) and subsequently modified by multiple cycles of magmatism, metamorphism, sedimentation, and deformation along their margins (Friend and Nutman, 2005; Windley and Gerde, 2009; Goscombe et al., 2019). These processes eventually led to the growth of cratons that we see in their present configuration. Tectonics played a pivotal role in this evolutionary process in terms of crust-mantle coupling and decoupling. Although the debate on how and when the tectonic styles of the Earth

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Synthesis of Fused Pyran and Tetracyclic Pyran Rings by Intramolecular Palladium-catalyzed β -H Elimination and C–H Bond Functionalization

Rathin Jana,^{1,*} Mitali Dewan¹ and Gourisankar Roymahapatra²

Abstract

Pyrans constitute an important class of 6-member heterocycles with one oxygen atom. Together with its benzo derivatives, pyrans can formulate a prevalent variety of natural and synthetic products in industrial applications. This is an important core molecule having versatile use with its derivatives in pharmaceuticals, dye industry, catalysis, agrochemicals and many more. Several methods for the preparation of pyran derivatives have been reported earlier. This article reports the development of an efficient method for the construction of a fused pyran ring by intramolecular Heck reaction followed by β -H elimination from O-allylated ether. A tetracyclic pyran ring has also been synthesized by intramolecular Heck reaction followed by C–H bond activation from O-methylallylated ether.

Keywords: Fused pyran; Intermolecular Heck; Regioselective; C–H bond functionalization; Alkyl palladium complex.

Received date: 12 January 2021; Accepted date: 17 April 2021.

Article type: Research article.

1. Introduction

Pyran, an oxygen-containing heterocyclic moiety, exhibits an display of pharmacological properties, agrochemical, and industrial properties.^[1-3] Pyran is the most important structural subunits found widely in natural products, *e.g.* coumarins, benzopyrans, sugars, flavonoids, xanthenes, *etc.* The various anticancer proficiencies of pyrans have been furthermore demonstrated by the fact that this heterocycle has recently been a crucial point for researchers worldwide.^[1] Together with its benzo derivatives, pyrans can formulate a widespread variation for pharmaceutical applications with many approved drugs, and promising candidates in clinical trials. In the last decade, cyclodextrins and carbohydrate-based polymers have been investigated for innovative biomedical applications.^[2] Pyran moiety is found to be a pivot to synthesize macrolide antibiotics, aminoglycosides, anthracycline antibiotics, neurological modulators and many others antibiotics and anti-infective, anti-inflammatory agents, agrochemicals, toxins, polymers and additives.^[3] Recently bioactive natural products having pyran moiety

have been isolated having various applications.^[2] Pyran based dyes have also arisen as talented photoredox catalysts and key components in solar cells and sensors.^[2] Palladium(II) complexes are enormously significant in organopalladium chemistry. They are typically electrophilic, soluble in common organic solvents, and stable to air. Thus, they are easily stored and handled. Cyclization by palladium-catalyzed oxidative addition/reductive elimination is a useful method for the synthesis of heterocycles.^[4-6] This method involves the addition of a covalent molecule to a Pd(0) complex followed by oxidation of Pd(0) to Pd(II), to afford an organopalladium(II) halide or triflate complex. Then the β -bonded species, undergoes rapid insertion of an unsaturated species. Then reductive elimination gives the desired heterocycle. The mechanistic details of these processes have been reviewed.^[7-11] The palladium-catalyzed cyclization of vinylic/aryl halides or triflates containing alkenes, dienes, alkynes, and arenes via oxidative addition/reductive elimination reactions provides a powerful method to a various pyran and furans heterocycles^[11-29] Among them pyran is core structure of various natural products. Numerous synthetic efforts for the preparation of pyran rings have been reported by different groups.^[30-37] Being inspired by the importance of pyran derivatives, we have synthesized this pyran by palladium catalyzed intermolecular Heck reaction. Here we describe the applicability of our early developed

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Synthesis of 9, 10-dihydrophenanthrene, Phenanthrene, Mono- and Dialkyl Phenanthrene and Octa-hydro Phenanthrene by Palladium-catalyzed Heck Reactions[‡]

Rathin Jana,^{1,*} Mitali Dewan¹ and Gourisankar Roymahapatra²

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A new approach of reaction mechanism to synthesize 9, 10-dihydro phenanthrene, alkyl phenanthrene, and octa-hydro phenanthrene has been developed via a palladium-catalyzed Heck reaction followed by Reverse Diels-Alder reaction of formaldehyde elimination. The procedure is useful for the synthesis of homologous compounds with a suitable starting material. This will be a new approach to synthesize the phenanthrene derivatives to originate a huge variety of natural and synthetic products for industrial and biomedical applications.

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Received: 12 January 2021; Accepted: 5 June 2021.

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1. Introduction:

Palladium-catalyzed C-C bond-forming^[1-3] reaction is significant for the synthesis of carbocyclic compounds.^[4] Polycyclic aromatic hydrocarbons (PAHs), more simply known as polyarenes, constitute extraordinarily large and various classes of organic molecules.^[5,6] Phenanthrene is an important core structure of PAH. The phenanthrene moiety can not only be found in several natural products, of which many exhibit interesting biological activity,^[7] but more recently phenanthrenes plays an important role as interesting ligands for novel catalyst systems.^[8] Previously it was thought that PAHs are direct-acting carcinogens,^[9] but it is now accepted that PAHs require metabolic activation to express tumorigenic reactivity.^[10,11] Due to its highly lipophilic behavior, phenanthrenes and PAHs are soluble in most organic solvents, and they manifest various functions such as light sensitivity, heat resistance, conductivity; emit ability, corrosion resistance, and physiological action.^[12] Numerous synthetic efforts for the preparation of PAHs have been reported by different groups, of which most common is oxidative photocyclization of

stilbene derivatives.^[13] Among other methods intramolecular Diels–Alder reaction,^[14] flash vacuum pyrolysis,^[15-18] olefin metathesis,^[19] Friedel-Crafts type cyclization,^[20] dimerization or trimerization of acetylenes and arynes,^[21,22] transition metal-catalyzed cycloisomerization,^[23,24] etc. are the key step for making of a benzene ring for the synthesis of PAHs. Palladium-catalyzed C-H bond activation has been used widely in numerous organic syntheses since this reaction gives a solution for the construction of carbo- and heterocycles from the corresponding halides and triflates.^[25-31] Some groups have developed a novel Palladium-catalyzed 1,4 migration/C-H activation for the synthesis of complex fused polycycles.^[32-34] The major sources of PAHs are crude oil, coal, oil shale. Methylphenanthrene belongs to an important group of alkyl-aromatic hydrocarbons which are present in natural environments. There is a great variety of methods which are available for the synthesis of phenanthrene and its derivatives. Perhaps the most extensive method is the classical Haworth synthesis. The importance of these PAH compounds attracted researchers to synthesize new phenanthrene derivatives and also to try alternate reaction mechanisms. In recent times (2019), Juan *et al.* has derived a variety of phenanthrene derivatives by palladium-catalyzed controlled Suzuki–Miyaura coupling reaction followed by C–H activation.^[35] Scientists also reported efficient approaches for synthesizing functionalized phenanthrenes with a broad substrate range and good functional groups.^[36] Recently Jin *et al.* reported a series ofazole-fused phenanthrenes which are found to be important

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Bioactive Metal Complexes of Schiff Base Derived from 2,3-Dioxobutane, Ethane-1,2-diamine and 4-Chloro-2-formylphenol: Spectral Studies and *in vitro* Antimicrobial Activity

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A novel series of trivalent coordination complexes was synthesized by the reaction between a chloride/acetate salt of iron, chromium, cobalt or manganese ions and NNNNOO type persuasive Schiff base ligand synthesized from 2,3-dioxobutane, ethane-1,2-diamine and 4-chloro-2-formylphenol. Synthesized compounds were characterized by using elemental analysis, molar conductance, magnetic moment, IR, UV-visible, ¹H NMR, ¹³C NMR and ESI-MS spectral analyses. IR and NMR spectra favoured hexadentate coordination behaviour of ligand. Electronic spectra and magnetic moment data reveal *O_h* geometry with distortion around the metal ion in complexes. The molar conductance values show 1:1 electrolytic nature of complexes. Biological potentiality of the ligand and its metal complexes were tested *in vitro* against two bacterial and two fungal strains; *Bacillus subtilis*, *Escherichia coli* and *Aspirtgillus niger*, *Aspirtgillus flavus*, respectively.

Keywords: Schiff base, Bioactive moieties, Mononuclear complexes, Antimicrobial potency.

INTRODUCTION

Schiff base, a class of potent lone pair donor moiety shows better response among other species of donors owing to easier designing and structural suppleness to bind with metal ions [1,2]. Schiff base ligands synthesized with diketones/hydroxy aldehydes and amines have the unique potential to behave as a drug from antimicrobial to anticancer and their metal complexes have always shown improved potency than free ligand [3-5]. Recent developments in Schiff bases and their metal complexes and their applications in various field of pharmacology as antibacterial, antifungal, anti-inflammatory, anti-oxidant, anticancer agent, MRI contrasting agent, *etc.*, clearly gives an indication of success opportunities in the field of medicinal inorganic chemistry, especially in coordination chemistry [6-9]. Metal complexes of several transition and some rare earth metal ions in their existing oxidation states with Schiff base moieties as well as with other lone pair donor moieties have/had been developed and then applied for their

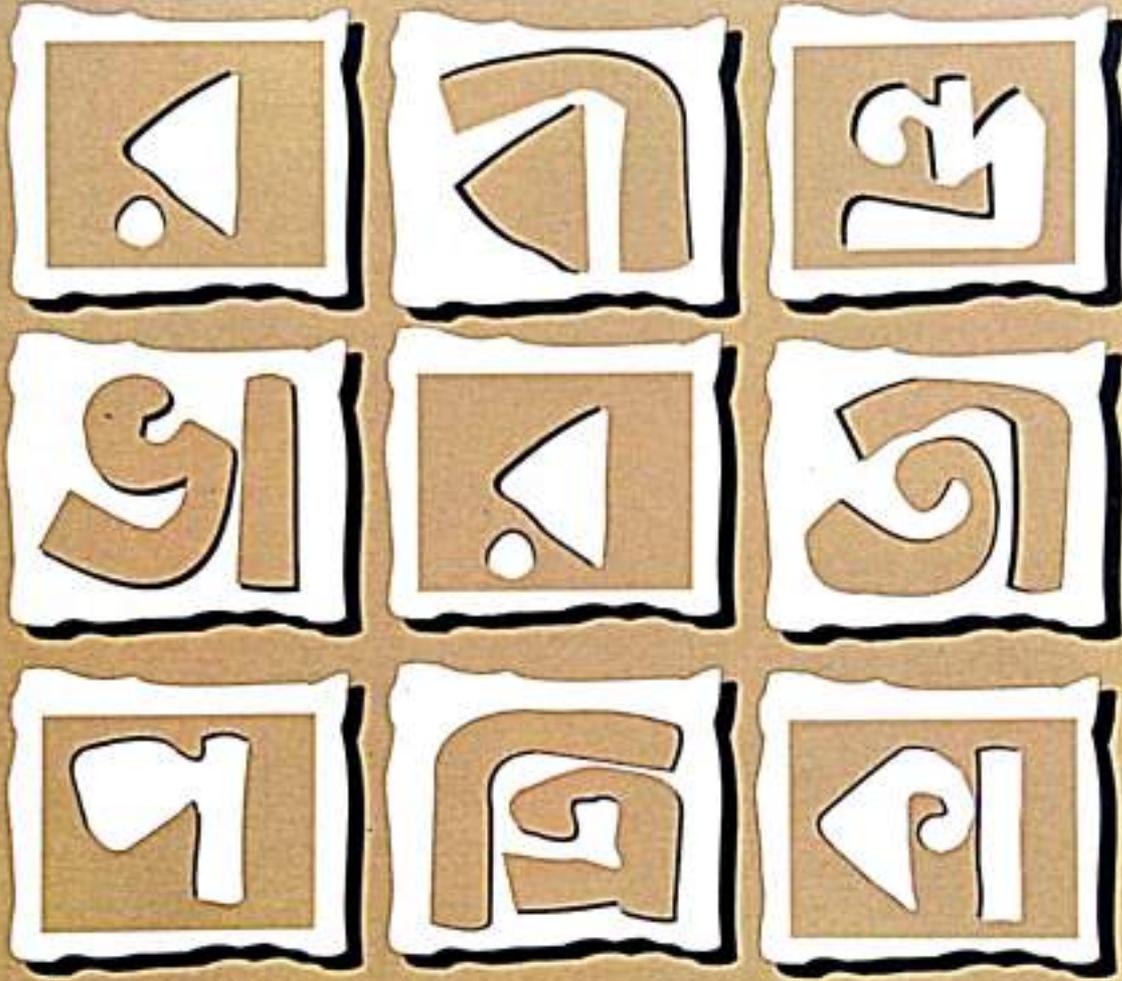
therapeutic explorations in diabetes, tuberculosis, HIV, *etc.* [10-16]. Schiff base metal complexes are also the molecule of interest for those researchers who are searching potent material for catalysis, photovoltaic activity, chemosensor activity, nano-material syntheses and other emerging field of human wellness research [17-24].

In present period of COVID-19 pandemic, when co-infections of bacterial and fungal pathogens are seen in patients during viral infection, the researchers are seeking for novel and potent antimicrobial agents to treat these co-infections and thus to control COVID-19 mortality rate also [25-28]. In such type of condition, development of new antibacterial and antifungal agents is definitely a great support in the field of drug discovery. Other than traditional organic synthons, pharmacologists may also look towards metal based drugs like coordination molecules because previous studies indicate that complexation may enhance the potential of many commercially available antibiotic drugs against many pathogens and even also break the resistance nature of many drug resistance bacteria/fungi [29-32].

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Quasielastic backscattering and barrier distribution for the weakly bound projectile ${}^6\text{Li}$ on ${}^{159}\text{Tb}$

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The excitation function for quasielastic scattering of the weakly bound projectile ${}^6\text{Li}$ on a ${}^{159}\text{Tb}$ target, at large backward angle, has been measured at energies around the Coulomb barrier. The corresponding quasielastic barrier distribution has been extracted from the experimental cross sections, both including and excluding the α particles produced in the reaction. The quasielastic scattering cross sections, excluding the α particles, have been analyzed in the framework of coupled channels calculations. The centroid of the quasielastic barrier distribution, including the α particles, is found to shift towards higher energy relative to the centroid of the fusion barrier distribution for the system. This has been attributed to the low α -breakup threshold of the nucleus ${}^6\text{Li}$.

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I. INTRODUCTION

Large back-angle quasielastic scattering is a powerful tool for the analysis of barrier distributions close to the Coulomb barrier [1]. Investigation of the quasielastic scattering process in various systems has been stimulated in recent years, especially in the context of reactions induced by weakly bound stable projectiles, where breakup is an important reaction mechanism. Quasielastic (QEL) scattering is defined as the sum of all direct processes, like elastic and inelastic scattering and transfer channels. Large back-angle QEL scattering is complementary to the fusion process, since the former is related to the reflection probability at the barrier, while the latter is related to the penetration probability.

Fusion is usually the dominant mode of reaction at energies around the barrier, except in cases where direct reaction channels dominate at lower energies. It is well known that the coupling of the relative motion of the colliding nuclei to their internal degrees of freedom manifests itself as a strong enhancement of fusion cross sections at sub-barrier energies [2]. However, the nature of the couplings affecting the fusion process is not always apparent from the measured fusion excitation function. Rowley *et al.* [3] proposed that a barrier distribution, resulting from channel couplings, can be extracted from a precisely measured fusion excitation function

using the relation

$$D_{\text{fus}}(E) = \frac{d^2}{dE^2} [E\sigma_{\text{fus}}(E)], \quad (1)$$

where $\sigma_{\text{fus}}(E)$ is the fusion cross section for the system at the center-of-mass energy E . Over the years, this prescription has been very successful for understanding the fusion mechanism in a wide range of reactions [2].

Alternatively, a similar barrier distribution can also be extracted from a much simpler measurement of the QEL scattering excitation function at large back angle. The QEL barrier distribution D_{qel} is obtained as [4]

$$D_{\text{qel}}(E) = -\frac{d}{dE} \left[\frac{d\sigma_{\text{qel}}}{d\sigma_{\text{Ruth}}}(E) \right], \quad (2)$$

where $(d\sigma_{\text{qel}}/d\sigma_{\text{Ruth}})$ is the ratio of QEL scattering and Rutherford scattering differential cross sections at a fixed back angle. Zagrebaev [5] argued that the barrier distribution obtained from QEL scattering excitation function determines a threshold distribution for all reaction processes other than fusion, and this has important ramifications in the case of heavy or weakly bound projectiles, where contributions from deep-inelastic collisions or breakup processes are important. This interpretation explains the differences observed in the distributions obtained from fusion and QEL scattering for very heavy systems, like ${}^{48}\text{Ti} + {}^{208}\text{Pb}$, ${}^{64}\text{Ni} + {}^{208}\text{Pb}$, and ${}^{70}\text{Zn} + {}^{208}\text{Pb}$ [6], where the deep-inelastic process is a significant contributor. A similar situation can also arise in the case of reactions with weakly bound nuclei, where the breakup channel is an important reaction mechanism.

For weakly bound nuclei, following projectile breakup if none of the fragments are captured by the target then the process is called noncapture breakup (NCBU); if one of the fragments fuses with the target then it is called an incomplete fusion (ICF) process. The breakup channel is known to

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Large back-angle quasielastic scattering for ${}^7\text{Li} + {}^{159}\text{Tb}$

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Quasielastic scattering excitation function at large backward angle has been measured for the weakly bound system ${}^7\text{Li} + {}^{159}\text{Tb}$ at energies around the Coulomb barrier. The corresponding quasielastic barrier distribution has been derived from the excitation function, both including and excluding the α particles produced in the reaction. The centroid of the barrier distribution obtained after inclusion of α particles was found to be shifted higher in energy, compared with the distribution excluding the α particles. The quasielastic data, excluding the α particles, have been analyzed in the framework of continuum discretized coupled-channels calculations. The quasielastic barrier distribution for ${}^7\text{Li} + {}^{159}\text{Tb}$, has also been compared with the fusion barrier distribution for the system.

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I. INTRODUCTION

Heavy-ion fusion at near-barrier energies is strongly affected by the internal structure of the colliding nuclei and coupling to the direct nuclear processes, like inelastic excitation and direct nucleon transfer. The coupling of the relative motion to the internal degrees of freedom successfully explained the subbarrier fusion enhancement observed in heavy-ion collisions with respect to the one-dimensional barrier penetration model calculations [1,2].

The coupling essentially modifies the effective interaction potential and in turn splits the single, uncoupled fusion barrier into a distribution of barriers. The fusion barrier distribution, D_{fus} for a system can be derived from the measured fusion excitation function as [3]

$$D_{\text{fus}}(E) = \frac{d^2}{dE^2} [E\sigma_{\text{fus}}(E)], \quad (1)$$

where $\sigma_{\text{fus}}(E)$ is the fusion cross section for the system at the center-of-mass energy E . Over the past several years of research in heavy-ion collisions, $D_{\text{fus}}(E)$ has evolved to be a powerful tool to decipher the effects of coupling of various channels on subbarrier fusion and hence probe the

reaction dynamics of nucleus-nucleus collisions [2]. Since extraction of $D_{\text{fus}}(E)$ involves the second derivative of $E\sigma_{\text{fus}}(E)$, obtaining a meaningful barrier distribution requires very precisely measured fusion data.

A similar barrier distribution can also be extracted from large back-angle quasielastic scattering excitation function [4]. The quasielastic scattering is defined as the sum of all direct processes, like elastic and inelastic scattering and transfer processes. Fusion is related to transmission through the barrier, whereas large back-angle quasielastic scattering is related to reflection at the barrier. Because of the conservation of reaction flux, these two processes may be considered as complementary to each other. The quasielastic barrier distribution, D_{qel} is obtained as [4]

$$D_{\text{qel}}(E) = -\frac{d}{dE} \left[\frac{d\sigma_{\text{qel}}}{d\sigma_{\text{Ruth}}}(E) \right], \quad (2)$$

where $d\sigma_{\text{qel}}/d\sigma_{\text{Ruth}}$ is the ratio of quasielastic scattering and Rutherford scattering differential cross sections at a fixed back-angle. Because D_{qel} is derived from the first derivative, unlike D_{fus} , the uncertainty associated with D_{qel} is less than that associated with D_{fus} .

It has been observed that, for heavy-ion collisions involving tightly bound nuclei, where fusion is the most dominant reaction process at near-barrier energies, D_{fus} and D_{qel} are very similar [2,5–8]. By contrast, for very heavy systems, where deep-inelastic processes become important, it has been argued by Zagrabaev [9] that the quasielastic barrier distribution extracted from the sum of elastic and inelastic backscattering processes represents the total reaction threshold distribution and differs from the distribution derived from the fusion excitation function. For reactions, where cross sections of nonfusion channels are comparable to fusion cross

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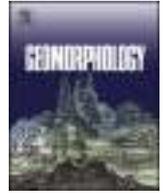
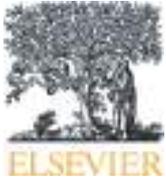
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Avulsion of the Brahmaputra in Bangladesh during the 18th–19th century: A review based on cartographic and literary evidence

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ABSTRACT

Avulsions involve switching of fluvial discharge through a new channel from an existing course and occur over varied timeframes ranging from hours to decades. With a peak discharge above 100,000 m³/s, the Brahmaputra (2900 km) is one of the largest rivers in the world. Its lower course through the Ganga–Brahmaputra–Meghna (GBM) Delta of Bangladesh was first mapped in 1764–73 as a broad eastward-swinging curvature skirting the subsiding Sylhet Wetlands and falling into the Meghna River. Beginning from the late eighteenth century, the river started to avulse into a linear, more direct, southward passage into the Ganga called the Jamuna and decreased its length by 46 km (14.2%) from its former course to the Bay of Bengal. Examination of the established timeline and procedure of the avulsion event using maps and images from 1764–73, 1830–34, 1854–60, 1907–24, and 2014, in addition to evidence from contemporary literature and tree-ring reconstructed long-term discharge data, connoted certain discrepancies. Our re-evaluation indicated that the Brahmaputra shifted westward and was captured by a parallel distributary of the neighbouring Tista system initiating the switch. This was probably aided by exceptionally high monsoonal discharge between 1786 and 1790 as well as the 1787 break-in of the Tista into the Brahmaputra. Because of its high width:depth ratio and braided planform that prevented fast escape of the discharge, abandonment of the eastern channel—the ‘Old’ Brahmaputra—progressed gradually; well into the next century with the new channel taking over almost completely by 1855–60. Comparable switchings of the Brahmaputra occurred six times in the last 11 kyr and significantly influenced development of the GBM Delta. The century-scale timeline of the last avulsion event described here refines its current understanding by proposing river capture as the mechanism of avulsion, possibly triggered by clustering of high-flood years.

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Minimum r -neighborhood covering set of permutation graphs

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For a connected graph $G(V, E)$ and a fixed integer $r > 0$, a node $q \in V$ r -dominates another node $s \in V$ if $d(q, s) \leq r$. An edge (q, s) is r -neighborhood covered by a vertex t , if $d(q, t) \leq r$ and $d(s, t) \leq r$, i.e., both the vertices q and s are r -dominated by the vertex t . A set $C_r \subseteq V$ is known to be a r -neighborhood covering (r -NC) set of graph G if and only if one or more vertices of C_r r -dominate each edge in E . Among all r -NC sets of graph G , the set with fewest cardinality is the minimum r -NC set of G and we indicate its cardinality as r -NC-number and we denote it by the symbol $\rho(G, r)$. This is an NP-complete problem on general graphs. It is also NP-complete for chordal graphs. Here, we develop an $O(n)$ time algorithm for computing a minimum r -NC set of permutation graphs, where n indicates the order of the set V .

Keywords: r -neighborhood covering; permutation graph; algorithm.

Mathematics Subject Classification 2020: 05C30, 05C12, 68R10

An optimal algorithm to find minimum k -hop connected dominating set of permutation graphs

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A set $D_k \subseteq V$ is said to be a k -hop dominating set (k -HDS) of a graph $G = (V, E)$ if every vertex $x \in V$ is within k -distances from at least one vertex $t \in D_k$, i.e. $d(x, t) \leq k$, where k is a fixed positive integer. A dominating set D_k is said to be minimum k -hop connected dominating set of a graph G , if it is minimal as well as it is k -HDS and the subgraph of G made by D_k is connected. In this paper, we present an $O(n)$ -time algorithm for computing a minimum k -hop connected dominating set of permutation graphs with n vertices.

Keywords: Algorithms; k -hop connected domination; permutation graphs.

AMS Subject Classification: 05C30, 05C12, 68R10, 68Q25

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Instigating the *In Vitro* Anticancer Activity of New Pyridine–Thiazole-Based Co(III), Mn(II), and Ni(II) Complexes: Synthesis, Structure, DFT, Docking, and MD Simulation Studies

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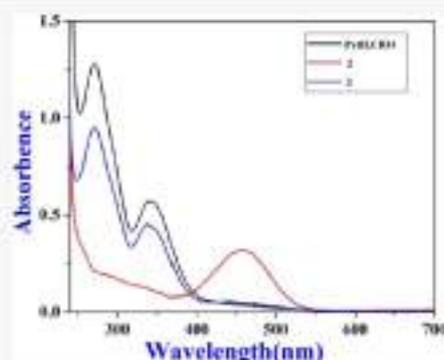
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ABSTRACT: The perchlorate salt of (4-(4-methoxy phenyl)-2-(2-(1-pyridine-2-yl)ethylidene)hydrazinyl)thiazole (PyTH·ClO₄) and its metal perchlorate derivatives, namely, [Co(PyTH)₂](ClO₄)₂ (1), [Mn(PyTH)₂](ClO₄)₂ (2), and [Ni(PyTH)₂](ClO₄)₂ (3), have been synthesized and characterized through single X-ray crystallography and spectroscopic methods. The ligand crystallizes in a space group *P2₁/n* in a nearly planar structure. The overall geometry of the complex salts is described as a distorted octahedron with a MN₆ chromophore. The ligand (PyTH·ClO₄) behaves as a neutral *N,N,N*-tridentate donor toward the “soft” Mn(II) and Ni(II) centers, whereas the deprotonated ligand stabilizes the “hard” Co(III) center. The DNA binding constant (*K_b*) values of PyTH·ClO₄, 1, 2, and 3 are determined using the UV–vis spectroscopic method, and the *K_i* values are 9.29×10^5 , 7.11×10^5 , 8.71×10^5 , and 7.82×10^5 mol⁻¹, respectively, indicating the intercalative mode of interactions with CT-DNA. All the derivatives show effective antiproliferative activity against U-937 human monocytic tumor cells with IC₅₀ values 4.374 ± 0.02 , 5.583 ± 0.12 , 0.3976 ± 0.05 , and 11.63 ± 0.01 μM for PyTH·ClO₄, 1, 2, and 3, respectively. The best apoptosis mode of cell death is shown by 2 followed by PyTH·ClO₄ and 1 at an equivalent concentration of IC₅₀ values. The combined molecular docking and dynamics simulation study evaluates the binding energies of anticancer agents, providing groove binding property with DNA. The 20 ns molecular dynamics simulation study reveals the maximum DNA binding stability of 2 corroborating the experimental results. The new class of metal derivatives of pyridine–thiazole can be used for advanced cancer therapeutics.



INTRODUCTION

The thiazole and pyridine-containing compounds have shown therapeutically potent biological activities, such as antimicrobial,¹ antitumor,^{1,2} anti-inflammatory,³ and hypoglycemic activities.⁴ Such excellent activities are related to the structural aspects of N and S heterocycles. Thiazole is a well-known stable NS donor heterocyclic aromatic compound having a Bird's Index of aromaticity of 79.⁵ The π -electron density makes C5 the site for electrophilic substitution and the C2 position as the site for nucleophilic substitution in thiazole. The aromatic behavior of thiazole was nicely explained by Erlenmeyer et al. based on the concept of isosterism, the lone pair of electrons on bivalent sulfur atoms being equivalent to the vinylene part of the pyridine structure.⁶ Both the electron-accepting and -donating properties are inherited in the thiazole ring due to the presence of a $-C=N$ bond and a $-S-$ bond, respectively. This unique property of thiazole has been exploited to establish several new biochemical formulae in advanced biology. Different groups in thiazole rings in different positions lead to plenty of bioactive thiazole derivatives having a wide range of applications in biology and pharmacy.^{7–14} On the other hand, pyridine (*pK_a* = 5.2) provides N-terminal and

forms stable salts, which is often used as a solvent to neutralize the acid formed in the reaction.¹⁵ Moreover, the metal directing property of pyridine makes it an important fluorophore in bioinorganic chemistry. Several high-profile proprietary drugs, namely, Nexium, Takepron, Singulair, and Actos, contain pyridine scaffolds.¹⁶ The compounds containing both thiazole and pyridine moieties have been used in designing new ligands for therapeutics, notably for cancer treatment. The antitumor activity of the molecules increased many folds while bonded covalently to metal ions. The reason may be that the formation of a metal–organic framework added some more properties such as redox activities, unsaturated metal center, strain in the complex structure, planarity, lipophilicity, and so forth than the metal-free organic

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তবু একালাব্য

ভাষা-সাহিত্য-সংস্কৃতি বিষয়ক গবেষণা পত্রিকা
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TABU EKALABYA

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বাংলা সাহিত্যে সামাজিক-সাংস্কৃতিক-রাজনৈতিক
ও ধর্মীয় আন্দোলন
বিশেষ সংখ্যা

সম্পাদক • দীপঙ্কর মল্লিক
আমন্ত্রিত সম্পাদক • দেবাশিস পাল



দি গৌরী কালচারাল এন্ড এডুকেশনাল অ্যাসোসিয়েশন
সমাজ-সংস্কৃতি-সাহিত্য গবেষণাকেন্দ্র

Asymmetric exclusion processes with fixed resources: Reservoir crowding and steady statesAstik Haldar,^{1,*} Parna Roy,^{2,†} and Abhik Basu^{1,‡}¹Theory Division, Saha Institute of Nuclear Physics, HBNI, Calcutta 700064, West Bengal, India²Shahid Matangini Hazra Government College for Women, Purba Medinipore 721649, West Bengal, India

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We study the reservoir crowding effect by considering the nonequilibrium steady states of an asymmetric exclusion process (TASEP) coupled to a reservoir with fixed available resources and dynamically coupled entry and exit rate. We elucidate how the steady states are controlled by the interplay between the coupled entry and exit rates, both being dynamically controlled by the reservoir population, and the fixed total particle number in the system. The TASEP can be in the low-density, high-density, maximal current, and shock phases. We show that such a TASEP is different from an open TASEP for *all* values of available resources: here the TASEP can support only localized domain walls for any (finite) amount of resources that do not tend to delocalize even for large resources, a feature attributed to the form of the dynamic coupling between the entry and exit rates. Furthermore, in the limit of infinite resources, in contrast to an open TASEP, the TASEP can be found in its high-density phase only for any finite values of the control parameters, again as a consequence of the coupling between the entry and exit rates.

DOI: [10.1103/PhysRevE.104.034106](https://doi.org/10.1103/PhysRevE.104.034106)**I. INTRODUCTION**

An overall theoretical understanding of nonequilibrium driven diffusive systems, with potential connections with hosts of natural phenomena, remains elusive today. In the absence of any general theoretical framework to study nonequilibrium systems, it is useful to consider and study simple model systems, where explicit calculations can be performed easily, helping to develop wide-ranging physical intuitions. The totally asymmetric simple exclusion process (TASEP), an archetypal driven system, was originally introduced as a conceptual model for describing protein synthesis in biological cells [1]. Later it emerged as a paradigmatic model for boundary-induced nonequilibrium phase transitions in one dimension [2]. Unlike a TASEP with open boundary conditions, TASEPs in closed geometries strictly conserve the total particle number. A TASEP on a ring with a single point defect has been studied in Ref. [3] that shows a localized domain wall (LDW) for intermediate densities. An open TASEP with a global constraint on the total particle number, i.e., a TASEP connected with a particle reservoir of finite capacity or a particle storage [4–8], is distinct from a conventional open TASEP or a TASEP on a ring. These models, broadly called TASEPs with finite resources, are expected to be relevant in related biological processes of protein synthesis in cells [4] and also in the context of traffic [9]; see also Ref. [10] for a similar study. In these models, the primary effect of the finiteness of the available resources is that the effective entry rate of the particles to the TASEP, e.g., the actual protein synthesis taking place, sensitively depends

upon the available resources. Detailed studies, both numerical MCS and analytical MFT, reveal rich nonuniform steady-state density profiles including pinning of domain walls in these models [4–8]. These have been applied to various different problems, e.g., limited resources in driven diffusive systems [11], different biological contexts like mRNA translations and motor protein dynamics in cells [12], and traffic problems [9]. Notable experimental studies relevant to these model systems include studies on spindles in eukaryotic cells [13]. From the standpoint of nonequilibrium statistical mechanics, these models serve as minimal models for “nonequilibrium phase transitions with a global conservation law.”

In the existing models for TASEPs with finite resources, the exit rates from the TASEP lanes are unaffected by the reservoir population. It is, however, reasonable to expect that a crowded reservoir (i.e., with “high” reservoir occupation) not only facilitates entry of particles into the TASEP but may also hinder particles leaving TASEP as well. This can potentially lead to a very low current in the TASEP in the steady state in the limit of high reservoir occupation. In this work, we explore a simple mechanism for avoidance of a crowded reservoir by the particles or agents, i.e., the particles are *more inclined* to leave the reservoir, but *more inhibited* to return to it, if the latter gets more crowded. We show that this ensures that even in the limit of infinite resources, the TASEP connected to a reservoir remains qualitatively different from a TASEP with open boundary conditions. We call this the “reservoir crowding effect” and model this in terms of “effective entry and exit rates,” both of which depend upon the instantaneous reservoir occupation and which are mutually coupled. In this article we study how this can affect the NESS of the TASEP connected to it.

We introduce and systematically study a simple minimal model for reservoir crowding that consists of a single TASEP

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Interrogating Gender and Empowering Women: A Study of Selected Poems of Rupi Kaur and Tishani Doshi

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Abstract

In my paper, I have endeavoured to examine some selected poems of Rupi Kaur and Tishani Doshi. Both of them challenge the gender stereotypes prevalent in society and address the feminist issues perceived through multiple avenues of life. The women in their poems are the crusaders of hope for the marginalised, peripheral women in the world. I have examined how they aim at transforming the world to create a better future for everyone. The women they presented in their poems are free thinkers. I have attempted to show how these two women poets projected women who assert their rights and might and prove their self-sufficiency leaving their silenced, suppressed, peripheral zone of existence. The women of Kaur and Doshi's poems question the lopsided societal norms which are preserved in gender-politics.

Keywords: Gender, Empowerment, Feminist, Women

Gender, the social elaboration of biological sex, constitutes one's sense of identity. It is central to our understanding of 'self'. In "Feminist and Gender Theories", Scott Appelrouth and Laura Edles

**PHYSICS OF ELEMENTARY PARTICLES
AND ATOMIC NUCLEI. THEORY**

Theoretical Study of the Role of Symmetry Energy as Well as Its Density Slope and Curvature on Neutron Star Core Crust Transition Density Using Finite Range Effective Interaction

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Abstract—The core crust transition density ρ_t and core crust transition pressure P_t of neutron stars are analyzed with the thermodynamical approach using finite range effective interaction for two different splittings of exchange strength parameters. The role of density derivatives of symmetry energy on ρ_t and P_t are studied and it is found that reducing the effect of slope, the curvature of symmetry energy dominates the variation of transition density. The results are compared with various models quoted in the literature.

Keywords: equation of state, nuclear symmetry energy, neutron star, transition density

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1. INTRODUCTION

Neutron stars are virtual laboratories for the physics and also natural measuring grounds of our learning about the Equation of State (EOS) of dense neutron-rich nuclear matter under extreme conditions [1, 2]. It has been a really challenging assignment for both the nuclear physics and astrophysics community to understand the structures and properties of neutron stars [NS] [3]. The EOS employed applies to different dynamical and static processes of neutron stars [4–12]. The EOS of symmetric nuclear matter (SNM) near to the saturation density, is well constrained and the related predictions are more stable but at high densities, these predictions and estimations suffer from diverse uncertainties. Our main interest is to study about these predictions like the core-crust interface. The interior of a neutron star is partitioned into the inner core and the outer one. Most of the star mass contains in the core region and the crust contains only a few percent of the total mass [13–19]. Some of the well-established approaches like the dynamical method [20–26], the thermodynamical method [27–30], and the random phase approximation (RPA) [16, 31] are employed to find the density at which the uniform liquid first becomes unstable against small-amplitude density fluctuations and the formation of nuclear clusters. Recently, Fortin et al. [32] have introduced a

method to determine the transition density in the framework of the unified EOS.

The nuclear matter symmetry energy $E_{\text{sym}}(\rho)$, its density derivatives like slope $L = 3\rho_0 \frac{dE_{\text{sym}}(\rho)}{d\rho}$ and curvature parameter $K_{\text{sym}} = 9\rho_0^2 \frac{d^2E_{\text{sym}}(\rho)}{d\rho^2}$ are related

to the transition density ρ_t . Also, these quantities are directly related to the neutron skin thickness “S” of heavy nuclei [33–35]. Various models or interactions are used to modify the range of transition density and constrain the value of star radius.

Finite range effective interactions successfully explained various properties of nuclear matter like modification of nucleon effective mass, calculation the values of 2nd and 4th order symmetry energy, proton fraction, β equilibrium, neutron skin thickness of some heavy nuclei, etc. Though the isoscalar part of the nuclear EOS is well established, at the same time the isovector part is still lesser known due to our limited knowledge of spin and isospin dependence of the nuclear force. In our present work, we analyze the core crust transition density as well as pressure at the inner edge of the neutron star using finite range effective interaction for two different splittings of exchange strength parameters. We also studied the role of density slope and curvature of symmetry energy on core



Disclosing Cyclic(Alkyl)(Amino)Carbenes as One-Electron Reductants: Synthesis of Acyclic(Amino)(Aryl)Carbene-Based Kekulé Diradicaloids

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Dedicated to Professor A. Ajayaghosh on the occasion of his 60th birthday

Abstract: Herein, we disclose cyclic(alkyl)(amino)carbenes (CAACs) to be one-electron reductants under the formation of a transient radical cation as indicated by EPR spectroscopy. The disclosed CAAC reducing reactivity was used to synthesize acyclic(amino)(aryl)carbene-based Thiele and Chichibabin hydrocarbons, a new class of Kekulé diradicaloids. The results

demonstrate CAACs to be potent organic reductants. Notably, the acyclic(amino)(aryl)carbene-based Chichibabin's hydrocarbon shows an appreciable population of the triplet state at room temperature, as evidenced by both variable-temperature NMR and EPR spectroscopy.

Introduction

Since the report of cyclic(alkyl)(amino)carbenes (CAACs) in 2005 by Bertrand's group^[1] such carbenes have been vastly used in different research areas ranging from advanced synthetic chemistry,^[2] organometallic chemistry^[3] to catalysis^[4] and material chemistry.^[5] In most cases it has been used as Lewis base, that is, a two-electron σ -donor accompanied by π -acceptor properties. In comparison with N-heterocyclic carbenes (NHCs), CAACs are considered as both more nucleophilic (stronger σ -donors) as well as more electrophilic (stronger π -acceptors) in nature due to the differences in substitution at the carbenic carbon center: two electronegative/ π -donating amino substituents versus one electronegative/ π -donating amino substituent and one σ -donating alkyl group.^[6] On the other hand, CAACs have a relatively smaller singlet-triplet energy gap compared to NHCs.^[6] As a result, CAACs are known to share one-electron with a reaction partner to form a covalent bond under the formation of various compounds including C-center based diradicals.^[7] However, unlike for NHCs the formation of radical-cations of CAACs have not been reported, not even in reactions with $\text{Ph}_3\text{C}^+\text{X}^-$ ($\text{X}=\text{PF}_6$ and $\text{B}(\text{C}_6\text{F}_5)_4$)^[8] or $\text{B}(\text{C}_6\text{F}_5)_3$.^[9] In the case of NHCs **I** the formation of radical cations **II** (Scheme 1) was observed with various oxidizing reagents.^[10] Recently, the formation of NHC-derived radical cations **II** and respective single electron transfer events were studied comprehensively by UV/Vis spectroscopy.^[11] NHC-derived radical cations have limited stability; either they abstract available hydrogen atoms to yield **III** or they dimerize to the dication of NHC-NHC dimer **IV** (Scheme 1), based on the N-substituents.^[10] The radical cations of parent carbenes (CH_2) as well as diaryl carbenes have been of particular interest for a long time during which they have been studied as transient species.^[12] Thus, we were

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Computation of minimum d -hop connected dominating set of trees in $O(n)$ time

Research Article

Amita Samanta Adhya, Sukumar Mondal, Sambhu Charan Barman, Jonecis A. Dayap

Abstract: For a graph $G = (V, E)$ and a fixed constant $d \in \mathbb{N}$, a subset D_{hd} of the vertex set V is a d -hop connected dominating set of the graph G if each vertex $t \in V$ is situated at most d -steps from at least one vertex $z \in D_{hd}$, that is, $d(t, z) \leq d$, and the subgraph of G induced by D_{hd} is connected. If D_{hd} has minimum cardinality, then it is a minimum d -hop connected dominating set. In this paper, we present two $O(n)$ -time algorithms for computing a minimum D_{hd} of trees with n vertices. We also design an algorithm to find the central vertices of a tree. Besides that, we also study some properties related to hop-domination on trees.

2010 MSC: 05C30, 05C12

Keywords: D -hop connected domination, Domination number, Trees

1. Introduction

A simple, connected, undirected graph without any cycles is called a *tree*. Trees are the very simplest category of graphs with enormous descriptive structure. Cayley [9] introduced the term “tree” first. Macky [25] made a tree database with at most 18 vertices. A rooted tree comes with a specified vertex, known as the root, which is distinct from the other nodes by being the ancestor node of every node

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Interrogating Memory in Robin S. Ngangom's *The Desire of Roots*

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Abstract

Robin S Ngangom's poetry is all about the culture, the community, and the plurality of Northeastern India. To read Ngangom is to explore different modes of memory. My paper aims at investigating some selected poems from his collection of poems entitled *The Desire of Roots* under the theoretical framework of memory. Ngangom's memory poems remain multidirectional as they address complex social realities and trigger serious issues of belongingness, identity crisis, and ethnicity. I propose to examine how the poet's poems on remembering and forgetting become political in his world of experiences. This paper unearths the discourses of "multidirectional memory", "folklore", "collective memory", and "trans-local memory" woven into the poems. I intend to study how memory operates to restore the past and reconstruct history. The research question revolves around the interconnection among history, identity, race, politics, and ethnicity.

Keywords: Memory, Remembering, North-East, multidirectional

The multicultural, multi-ethnic North-East India remains an alluring, intersectional field for memory study. Since time immemorial, the Northeastern region of India has charmed people with its impeccable

Impact of Poly (Vinyl Alcohol) on The Thermogelation Property and Drug Release Profile of Ophthalmic Formulations Based on Poloxamer 407

Mitali Dewan,^{*,[a, b]} Arpita Adhikari,^[a] Koushik Dutta,^[a] and Dipankar Chattopadhyay^{*,[a]}

In this study, we have designed and assessed a Ketorolac tromethamine (KT) based thermally responsive *in situ* ocular gelling system. These gelling systems consist of a thermally responsive *in situ* gelling polymer, poloxamer 407 (PM) and different molecular weight of poly (vinyl alcohol) (PVA) as release retardant. The formulations were analyzed for sol-gel

transition temperature, gelling aptitude, viscosity and rheological studies, gel morphology study, gel dissolution property and *in vitro* drug release study. FTIR spectral analysis was performed to explore any polymer-polymer or drug-polymer association. In comparison to commercially available drugs, the new formulations present a longer-lasting drug release profile.

Introduction

Now a day's it is quite challenging to construct efficient ocular drug delivery strategies which can present a long lasting release behavior. It should be more effective than conventional ophthalmic delivery system. Mostly prescribed and well approved way of applying ocular drug is in drop form. However, the primary disadvantages of utilising these eye drops are that only up to 5% of the drug dosage is absorbed by the cornea,^[1] with the remainder being rapidly ejected by the lachrymal and nasolacrimal routes.^[2,3] So, to attain targeted therapeutic effect either concentrated drug solution or frequent instillation of drug is required which may also bring out adverse effects and corneal cell injury.^[4-6] There are varieties of market available ophthalmic dosages forms like viscous solutions, ointments, inserts, gels, and suspensions etc that can lengthen precorneal contact timings and enhance ocular bioavailability. But these are also not appropriate for the ophthalmic use because of some other drawbacks such as blurry vision, annoyance of eye, patient refusal to comply, etc.^[7-9] Therefore, a drug dosages in the liquid form which is capable of enhancing ocular bioavailability is most suitable and demanding. Subsequently, the evolution of stable and sustained release *in situ* gel systems has been attempted as the best possible choice to surpass the foregoing problems. *In situ* forming gel systems are made up of different polymers loading with requisite drugs and formulated as liquid form so that it can be instilled without any hurdle into the eye but quickly converted to the gel during exposure to physiological condition. Thus sustained drug release rate of the delivery system

could be achieved.^[10-12] Different physiological stimulant including pH and temperature of precorneal surface, or tear fluid ionic composition can causes the sol to gel phase transition.^[13-16]

There exists a number of methyl cellulose and poloxamer 407 based thermo-reversible *in situ* gel formulation which show phase transition at physiological temperature. These newly developed formulations have ascertained their efficiency in controlling the drug release rate by enhancing ocular bioavailability in different studies.^[12,15-25]

Among different thermo responsive polymers, poloxamer 407 (Trade names are Lutrol^(R)F127, or Kolliphor^(R)P 407) is very useful synthetic polymers which have been used widely in different thermo-reversible *in-situ* gel ophthalmic formulations.^[12,15,16,22-28] It is a block copolymer (ABA type triblock) poly (ethylene oxide)-b-poly (propylene oxide)-b-poly (ethylene oxide) [PEO (A)-PPO (B)-PEO (A)] contain hydrophilic ethylene oxide unit (70%) and hydrophobic propylene oxide unit (30%), therefore it is amphiphilic in nature.^[12,29] Its molecular weight is around 13000 Dalton. Poloxamer 407 is non ionic, soluble in chilled water (~4 °C) and displays thermo-reversible gelation property. It turns from sol to gel state with elevated temperature because the hydrophilic ethylene oxide units are desolvated with increasing temperature and dominated hydrophobic interaction leads to micellar entanglement and gel formation.^[29-31] Poloxamer 407 is suitable polymer for the employment in ophthalmic drug delivery system due to its *in-situ* gel forming capacity in eye environment, ability to form transparent gel, biocompatibility and non-toxic nature.^[26,32]

Generally, 18 wt% of aqueous poloxamer 407 solution forms gel at physiological temperature, so it can be used as ophthalmic drug delivery vehicle but the inferior mechanical strength of the gel causes rapid erosion which limits the use of this concentration. Therefore, to achieve the desired mechanical strength, a relatively higher concentration (20–25%) has to be used. But this highly concentrated solution causes gel formation below room temperature so create difficulty to instill into eye as drop form. This high concentration may also cause damage to cornea.^[13] So it is extremely challenging to develop

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Covalent surface modification of nickel ferrite nanoparticles for electrochemical supercapacitor performance†

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Magnetic nanoparticles due to their high surface-to-volume ratio play vital roles in diverse applications, including tunable optical, electrical, catalytic, biological, nanofluidic, electrochemical supercapacitor, and data storage. However, there is a pressing need for proper surface functionalization of such nanoparticles in achieving the desired material properties for multi-functional applications. In this regard, aryl diazonium salts are one of the intriguing components to modify the surfaces of NiFe₂O₄ nanoparticles through a radical mechanism forming robust covalent bonds, which create stable interfaces at the NP-organic molecules. Complimentary surface analysis techniques are utilized to ensure the formation of NPs and covalent surface functionalization. An enhancement of saturation magnetization in the functionalized NPs was observed as compared to the pristine NiFe₂O₄ NPs ensuring excellent nexus between NPs and organic molecules. NiFe₂O₄, a heterometallic system containing electroactive metal ions of different charges can impact the overall capacitance. A sharp increase in specific capacitance was recorded in 3 M KOH (~1279 F g⁻¹) of the modified NiFe₂O₄ NPs compared to the unmodified NPs along with high retention of capacitance (~82–90%) after 2000 cycles. This high specific capacitance originates from the larger conduction channels to the electrolyte ions in aryl-modified NiFe₂O₄ NPs compared to pristine NPs. These results open very promising avenues to design surface-functionalized magnetic NPs for future energy storage applications.

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The sharp depletion of fossil fuel sources around the world gives rise to the demand for clean energy. Among the forthcoming different types of energy storage devices, supercapacitors (also known as electrochemical capacitors), can supplement or replace batteries as potential energy storage technologies due to their extremely high-power density and exceptional cyclic lifetime.¹ The low energy densities of supercapacitors compared to batteries have constrained their large-scale applications. Since the development and commercialization of electric vehicles (EVs), the demand for high-energy-density supercapacitors have increased manifold. Efforts have been made to overcome low energy density, increasing the device's working potential window, and boosting capacitance.² Supercapacitor devices can be classified into two types based on their charge storage mechanism; (a) electrical double-layer

capacitance (EDLC) capacitors, and (b) pseudocapacitors. Energy storage of electrical charges occurs in EDLC materials (such as graphene and graphene-type carbon materials, porous carbon, activated carbon, and other dielectric materials)^{3–5} by the adsorption of opposite electrical charges on the electrode surface. While pseudocapacitor materials (for instance, transition metal oxides, conducting polymers, metal carbides and nitrides, and layered double hydroxides),^{6–9} provide energy through a fast and reversible faradaic process between the electrolyte and the surface of the electrode materials in addition to the EDLC. These materials exhibit significantly higher specific capacitance and energy density but suffer from low power performance, also lack longer cyclic stability, and mechanical durability.¹⁰ Numerous studies such as spinel ferrites (AB₂O₄ type), NiFe₂O₄, CoFe₂O₄, and CuFe₂O₄, because of their abundance in nature, affordability, and environmental friendliness, as well as their various redox states, high specific surface area, along with their excellent electrochemical stability can reveal high pseudocapacitance.¹¹ NiFe₂O₄ has been extensively utilized as the anode material in pseudocapacitor devices due to stronger metal ion-oxygen bonds, and Ni^{2+/3+} and Fe^{2+/3+} redox couple in enabling faster charge transfer, making it an energy-density material. However, its cycling stability still

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Recent synthetic journey on pyrrole-fused compounds

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Pyrroles and their fused compounds are widely known as biologically active scaffolds, which are mainly fused at the 1–2 (a), 2–3 (b), 3–4 (c) and 4–5 (d) positions. In pyrrole ring systems, the combination of ring fusions (a–b/a–c/a–d, etc.) gives rise to pharmacophores, resulting in the production of more active molecules. In this tutorial review, we highlight the recent research on the synthesis of different pyrrole-fused heterocycles. Specifically, we categorize the fused pyrroles according to their site of fusion and highlight their various applications in pharmacology, materials science, industry, and biological science. Furthermore, we present the diverse synthetic methods reported for the production of the pyrrole ring by modification of the existing synthetic pathways, metal/metal-free approaches for the synthesis of a-, b- and c-fused rings, multi-step reactions, and cascade reactions for multi-fused rings. This review aims to provide readers with broad knowledge on the synthesis and relevance of diverse fused pyrrole rings, which are considered to be particularly relevant to the disciplines of synthetic chemistry, medicinal chemistry, and drug development.

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1. Introduction

Heterocyclic chemistry plays a prominent role in organic chemistry given that this class of compounds has gained significant attention due to their industrial and biological applicability and contribution to mankind. According to Chemical Abstracts, more than 24 million heterocyclic compounds have been reported and to date 80% of all total drug molecules contain



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Garia, Kolkata, India. Her research is focused on heterocyclic compound synthesis and their biological study.

Mrs Chandana Pramanik was born (1983) in a village in Paschim Medinipur, West Bengal, India. She studied Chemistry (Hons) at Panskura Banamali College, Vidyasagar University in West Bengal, where she received her BSc Degree in 2004. She obtained her MSc (2006) from Vidyasagar University, Paschim Medinipur. She has been working as an Assistant Professor since 2010 at the Department of Chemistry, Dinabandhu Andrews College,



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Mini-Review Article

Bromoaldehyde as a Useful Starting Materials for the Synthesis of Various Hetero Cyclic and Carbocyclic Molecules by Pd-catalyzed Reaction

Author(s): [Mitali Dewan](#)^{iD}, [Debasish Kundu](#)^{iD} and [Rathin Jana*](#)^{iD}

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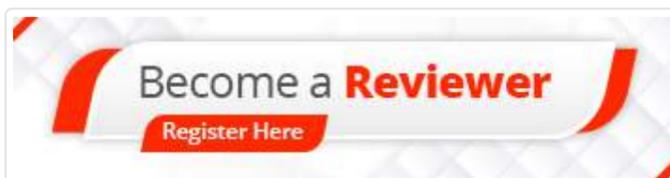
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Abstract

This short review presents an overview of the effectiveness of β -bromoaldehyde as synthetic tool in organic chemistry. Few groups have reported significant contributions on β -bromoaldehyde. The aim of our short review was to give an overview of the latest advances in the chemistry of β -bromoaldehyde from their preparation to their transformations and applications in organic synthesis of some heterocyclic and carbocyclic molecules by using palladium-catalyzed reaction.

Keywords: [Pyran](#), [intermolecular heck](#), [C-H bond functionalization](#), [palladium](#), [complex](#), [9,10 dihydrophenanthrene](#), [halovinylaldehydes](#).

Does Rising Energy Prices Lead to Production Fragmentation? An Example from Indian Manufacturing Industries

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Supratik Guha¹ 

Abstract

How does the price of energy affect the extent of production fragmentation in India's manufacturing industries? The prevailing literature has engaged with production fragmentation and trade in middle products for a long time, but the relationship between energy prices and production fragmentation is less understood. This article deals with firm-level panel data of India's manufacturing industries between 2005 and 2018 to estimate the impact of rising energy prices on the outsourcing decisions/production organization of the manufacturing firms. The article also uses a number of covariates, including wages, welfare expenses, sales, profit after tax, dividend rate, foreign exchange earnings and an interaction term between energy prices and foreign exchange earnings. The empirical results of this article indicate that larger firms tend to outsource production in part to smaller firms in order to cope with rising energy prices and keep their profitability intact. Static and dynamic panel estimates with a variety of robustness analyses support the main conjectures.

JEL Classification: F18, L23, Q410, Q500

Keywords

Production fragmentation, outsourcing, energy prices, manufacturing industry, panel data

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Island area changes in the Sundarban region of the abandoned western Ganga–Brahmaputra–Meghna Delta, India and Bangladesh

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ABSTRACT

Delta shapes are governed by relative dominance of wave, tidal, and fluvial processes, while their coastline changes primarily depend on activation and abandonment of distributary channels. The partly-reclaimed Sundarban Mangrove Wetlands occupy the fluvially abandoned western part of the macro-mesotidal Lower Ganga–Brahmaputra–Meghna Delta (GBMD) in India and Bangladesh. To ascertain the evolution of the planform of this 15,500-km² region over a century, maps and images pertaining to 1904–24 (Survey of India topographical maps), 1967 (Corona space photographs), 2001 (IRS-1D LISS-3 + Pan merged images), and 2015–16 (ResourceSat-2 LISS-4 fmx images) were digitally compared for documenting the changes in the areas of ~250 mangrove-covered and reclaimed tidal islands above the spring high water level. Area change of the individual islands was also studied based on their relative north–south and west–east positions.

The results indicated that while erosion of the estuary margins and the sea facing coastline—up to 40 m/yr—was continuing for decades in the southern islands, intervening channels between the northern islands were getting silted up, especially in the western sector, resulting in land gain. Area change in the central sector mostly tended to be small and erosional. Overall, the total island area & counts changed from 11,903 km² & 253 (1904–24), respectively, through 11,663 km² & 250 (1967), 11,506 km² & 244 (2001), and 11,455 km² & 251 (2015–16). The reduction rate of area, at -4.46 km²/yr, remained noticeably similar across all intervals of mapping / imaging years and projects that the region will lose 3.4 % of its present extent by 2100 if the observed tendencies continue. The trend of area reduction was 2.55-times higher in the western (Indian) segment of the region, than the eastern (Bangladeshi) section. At the level of individual islands, the trends of area change were classified into nine types involving linear and non-linear changes, with dominance of continuous (post-2001) erosion in 48.3 % (68.9 %) of the islands. Conversely, continuous (post-2001) accretion dominates in 15.8 % (31.1 %) of the islands.

The retrogradation of the southern Sundarban can be ascribed to sediment starvation of the western GBMD due to abandonment of its deltaic distributaries and shelf bypassing of sediments through the Swatch of No Ground submarine canyon. On the other hand, the accretion of the northern interior areas, especially in the west, was mostly related to sediment reworking in a floodtide dominated environment, intervened by reclamation efforts. Factors like relative sea level rise, locational shifts in landfalls of cyclonic storms, and reclamation-related deforestation had little detectable influence on island area changes. As the observed tendencies of area change are likely to continue, planning for the region must integrate the transformations into management and development initiatives.

1. Introduction

Formed at the interface of the land and the sea, deltas are some of the

most ubiquitous landforms of the earth. Their overall shapes are determined by the relative dominance of wave, tidal, and fluvial forcings. On timescales ranging from decades to centuries, erosion and deposition

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Edge-vertex domination on interval graphs

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For an undirected as well as connected graph $G = (V, E)$, a node point $w \in V(G)$ is edge-vertex dominated by an edge $e \in E(G)$ if w is incident to e or w is incident to an adjacent edge of e . A set $D_{EV} \subseteq E$ is called an edge-vertex dominating set of G if every node point of G is edge-vertex dominated by at least one edge of D_{EV} . The minimum cardinality among all edge-vertex dominating sets is the edge-vertex domination number, symbolled by $\gamma_{EV}(G)$. Here, we propose an algorithm that runs in $O(n)$ -time for determining a minimum-cardinality D_{EV} of interval graph with n nodes. We also study some properties relating to the edge-vertex dominating set of interval graphs.

Keywords: Domination; edge-vertex domination number; interval graph.

Mathematics Subject Classification 2020: 05C30, 05C12, 68R10

1. Introduction

In a graph structure $G = (V, E)$, V represents the node point set/vertex set and E represents the link set/edge set. We also assume that G is connected and has neither self-loop nor parallel edges. We use the symbol $N_G(w)$ to represent the

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Original Research Paper

Vertex Betweenness Centrality of Corona Graphs and Unicyclic Graphs

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Abstract. The idea of centrality measurements is quite appropriate for determining the important vertices or edges in a network. A vertex in a network may be an important vertex depending on its angle of assumption. There are many centrality measurements to find the characteristics of a vertex in a network. Betweenness centrality is an important variant of centrality measurement for analyzing complex networks based on shortest paths. The betweenness centrality of a node point u is the sum of the fraction which has the number of shortest paths between any two node points v and w as denominator and the number of the shortest paths passing through the vertex u between them as numerator. This paper describes some theoretical results relating to the betweenness centrality and relative betweenness centrality of different types of corona graphs ($P_n \odot P_m$, $P_n \odot K_m$, $C_n \odot K_m$, $C_n \odot P_m$, $C_n \odot C_m$ and $C_n \odot K_{l,m}$) and unicyclic graphs ($A(n, k, l)$, $B(n, k, l)$, $D(n, k, l)$ and $E(n, k, l)$).

AMS Subject Classification: 05C30; 05C62; 05C38

Keywords and Phrases: Betweenness centrality, Corona graph, Unicyclic graph

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● প্রতিষ্ঠা অনুপ্রেরণা ●

॥ অধ্যাপক সুভাষরঞ্জন বসু ॥

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সূচীপত্র

পৃথিবীর ভৌমক ক্ষেত্রের সাম্প্রতিক পরিবর্তন ও

সমুদ্র বক্ষ সঞ্চারণ তত্ত্ব

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একটি পরিবেশগত মূল্যায়ণ

সুশোভন মজুমদার ২৮

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বায়ু সর্বাঙ্কার ফলাফল ৩২

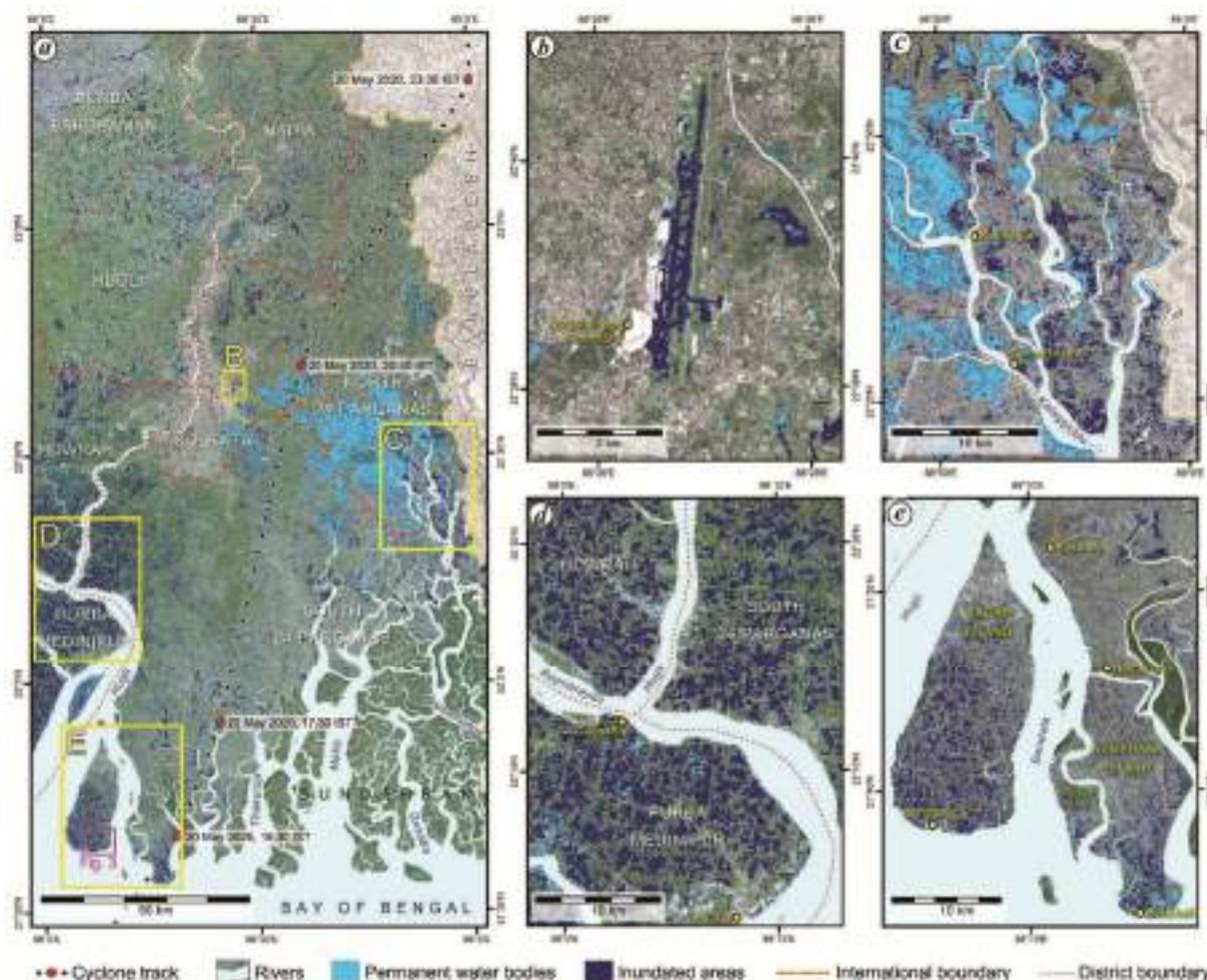


Figure 2. *a*, Inundated areas of the Lower Deltaic West Bengal on 22 May 2020, two days after the landfall of the *Amphan*. Rectangles denote the area enlarged in panels *b–e* and Figure 3, on either side of the storm track. *b*, The inundated area in the Netaji Subhas Chandra Bose International (NSCBI) Airport compound. *c*, Waterlogged areas alongside permanent water bodies of aquaculture farms in Sandeshkhali-I, -II, and Hingalganj blocks of North 24 Parganas district. *d*, Widespread flooding around the confluence of the Rupnarayan and Hugli rivers. *e*, The flood-affected islands of Sagar, Mousuni and Namkhana near the mouth of the Hugli estuary. Data source: Sentinel-1A and -1B Synthetic-Aperture Radar (SAR) C-band images of 19 May 2020 (pre-event) and 22 May 2020 (post-event), overlaid on Sentinel-2A Multi Spectral Instrument (MSI) images of 09 May 2020, Tiles T45QXD, T45QXE, and T45QXF. Storm track and ‘eye’ positions from IMD³.

a depression on 16 May 2020 (05:30 IST), and within 12 hours transformed into a deep depression with maximum sustained (3-min average) wind speed of 56 km/h (ref. 3) (Figure 1). The ‘eye’ of the storm initially shifted generally in N32°W direction till 17 May 2020 (17:30 IST), and thereafter started to move towards N24°E, and was positioned around 665 km east of Chennai as an extremely severe cyclonic storm on 18 May 2020 (02:30 IST). Subsequently, the system headed N22°W and strengthened into a super cyclonic storm on 18 May 2020 at 11:30 IST with sustained wind speed of 222 km/h (refs 3, 10). The sustained wind speed reached the maximum of 241 km/h on the same day (23:30 IST)³. Afterwards, the *Amphan* continued its

movement in the general direction of N13°E, and was positioned around 26 km south of Sagar Island of West Bengal as an extremely severe cyclonic storm on 20 May 2020 (14:30 IST)³. With a forward movement speed of 17.3 km/h towards N39°E, the central part of the storm crossed the Sundarban coastline for about two hours between 15:30 and 17:30 IST on 20 May 2020. It then continued as a very severe cyclonic storm for the next 6 h. Because the *Amphan*’s passage through the seafront occurred during low tide, the storm surge elevations were not exceptional, and saved the region from further damages. The reported storm surge height of 4.6 m was 2.2 m more than the mean highest high tide level of (+) 2.4 m at Sagar

Island^{3,11}. The mean-sea-level-adjusted lowest and highest astronomical tide levels at Sagar on 20 May 2020 were (–) 1.33 m at 15:10 IST and (+) 1.85 m at 20:44 IST respectively¹².

After landfall, the cyclone initially moved towards N16°E, and crossed the densely populated districts of South 24 Parganas, North 24 Parganas, and Kolkata with a maximum sustained wind speed of 157 km/h, gusting to 185 km/h (ref. 3) (Figure 2*a*). The ‘eye’ of the cyclone passed through the eastern outskirts of Kolkata, 10–15 km from the city centre. It then changed its direction to N34°E before entering Bangladesh and causing devastation in its western districts¹³. Finally, after moving generally towards N16°E into the west of Meghalaya, the

graphs are found in [2, 15, 21]. A dominating set D_k is said to be *minimum k -hop connected dominating set* ((in short $MkHCDS$)), if it is minimal as well as it is $kHDS$ and the subgraph of G induced by D_k is connected.

Hop domination has several elegant applications in the real life like facility location problems, land surveying, kernels of games and communication networks, ad hoc networks [16, 23].

Domination is an important problem in graph theory. Claude Berge first introduce the concept of the domination number of a graph. A book on the topic of domination [10] lists over 1,200 papers related to domination in graphs. Many researchers have been studied domination and its variations for its versatile applications in real life.

Among the variations of domination, the k -hop domination has been briefly discussed in the literature, see [2, 15]. This problem is NP-complete in general graphs and some special subclass of graphs [4, 11, 12, 16, 23]. Demaine et al. [8] proposed an $O(n^4)$ -time algorithm to compute $kHDS$ of planer graphs, where n is the number of nodes. Furthermore, Ayyaswamy et al. [2] discussed about Bounds on the hop domination number of a tree. Also, Rana et al. [19] have planed an efficient algorithm to solve the distance k -domination problem on permutation graphs. Kundu et al. [14] have designed an $O(n)$ time algorithm for computing an optimal $kHDS$ of a tree. Barman et al. [3] have designed an $O(n)$ time algorithm to compute minimum $kHDS$ of interval graphs. Recently Adhya et al. [1] have designed an algorithm for computing minimum k -hop connected dominating set of permutation graphs in $O(n)$ time.

In this paper, we propose an optimal algorithm to compute a minimum k -hop connected dominating set of the simple, undirected and connected interval graph in $O(n)$ time, where n is the number of nodes of the interval graph. This problem is similar with the problem of computing a connected dominating set, but dissimilar in terms of number of hops required to reach all the nodes. We have generalized the problem as k -hop connected dominating set problem on interval graphs.

2. Preliminaries

An interval graph can be displayed by an interval representation where intervals are drawn in a real line. Without affecting the generality, we presume that each interval consist of both of its extrimities/endpoints and that no two intervals share a common extrimity/endpoint. If in some particular cases the intervals share common endpoints then we apply the algorithm **CONVERT** (see [18]) to convert the intervals of I into intervals with distinct endpoints. We also presume that the graph G is simple, connected & the sorted endpoints list is given. We have labeled the intervals in I according to the increasing right end points, that is $b_1 < b_2 < \dots < b_n$. This indexing is called interval graph (IG) ordering. An interval graph and its interval representation are displayed in Figure 1. For arbitrary interval graph $G = (V, E)$, we recall a very important result presented in below.

Lemma 2.1. [17] *In interval graph ordering, if the nodes $x, y, z \in V$ are such that x is adjacent to z and $x < y < z$, then y must be adjacent to z . But y is not necessarily adjacent to x .*

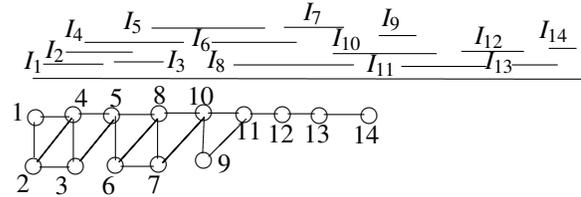


Figure 1. An interval graph and its interval representation on real line.

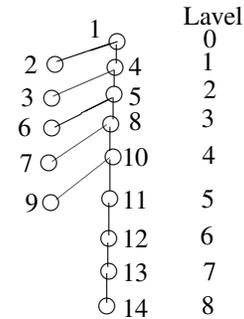


Figure 2. BFS-tree $T^*(1)$ of the graph G of Figure 1.

3. Formation of BFS-tree & main path

In graph theory, there exist several important graph BFS is an important graph traveling technique. Among them BFS is very useful and popular graph traveling process. Using this process we can form a BFS-tree on arbitrary graphs. The BFS-tree can be formed on general graphs in $O(n+m)$ time, where n and m indicate respectively the number of nodes and number of edges [22]. Recently, Barman et al. [3] have designed an **Algorithm IBFS** to construct a BFS tree $T^*(1)$, with root as 1 of interval graphs in $O(n)$ time, where n is the number of vertices. The BFS tree $T^*(1)$ rooted at 1 of the interval graph of Figure 1 is shown in Figure 2. The level of each node on BFS-tree $T^*(1)$ can be assigned by the BFS algorithm of Chen and Das [6].

Lemma 3.1. [6] *The level of each node of the BFS tree $T^*(1)$ can be computed, using BFS, in $O(n)$ time.*

In BFS tree $T^*(1)$ with root as 1, let u_{last} be any vertex at level h , where h is the height of tree $T^*(1)$. Also we assume that the shortest path between 1 and u_{last} which is $u_{last} \rightarrow parent(u_{last}) \rightarrow parent(parent(u_{last})) \rightarrow \dots \rightarrow 1$ as the *main*



Pnueli et al. [52] showed that this graph is a sub-class of comparability graph. A permutation graph can also be created by its corresponding matching diagram which contains two horizontal parallel lines, named as top line and bottom line. We put the numbers $1, 2, \dots, n$ on the top line, in their order, from left to right, and for each $i = 1, 2, \dots, n$ put the number $\pi(i)$ on the bottom line just below the number i on the top line. Finally, for each i , we draw a straight line joining two i 's on the top line and on the bottom line [26]. We use the same number i to label the resulting line segment. We note that the line i intersects the line j in the diagram iff i and j appear in the reversed order of magnitude in π . That is, lines i and j intersect iff vertices i and j of the corresponding permutation graph are adjacent. Figure 2 shows a permutation graph and Figure 1 is the corresponding matching diagram. We referred these figures throughout our paper.

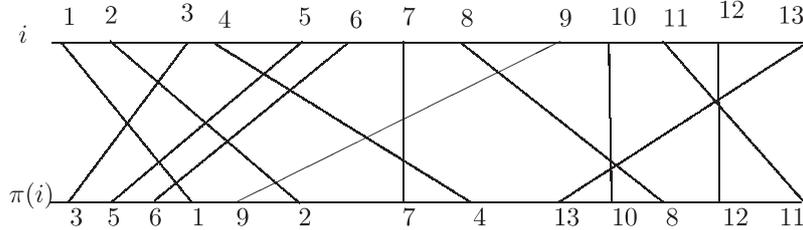


Fig. 1. Matching diagram of the permutation graph G of Figure 2

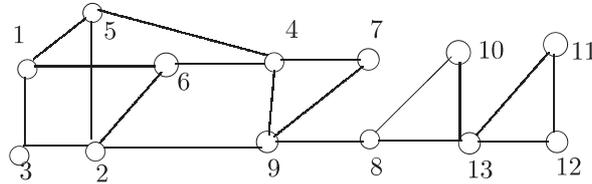


Fig. 2. A permutation graph G

We can set up the matching diagram for a given permutation graph in $O(n^2)$ time only when the graph is in the form of an adjacency list or an adjacency matrix [26, 47]. For this reason, we presume that a permutation representation is given for the input graph. Also, we create two arrays: one is $\pi(j)$, $j = 1, 2, 3, \dots, n$ in which we store the permutation numbers and other array is $\pi^{-1}(j)$, $j = 1, 2, 3, \dots, n$ in which we store the inverse permutation of π . We can compute the array $\pi^{-1}(j)$ from array π in $O(n)$ time.

1. Introduction

1.1. Interval graph

The class of interval graphs (IGs) is a very important subclass of intersection graph [61]. Let $I = \{I_1, I_2, \dots, I_n\}$, where $I_j = [a_j, b_j]$, $j = 1, 2, \dots, n$, be a set of intervals on a real line, a_j and b_j are respectively left and right endpoints of the interval I_j . We draw a vertex v_j for the interval I_j , $j = 1, 2, \dots, n$. Two vertices v_i and v_j are connected by an edge if and only if their corresponding intervals overlap. Thus, an undirected graph $G = (V, E)$ is said to be an IG if there is a one to one correspondence between its vertices of V and a family of intervals, I , on real line, such that two vertices are adjacent in G if and only if their corresponding intervals have nonempty intersection, i.e., there is a bijection $f : V \rightarrow I$. The set I is called an interval representation of G and G is referred to as the IG of I [29]. Without any loss of generality, we assume that each interval contains both of its endpoints and that no two intervals share a common endpoint. If the intervals have common end points, then the algorithm **CONVERT** [64] may be used to convert the intervals of I into intervals of distinct end points. We consider intervals in the set I rather than the vertices in G . Furthermore, we assume that the graph G is connected, the sorted endpoints list is given and the intervals in I are indexed by increasing right end points, i.e., $b_1 < b_2 < \dots < b_n$. This indexing is known as IG ordering. An IG and its interval representation are shown in Fig. 1. Now, we present some examples to explain Fig. 1. In Fig. 1, we see that intervals I_1 and I_2 have nonempty intersection, so, $(1, 2) \in E$. Again, intervals I_1 and I_5 have no common intersection, so, $(1, 5) \notin E$. IGs have received considerable attention [4, 7, 28, 56, 59, 60, 62, 63, 65-69, 71, 74-77] because of their application in the real world. Booth and Lucker [12] designed an algorithm to recognize IGs in $O(m+n)$ time.

IGs arise in the process of modeling real life situations, especially involving time dependencies or other restrictions that are linear in nature. This graph and various subclasses thereof arise in diverse areas, such as archeology, molecular biology, sociology, genetics, traffic planning, VLSI design, circuit routing, psychology, scheduling, transportation and others. Recently, IGs have found applications in protein sequencing [46], macro-substitution [27], circuit routine [58], file organization [13], job scheduling [13], routing of two points nets [31] and many others. An extensive discussion of IGs also appears in [29]. Thus, IGs have been studied intensely from both the theoretical and algorithmic points of view.

For any IG $G = (V, E)$ a very important result is stated below.

Lemma 1 ([59]). *In IG ordering, if the vertices $u, v, w \in V$ are such that $u < v < w$ and u is adjacent to w , then v must be adjacent to w . But v is not necessarily adjacent to u .*

সূচীপত্র

রবীন্দ্রনাথ

- রবীন্দ্রভাবনায় অধ্যাত্মবাদ ও মৃত্যুচেতনা অতসী মহাপাত্র ১
- বয়স্কির সমস্যা উত্তরণে সহায়ক সর্বাঙ্গীণ শিক্ষা ও রবীন্দ্রনাথের গান সুচরিতা বিশ্বাস ১৩
- ইকোপোয়েট্রি বা পরিবেশ-সচেতন কাব্য ভাবনায় বাংলার অন্যতম দুই প্রকৃতির কবি রবীন্দ্রনাথ ও জীবনানন্দ সমৃহিতা ভট্টাচার্য ২৪

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সমাজতান্ত্রিক আন্দোলনের প্রেক্ষাপটে মার্কসীয় নারীবাদের উন্মেষ সৌতি বসু

আমরা জানি, মার্কসীয় তত্ত্ব ধনতন্ত্রের অবসান ঘটিয়ে সমাজতন্ত্র প্রতিষ্ঠার কথা বলেছে, যেখানে সকলে সমান অধিকার পাবে, সর্বহারার একনায়কতন্ত্র প্রতিষ্ঠিত হবে, শ্রমিক-মালিকের ভেদ মুছে যাবে, সমাজে সাম্য প্রতিষ্ঠিত হবে। কিন্তু এই সাম্য মূলগতভাবে অর্থনৈতিক সাম্য, লিঙ্গগত বৈষম্য সমাজে আদিকাল থেকে চলে আসছে, তার অবসান ঘটানো কী এর মাধ্যমে সম্ভব হবে?—এই প্রশ্নে মনে হতেই পারে যে, মার্কসীয় তত্ত্ব সমাজ তথা সবকিছুকেই অর্থনীতির নিরিখে বিচার করেছে, তাই যে সাম্যের কথা মার্কস-এঞ্জেলস বলেছেন তা শুধুই অর্থনৈতিক সম্য। কিন্তু প্রশ্ন হলো যে, তাঁদের মতো সাম্যকামী মানুষেরা কি লিঙ্গ বৈষম্যকে লক্ষ করেননি? যদি তা করে থাকেন, তাহলে সেই বৈষম্যকে উপেক্ষা করে সাম্যবাদী সমাজ প্রতিষ্ঠার স্বপ্ন দেখা কি বাতুলতা নয়? মার্কস-এঞ্জেলস বা তাঁদের উত্তরসূরির লিঙ্গবৈষম্যকে আদৌ লক্ষ করেছেন কিনা, বা করে থাকলে কোন দৃষ্টিতে দেখেছেন, কী ছিল তাঁদের সমাধান, তাঁরা নিজেরা কতখানি পিতৃতন্ত্রের প্রভাব মুক্ত ছিলেন—এসবই আমার বর্তমান প্রবন্ধের আলোচ্য বিষয়।

মার্কস ও এঞ্জেলস লক্ষ করেছিলেন যে, সামন্ততন্ত্রের অবসানে শিল্পবিপ্লবের পর যখন ধনতন্ত্রের সূচনা হলো তখন দলে দলে ভূমিদাস এসে শহরে কল-কারখানায় যোগ দিল, তখন তাদের মধ্যে মহিলাদের সংখ্যা ছিল নিতান্তই কম। ধনতন্ত্র ধীরে ধীরে সামন্তযুগের পিতৃতান্ত্রিক পারিবারিক বন্ধনকে শিথিল করে ফেলল এবং নারী-পুরুষের ভেদও অনেকাংশে মুছে যেতে লাগল কারণ ধীরে ধীরে আত্মীয়তার পরিবর্তে নারী ও পুরুষের মধ্যে নতুন আর্থিক সম্পর্ক গড়ে উঠতে শুরু করল এবং উভয়েই উৎপাদন যন্ত্রে রূপান্তরিত হয়ে গেল।

ধনতান্ত্রিক ব্যবস্থা চিরদিনই কারখানার মালিকের মুনাফা লাভের প্রবৃত্তির দ্বারাই চালিত হয়। এখন উৎপাদন যত বেশি হবে মুনাফাও তত বেশি হবে। আর উৎপাদন বাড়ানোর জন্য উৎপাদনকারী শ্রমিকের প্রয়োজন। তাই উৎপাদনের মূল কারিগর। ধনতন্ত্র আর কেবলমাত্র পুরুষ শ্রমিক নিয়ে সন্তুষ্ট থাকতে পারল না। নারী ও শিশুকেও এই ব্যবস্থার অন্তর্ভুক্ত করে ফেলল। মার্কস লক্ষ করেছেন যে, কলকারখানা ও যন্ত্রপাতির যত উন্নতি হয়েছে, শিল্পক্ষেত্রে নারীর সংখ্যাও তত বৃদ্ধি পেয়েছে।

এখন, প্রশ্ন উঠতে পারে যে, শিল্পক্ষেত্রে নারীর প্রবেশের মাধ্যমে কী নারীর কোনো উপকার হলো? যে নারী এতদিন পরিবারের জাঁতাকলে পিষ্ট হচ্ছিল, সে যখন বৃহত্তর সামাজিক ক্ষেত্রে যোগদান করল, তখন কি সে মুক্তির পথে একধাপ এগোল, নাকি নিজেকে প্রকারান্তরে আরও



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Oxo transfer reaction: Dioxido and monooxidovanadium(V) complexes

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A B S T R A C T

A dioxidovanadium(V) complex of type $[(L_{ONO}H^{\ominus})(VO_2)]$ (**1**) was isolated where $L_{ONO}H_2$ is a tridentate ONO donor benzhydrazide ligand. **1** undergoes an oxo transfer reaction with triphenylphosphine in presence of 8-hydroxyquinoline (HQ) and affords a monooxidovanadium(V) complex of type $[(L_{ONO}^{\ominus})(VO)(Q^{\ominus})]$ (**2**). **1** and **2** were substantiated by elemental analyses, ESI-mass, IR, 1H NMR, ^{51}V NMR and UV-vis spectra. The molecular geometries of **1** and **2** were authenticated by single crystal X-ray crystallography. UV-vis absorption spectra of **1** and **2** display bands respectively at 325 and 320 nm due to oxido \rightarrow vanadium(V) charge transfer transitions. **1** exhibit an irreversible cathodic peak at -0.44 V whereas **2** displays a reversible cathodic wave at -0.60 V in cyclic voltammogram due to the VO^{3+}/VO^{2+} redox couple.

1. Introduction

Metal-oxo complexes play significant role in chemical science because of their ability to transfer the oxo functional group. The oxo-transfer reaction is a crucial biochemical process for enzymatic activities of oxotranferases enzymes like sulfite oxidase, dimethylsulfoxide reductase and xanthine oxidase [1–5]. The reaction is also useful for several transformations in organic syntheses [6–8]. The oxidant used for these types of oxo transfer reactions are high valent transition metal oxide or oxoanions [9,10] or metal complexes [11–14] having metal-oxo functional group. Generally, titanium, manganese, iron, molybdenum, ruthenium and osmium [15–19] metals are used for this purpose. It is worth mentioning that the oxovanadium complexes are also promising for these purposes because oxidovanadium (IV/V) complexes exhibit versatile biological activities [20–25]. The active participation of dioxidovanadium(V) core in haloperoxidase [26,27] and insulin mimicking activity [28] was established in several investigations. The stoichiometric and catalytic oxidation [29,30] of organic substrates by oxidovanadium precursors were documented in various aspects. Moreover, oxido-metal assemblies that are the building blocks of several functional materials [31,32] have been a subject of investigation in current chemical research. In this project, a new type of dioxidovanadium(V) complex was synthesized and the oxo-transfer reaction using triphenylphosphine was studied. Many oxo-transfer reaction were carried out in last few decades but isolation of the solid products was very limited in scope [33–37]. The report presents a dioxovanadium(V) complex of the

type $[(L_{ONO}H^{\ominus})(VO_2)]$ (**1**) and a monooxovanadium(V) complex of the type $[(L_{ONO}^{\ominus})(VO)(Q^{\ominus})]$ (**2**) where HQ = 8-hydroxyquinoline and $L_{ONO}H_2$ is a tridentate ONO donor benzhydrazide ligand. The oxo transfer reaction is outlined in Chart 1.

2. Experimental section

2.1. Materials and methods

Ammonium vanadate was purchased from Loba chemicals and other reagents or analytical-grade materials were obtained from commercial suppliers and used without further purification. Spectroscopic-grade solvents were used for spectroscopic and electrochemical measurements. The tridentate ligands, (E)-N'-(2-hydroxybenzylidene)benzohydrazide ($L_{ONO}H_2$) was prepared by the reported procedures [38]. The C, H and N contents of the compounds were obtained from a PerkinElmer 2400 Series II elemental analyzer. The elemental analyses were performed after evaporating the solvents under high vacuum. Infrared spectra of the samples were measured from 4000 to 400 cm^{-1} with KBr pellets at 295 K on a PerkinElmer Spectrum RX 1 Fourier transform infrared (FT-IR) spectrophotometer. 1H NMR spectra in $CDCl_3$ and $DMSO-d_6$ were recorded on a Bruker DPX 500 MHz spectrometer. Electrospray ionization (ESI) mass spectra were obtained from LSMS 2020 mass spectrometer. Electronic absorption spectra of the solutions of the complexes were recorded on a PerkinElmer Lambda 750 spectrophotometer in the range of 3300–175 nm. The electro-analytical

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Computation of diameter, radius and center of permutation graphs

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For a connected graph $G(V, E)$, we use the notation $d(a_1, a_2)$ to represent the distance between two node points a_1 and a_2 and it is the minimum of the lengths of all paths between them. The eccentricity $e(a)$ of a node point $a \in V$ is considered as the maximum length of all shortest paths starts from a to the remaining nodes, i.e., $e(a) = \max\{d(a, u_1) : u_1 \in V\}$. The diameter of a graph G , we denote it by $d(G)$ and it is the length of the longest shortest path in G , i.e., $d(G) = \max\{e(a) : a \in V\}$. Also, the radius of a graph G , we denote it by the symbol $r(G)$ and it is the least eccentricity of all node points in V , i.e., $r(G) = \min\{e(a) : a \in V\}$. The central vertex/node point x of a graph G is a node whose eccentricity is same as G 's radius, i.e., $e(x) = r(G)$. The collection of all central nodes of a graph G is considered as the center of G and it is symbolized by $c(G)$, i.e., $c(G) = \{x \in V : e(x) = r(G)\}$. A graph may have one or more central vertices. This paper develops an optimal algorithm to compute the diameter, radius and

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Recent advances in the (3+2) cycloaddition of azomethine ylide

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Nitrogen-containing heterocyclic compounds are some of the most significant compounds that are produced artificially or naturally. These heterocyclic rings are virtually always present in the biological system, from the smallest eukaryotes to the largest prokaryotic cell. The compounds that are synthesized by the help of azomethine ylides that fall in this category are quite important because they bind with our biological living cells. One cannot ignore the possibility of using different derivatives of these azomethine ylide skeletons not only as medications but also as organo-electroznic materials, fluorescent probes, etc. The synthesis of several scaffold derivatives during the last few years utilizing a range of methods is the main topic of this review. We outlined the precise synthetic routes for each technique and highlighted the yield variance from a variety of perspectives.

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Introduction

The remarkable improvement in the field of chemistry over the past few decades have given mankind an unprecedented ability to cure several diseases. A very frequent occurrence in the pharmaceutical drugs, functional materials, agrochemicals, and many biologically active and significant molecules is that of nitrogen-containing heterocycles. They are also commonly observed in biomolecules, such as enzymes, vitamins, natural products, and biologically active substances with antifungal, anti-inflammatory, antibacterial, antioxidant, and anticancer activities.

In this review, we have described the synthesis of 3-azabicyclo[3.2.0]heptanes, 2,3-pyrrolidinyl dispirooxindoles scaffolds, azepino-[3,4,5-*cd*]indoles, tetrahydroisoquinolines, bridged-azocines, azocanes, benzoazepine skeletons, pyrrolidinyl spirooxindoles, spiropyrazolones, polyquinanes, imidazoles, spiro-1,4 benzo diazepin-2-ones, and 5-membered N-heterocyclic imidazolidines, etc. They are commonly found in different biologically active metabolites and therapeutics (antifungal, analgesics, anticancer, anti-inflammatory, antitumor, antidepressants, etc.)

3-Azabicyclo[3.2.0]heptane derivatives show fascinating biological features, and they are conformationally strained proxies for the piperidine ring (Fig. 1). They are widely prevalent in medicinal chemistry due to their antischizophrenic, analgesic, and antibacterial properties.¹

Tetrahydroisoquinolines² (THIQs) are effective anticancer agents with a variety of chemotherapeutic, antimicrobial, and other bioactivities such as (*S*)-cryptostaline II, coralydine, lycorine, a sequence of 5,6-dihydroplicane alkaloids, and a TRMP8 channel receptor antagonist (Fig. 2).

Indole analogs³ possess the unusual ability to imitate the peptide sequences and bind transiently to enzymes, which facilitates the discovery of new medications with a range of approaches to action. The [3+2] cycloaddition of imino esters with several electron-deficient compounds is one of the most suitable techniques for synthesizing structurally different 4,4-disubstituted pyrrolidines.⁴

Pyrrolidines belong to an influential class of organic drugs (Fig. 3) because of their unique structure, flexible frameworks, and therapeutic properties; therefore, the synthesis of these kinds of moieties is highly desirable.

Bridge azocines and azocanes⁵ such as apparicine, a monoterpene indole alkaloid, is potent against type 3 poliovirus, uleine has antiulcer and anti-inflammatory properties, lundruine type alkaloids are found to be efficacious toward B16, melanoma cells, and can overcome chemoresistance in vincristine-resistant KB cells. Another alkaloid of this class FR901483 plays a vital role in imposing strong immunosuppressive action *in vitro* and extending the survival of skin grafts (Fig. 4).

Spirocyclic oxindoles incorporate both oxindoles and a di- or tri-nitrogen-bearing heterocyclic ring, a prominent class of oxindoles is pyrrolidinyl spirooxindole. This class of compounds has unique and diverse biological properties, for example, cyanogramide,⁶ is shown to be effective in reversing the drug resistance in MCF-7, K562, and KB cell lines, and spirostatin A and B⁶ have been identified as potent cell cycle disruptors at the

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এবং প্রান্তিক

চণ্ডিবেড়িয়া, সারদাপল্লী, পোঃ - কেঁস্তুপুৰ, কলকাতা - ৭০০১০২

সমুদ্র উপকূল ব্যবস্থাপনার রূপরেখা (Coastal Management : An Outline)

নবেন্দুশেখর কর

ভারত তথা বর্তমান বিশ্বের উপকূলীয় অঞ্চলগুলি নানা ধরনের পরিবেশগত সমস্যার জর্জরিত। সমুদ্র জলতলের বৃষ্টি, ক্রান্তীয় ঘূর্ণবাতের সংখ্যাবৃদ্ধি, উপকূলীয় নগরায়ণ, পরিবেশ দূষণগত সমস্যা, উপকূলের ক্ষয় ইত্যাদি বর্তমানে উপকূলীয় অঞ্চলগুলিকে পৃথিবীর অন্যতম বিপন্ন অঞ্চল করে তুলেছে বললে হয়তো অত্যুক্তি হবেনা। যেমন অতি সম্প্রতি (৯ই নভেম্বর ২০১৯) বুলবুল নামক ঘূর্ণিঝড় ভারতীয় সুন্দরবনের পশ্চিমাংশে অবস্থিত সাগর, নামখানা ও পাথরপ্রতিমার বিস্তীর্ণ অংশে তাণ্ডন চালিয়ে গেছে একইভাবে প্রাকৃতিক দুর্যোগের কবলে পড়ে হুগলী খাঁড়িতে অবস্থিত ঘোড়ামারা দ্বীপটির প্রায় সিংহভাগ অংশ জলের তলায় বিলীন হয়েছে গত কয়েক দশকে। এই পরিস্থিতিতে সমুদ্র উপকূল ব্যবস্থাপনা বা কোস্টাল ম্যানেজমেন্ট-এর সম্পর্কে জানা ও তার প্রয়োগ— যেন আরও বেশি গুরুত্বপূর্ণ হয়ে উঠেছে।

ইয়তো বা একারণেই বিশ্ববিদ্যালয় মঞ্জুরী কমিশন তথা বিশ্ববিদ্যালয়গুলি স্কিল এনহান্সমেন্ট কোর্স (Sec : Skill Enhancement Course) বা ছাত্রছাত্রীদের দক্ষতা বৃদ্ধির পাঠ হিসেবে 'কোস্টাল ম্যানেজমেন্ট'—ভূগোলের আঙার গ্র্যাজুয়েট সিলেবাসের অন্তর্ভুক্ত করেছে। যদিও সিলেবাসের অন্তর্ভুক্ত বিষয়গুলির কিছু বিষয় প্রাকৃতিক ভূগোলের অংশ হিসাবে কিছুটা জানা থাকলেও সার্বিকভাবে SEC অংশের দৃষ্টিভঙ্গি তথা উত্তর লেখার কায়দা অনেকটাই আলাদা।

উপকূলের সংজ্ঞা :

উপকূল বলতে বোঝায় সমুদ্রপাড় সংলগ্ন স্থলভাগ, জলভাগ ও সাময়িক বা অধিকাংশ সময়ে সমুদ্রের বা ঝড়ের জলে নিমজ্জিত হয় এমন একটি

বৃহৎ অঞ্চলকে যেখানে স্থলভাগের প্রাকৃতিক প্রক্রিয়াগুলি এবং মানুষের ক্রিয়াকলাপ সামুদ্রিক প্রক্রিয়াগুলিকে প্রভাবিত করে এবং সামুদ্রিক প্রক্রিয়াগুলি উল্টোদিকে স্থলভাগের প্রাকৃতিক ও মানবীয় ক্রিয়াকলাপের উপর প্রভাব বিস্তার করে। এই প্রক্রিয়াগুলিকে উপকূলীয় প্রক্রিয়া বলা হয়। 'কোস্টাল ম্যানেজমেন্ট'-এর ভাষায় উপকূল হল পৃথিবী পৃষ্ঠের সেই অংশ যেখানে উপকূলীয় প্রক্রিয়াগুলি কাজ করে—অর্থাৎ স্থলভাগের দিকে এর সীমানা নির্ধারিত হয় যতদূর পর্যন্ত সামুদ্রিক প্রক্রিয়াগুলি প্রভাব বিস্তার করে এবং জলভাগের দিকে যতদূর অবধি সমুদ্রের বৃহৎ স্থলভাগের পলি সঞ্চারিত হয়।

প্রসঙ্গত উল্লেখ করা সরকার সমুদ্রপাড়ে যে রেখা বরাবর সমুদ্রের জলভাগ ও স্থলভাগ মিলিত হয় তাকে উপকূলরেখা (Coastline or Shoreline) বলা হয়। জোয়ার-ভাটা, সমুদ্রতরঙ্গ প্রভৃতির সাথে এই সীমারেখাটি সতত পরিবর্তনশীল। উপকূলরেখা একটি রৈখিক সীমা বিশেষ, অন্যদিকে উপকূল একটি বৃহৎ এলাকা যেখানে বিভিন্ন ধরনের ভূমিবৃপ যেমন—তটভূমি, বালিরাড়ি, ভূগুতট, পুরোদেশীয় বাঁধ বা দ্বীপ ও খাঁড়ি ইত্যাদি দেখতে পাওয়া যায়। স্থলভাগের অংশে জোয়ার-ভাটা, ঝড়ের অবস্থান, সামুদ্রিক ঘূর্ণবাত ও বন্যা ইত্যাদি সামুদ্রিক প্রভাবকে নির্দেশ করে এবং বর্ধীপ, মগ চড়া, পুরোদেশীয় ভূমিবৃপ ইত্যাদি জলভাগে স্থলভাগের প্রক্রিয়াগুলির প্রভাবকে নির্দেশ করে।

উপকূলের পরিবর্তনশীল চরিত্র :

বিশ্বের অন্যতম পরিবর্তনশীল বা ডাইনামিক অঞ্চল হল উপকূলীয় অঞ্চলগুলি। একটু তলিয়ে ডাবলে দেখা যাবে উপকূলীয় অঞ্চল হল সেই বিশেষ এলাকা সেখানে

* ভূগোল বিভাগ, শহীদ মাহমুদী হাজার সরকারি মহিলা কলেজ, তমলুক

আবহাওয়ার পূর্বাভাস

ড. নবেন্দু শেখর কর

সারসংক্ষেপ : দৈনন্দিন জীবনযাত্রা থেকে শুরু করে চাষাবাদ, পরিবহন ব্যবস্থা বা আবহাওয়া সম্পর্কিত দুর্ঘটনা মোকাবিলা সকল ক্ষেত্রেই সঠিক আবহাওয়া পূর্বাভাস অত্যন্ত জরুরি। সে কারণে বিজ্ঞানভিত্তিক তথ্যের ওপর নির্ভর করে বিজ্ঞানসম্মত উপায়ে পর্যবেক্ষণ ও গবেষণার মাধ্যমে আগামী আবহাওয়া সম্পর্কে পূর্বানুমান প্রয়োজন, যা তিনটি ধাপে সম্পন্ন হয়— আবহাওয়া সংক্রান্ত তথ্য আহরণ, তথ্য সংকলন ও বিশ্লেষণ এবং আবহাওয়ার পূর্বানুমান। নানা পরিমাপক যন্ত্র, বেলুন, রাজার এবং অধুনা আবহাওয়া তথ্য সংগ্রহকারী স্যাটেলাইট এর মাধ্যমে তথ্য সংগৃহীত হয়। এরপর নানা সটওয়ার এর সাহায্যে, গাণিতিক ও মানচিত্রকরণের মাধ্যমে সেই তথ্য সংকলিত ও সংরক্ষিত হয়। এই তথ্যের সাহায্যে বিবেচনায় প্রধানত তিনটি উপায়— সিনপটিক পদ্ধতি, স্যাটেলাইটস্টিকাল পদ্ধতি ও নিউমারিক্যাল পদ্ধতি প্রয়োগ করে আবহাওয়ার পূর্বানুমান করে থাকেন। সময়কালের ভিত্তিতে এই পূর্বাভাস কে স্বল্প, মধ্য ও দীর্ঘকালীন এই তিনটি ভাগে ভাগ করা হয়ে থাকে। ভারতে আবহাওয়ার পূর্বাভাস এর দায়িত্ব বহন করে প্রধানত IMD (ভারতের আবহাওয়া দপ্তর) ও কিছু বেসরকারি সংস্থা। এই আলোচনার আবহাওয়া পূর্বাভাস পদ্ধতির বিবর্তন ও আধুনিকীকরণ, ভারত-এর বর্তমান আবহাওয়া পূর্বাভাস পদ্ধতি, ধরণ, প্রযুক্তি, সফলতা ও সজ্ঞাবনার ওপর বিশেষ জোর দেওয়া হয়েছে।

১. ভূমিকা :

“চৈত্রতে ধর ধর / বৈশাখে কড় পাধর /
জৈষ্ঠ্যতে তারা ফুটে / তবে জানাবে বর্ষা বটে।”

—খনার বচন।

পৃথিবীর বিভিন্ন ভাষায় লোকমুখে এ ধরনের ছড়া প্রায়শই শোনা যায়। মানবসভ্যতার শুরু থেকেই আগামী দিন বা কতু কেমন যাবে তার অনুমান করার প্রয়াস দেখা যায়। কারণ আবহাওয়া আমাদের দৈনন্দিন জীবনযাত্রাকে প্রভাবিত করে। নানা আবহাওয়া সম্পর্কিত দুর্ঘটনা যেমন আমাদের প্রভাবিত করে তেমনিই চাষাবাদ কেমন হবে তাও নির্ভর করে আবহাওয়া ও জলবায়ুর ওপর। সমুদ্রে জাহাজ চলাচল, বিমানযাত্রা, এমনকি ট্রেন ও সড়কপথ-এ যাত্রার জন্যও আবহাওয়ার পূর্বাভাস অত্যন্ত গুরুত্বপূর্ণ।

প্রাচীনকালে আবহাওয়ার পূর্বানুমান নির্ভর করত আবহাওয়া সম্পর্কিত নানা বিষয় পর্যবেক্ষণ ও পূর্বাভিজ্ঞতার ওপর। পরবর্তীকালে বিজ্ঞানের উন্নতির সাথে এই ব্যবস্থার প্রভূত উন্নতি ঘটে। বিজ্ঞানী গ্যালিলিও তাপমাত্রা মাপার জন্য আবিষ্কার করেন থার্মোমিটার (১৫৯৩); বিজ্ঞানী টরিসেল্লী আবিষ্কার করেন বায়ুচাপ মাপক যন্ত্র ব্যারোমিটার (১৬৪৩); বিজ্ঞানী হ্যালি বায়ুর দিক ও গতিবেগ সংক্রান্ত মানচিত্র তৈরি করেন (১৬৩৬); বিজ্ঞানী বইশ ব্যালট

বায়ুচাপের সাথে বায়ুপ্রবাহের সম্পর্ক ব্যাখ্যা করেন (১৮৫৭)। এসকল আবিষ্কারের ফলে আবহাওয়ার বিভিন্ন উপাদানের বৈশিষ্ট্য যেমন তাপমাত্রা, আর্দ্রতা ও বৃষ্টিপাত, বায়ুচাপ ও বায়ুপ্রবাহের দিক ইত্যাদির তথ্য আবহবিদদের হাতে আসে। পরবর্তীকালে বেলুন, বিমানপোত, রাজার ও স্যাটেলাইটের সাহায্যে শুধু নিম্ন বায়ুমণ্ডল-ই নয় তার সাথে উর্ধ্ব বায়ুমণ্ডলেরও তথ্য আহরিত হয়। যার ওপর নির্ভর করে আবহবিদরা আবহাওয়ার পূর্বানুমান করে থাকেন। সুতরাং, বর্তমানে আবহাওয়ার পূর্বাভাস বলতে বোঝায় বিজ্ঞানভিত্তিক তথ্যের ওপর নির্ভর করে বিজ্ঞানসম্মত উপায়ে পর্যবেক্ষণ ও গবেষণার মাধ্যমে, আগামী আবহাওয়া সম্পর্কে পূর্বানুমান করার পদ্ধতিকে।

আবহাওয়া পূর্বাভাস ব্যবস্থার জনক হলেন ব্রিটিশ নৌবাহিনীর অ্যাডমিরাল রবার্ট ফিটজেরয়। এই ব্যবস্থার প্রবর্তনে তাঁকে বিখ্যাত আবহবিদ ফ্রান্সিস বুফো সাহায্য করেছিলেন। ঊনবিংশ শতকের মাঝামাঝি সময় থেকে টেলিগ্রাফ ব্যবস্থার মাধ্যমে পূর্বাভাস প্রেরণ সহজ হয়ে ওঠে ও সাধারণের কাছে তা জনপ্রিয় হয়। ভারতবর্ষে আবহাওয়া সংক্রান্ত তথ্য সংগ্রহ ও বিশ্লেষণ ও পূর্বাভাস সম্প্রচার করে থাকে ভারতীয় আবহাওয়া দপ্তর বা IMD (India Meteorological Department) যা প্রতিষ্ঠিত হয় ১৮৭৫ খ্রিস্টাব্দে।

সহকারী অধ্যাপক, ভূগোল বিভাগ, শহীদ মাতলিগাণী হাজরা গণ্ডা কলেজ ফর উইমেন, ডমলুক
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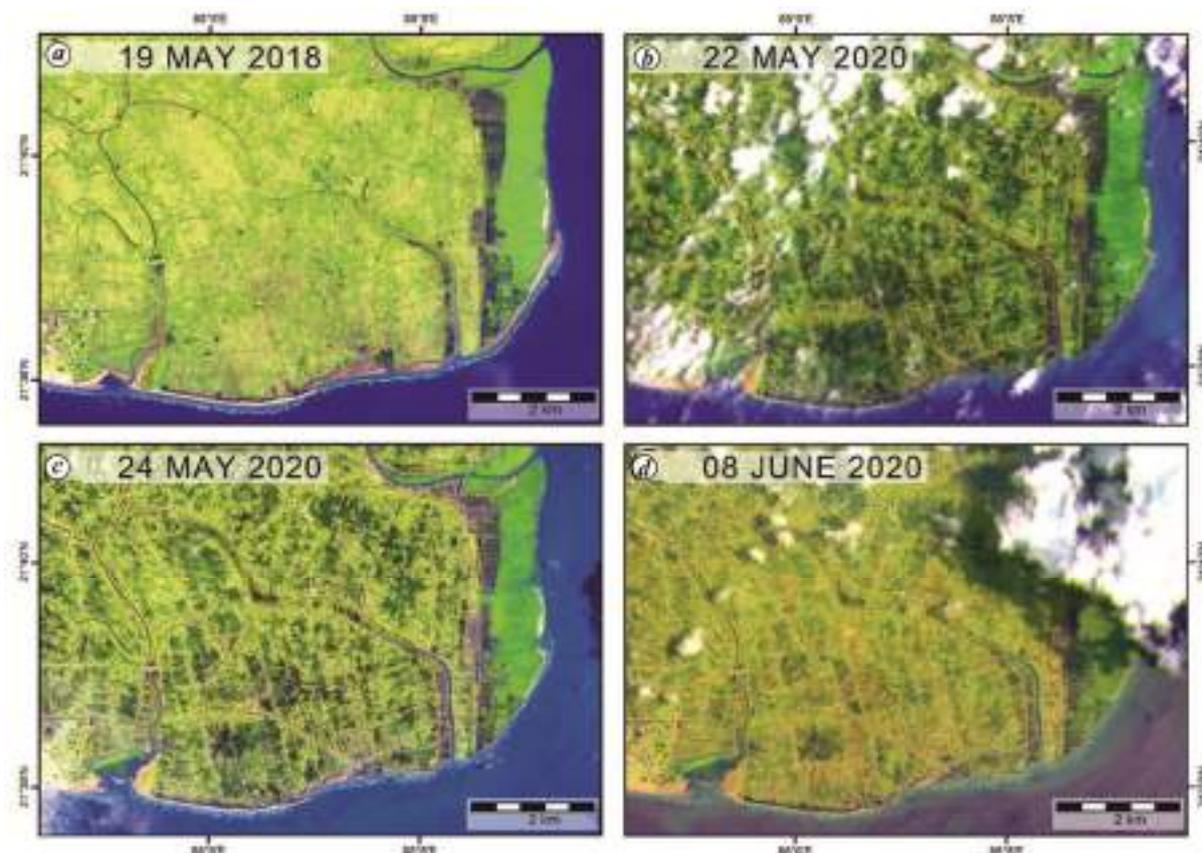


Figure 3. Time series images showing inundation from *Amphan*-related rainfall, storm surge and post-event recovery in the southeastern Sagar Island. *a*, The pre-event image of May 2018 represents the usual dry, pre-monsoon condition of the area. *b*, In contrast, all low-lying areas are seen to be flooded (dark blue and black) a couple of days after the *Amphan* crossed over. White patches denote clouds. *c*, *d*, Subsequently, the area shows signs of improvement with draining of floodwater. Source: *a* and *c*, Landsat-8 Pan-fused OLI, path-138 row-045; *b*, Resourcesat-2 LISS-3, path-108 row-056; *d*, Sentinel-2A MSI, tile T45QXE.

system weakened into a low-pressure area (23:30 IST on 21 May 2020)³, bringing its 10-day life cycle to end on 22 May 2020.

Accompanied by torrential rainfall¹⁴ (236.3 mm in Kolkata on 20 May 2020), the *Amphan* pounded the LDWB with complete disruption of civic facilities and large-scale storm inundation. The affected area (32,951 km²) was comprised of eight districts of the LDWB region mentioned earlier. Synthetic-Aperture Radar (SAR) C-band data of 19 May 2020 (pre-event) and 22 May 2020 (post-event) from Sentinel-1A and -1B satellites were processed using Sentinel Application Platform (SNAP) for extraction of the storm-inundation zones from this region (Figure 2). After radiometric calibration and terrain correction, histogram thresholding method was applied to the images for differentiating water pixels from non-water pixels. The threshold parameters were validated with the Sentinel-2A Multi Spectral Instrument (MSI)

image of 9 May 2020 (which is close to the event date) as proxy accuracy assessment. Next, water pixels were converted to polygons to get the inundation area vectors. Finally, district-wise inundated area statistics were generated by spatial analysis using vector overlay of pre- and post-inundation water areas.

The results show that 12.3% of the study area was inundated by storm waters of the *Amphan*. Expanse-wise, the two coastal districts were worst hit, with 1,809 km² (38.2% of district area) and 622 km² (6.2%) inundated in the Purba Medinipur and South 24 Parganas districts respectively. Inundation amounts for the other districts were: North 24 Parganas (420 km², 10.3%), Hugli (298 km², 9.5%) and Howrah (289 km², 19.7%). Maximum waterlogging can be identified around the Hugli Estuary region, and in the reclaimed areas of the Sundarban in North 24 Parganas and South 24 Parganas districts (Figure 2). The runways and tarmac of the Netaji

Subhas Chandra Bose International Airport of Kolkata were completely flooded and damaged by the cyclone¹⁵ (Figure 2*b*). Some recovery of the flooded areas was seen during the weeks following the event and before the onset of the monsoons, as the breached coastal embankments were repaired and accumulated waters drained (Figure 3). The impacts of salt water incursion into the farmlands, however, are likely to remain for years.

In the South and North 24 Parganas districts, the reclaimed Sundarban area is inherently vulnerable to tropical cyclones since its tidal islands were started to be embanked a couple of centuries ago. Prior to the *Amphan*, major cyclones like the *Aila* (May 2009)¹⁶ and the *Bulbul* (November 2019) battered this region in recent past, significantly affecting its socio-economic fabric. Despite being a more intense storm, the *Amphan* did not cause coastal flood like the *Aila* event, because, unlike the former, landfall of the latter coincided almost exactly with

রবীন্দ্রভাবনায় অধ্যাত্মবাদ ও মৃত্যুচেতনা

অতসী মহাপাত্র

রবীন্দ্র জীবন ও সাহিত্যে 'আধ্যাত্মিকতা' বা অধ্যাত্ম চেতনার একটি বিশেষ গুরুত্ব রয়েছে। 'আধ্যাত্মিক' শব্দের আভিধানিক অর্থ হল 'আত্মা থেকে জাত' বা 'আত্মা সম্বন্ধীয়' বা 'মানসিক' বা 'ব্রহ্ম বিষয়ক'। যে মতবাদে জড় অতিরিক্তভাবে চেতনতত্ত্বকে বা শুধু চেতনতত্ত্বকে স্বীকার করা হয়, কিংবা ঈশ্বর বা পরমাত্মা বা চিৎশক্তিকে জগৎ ও জীবনের মূলতত্ত্ব বলে মনে করা হয়, সেই মতবাদকে অধ্যাত্মবাদ বলে। এই মতবাদে পরমসত্তার আলোচনা ছাড়াও আত্মা, মোক্ষ, পরলোক, জন্মান্তর, কর্মফল, নৈতিক নিয়ম শৃঙ্খলাও স্বীকৃত হয়। ভারতীয় দর্শনে অধ্যাত্মবাদ স্বীকৃত হয়। মরমিয়া সাধকেরা তাঁদের অধ্যাত্ম সাধনায় অন্তর্দৃষ্টি ও তন্ময়তার সাথে সত্য ও সুন্দরের উপলব্ধির প্রয়াস করে থাকেন। সাধু-সন্ত, বাউল, সুফী চিন্তাবিদরা অনুভব করেন পরমসত্তা প্রেমময়, সৌন্দর্যময়। তিনি অবিনশ্বর ও সর্বত্র বিরাজমান। এই অর্থে 'আত্ম-পরিশুদ্ধির মাধ্যমে পরমসত্তার সাথে সম্বন্ধ স্থাপন করাই হল অধ্যাত্মবাদের মূল কথা। রবীন্দ্রনাথের মিস্টিক অধ্যাত্মভাবনা তাঁর দুঃখচেতনা, জীবনদেবতাবাদের প্রত্যয়, ঈশ্বরানুভূতি ঈশ্বর-প্রেম ও মানবতাবোধ, অমরত্বচেতনা, মুক্তির আদর্শ, মৃত্যুতে জীবনের পরিপূর্ণতার উপলব্ধি প্রভৃতির মধ্য দিয়ে এক গভীর জীবনবোধ তথা জীবনদর্শনের উদ্ভব ঘটিয়েছে। আলোচ্য প্রবন্ধে রবীন্দ্রনাথের আধ্যাত্মিক চিন্তাধারা ও মৃত্যু সম্পর্কিত চেতনার স্বরূপ বিষয়ে একটি সংক্ষিপ্ত আলোচনা করার চেষ্টা করা হয়েছে।

কোন বিষয়ে মনোভাব বা দৃষ্টিভঙ্গি গড়ে ওঠার ক্ষেত্রে সম্ভাব্য কারণগুলির মধ্যে অন্যতম হল মানুষের অভিজ্ঞতা ও পরিবেশ। রবীন্দ্রনাথ যখন জন্মগ্রহণ করেন, তখন ঠাকুরবাড়িতে আধ্যাত্মিক সংস্কৃতির একটি মনোভাব প্রবাহমান ছিল, তবে তা মূলত পিতা দেবেন্দ্রনাথকে কেন্দ্র করে। তাঁর আনুকূলে ঠাকুরবাড়ির ব্রাহ্ম পরিবেশেই রবীন্দ্রনাথ মানুষ হয়েছিলেন। দেবেন্দ্রনাথের চিন্তায় ও কর্মে সনাতন ভারতীয় ঐতিহ্যের তথা অধ্যাত্মভাবনার সমাবেশ লক্ষ্য করা যায়। তবে ব্রাহ্মধর্মের যে উল্লেখযোগ্য প্রভাব রবীন্দ্রজীবনে প্রতিফলিত হয়েছিল তা হল উপনিষদভিত্তিক আধ্যাত্মিকতা, যা তিনি সরাসরি পিতার কাছ থেকে লাভ করেছিলেন। শুধুমাত্র বাল্য বা কৈশোরকালেই নয়, তাঁর সমগ্র জীবন আবর্তিত হয়েছে উপনিষদিক অধ্যাত্মবাদকে কেন্দ্র করে। বাল্যকাল থেকেই তিনি উপনিষদীয় পরমপুরুষ তথা ব্রহ্মের কথা শুনে এসেছেন। উপনিষদের ভাবময় ও কাব্যময় ব্যাখ্যা শোনার সুযোগ পেয়েছেন এবং নিজে ব্রহ্মসংগীতও গেয়েছেন। তবে উপনয়ন উপলক্ষ্যে গায়ত্রী মন্ত্র পাওয়ার পর থেকেই রবীন্দ্রনাথের অধ্যাত্মচেতনার উন্মেষ ঘটে। উপনয়নের ফলে প্রাপ্ত গায়ত্রী মন্ত্রের আবৃত্তি ও তার অর্থ ও ধ্যান তাঁর আধ্যাত্মিক জীবনকে বিশেষভাবে প্রভাবিত করেছিল তা 'জীবনস্মৃতি' ও 'মানুষের ধর্ম' গ্রন্থ থেকে জানা যায়। এই প্রসঙ্গে সুকুমার সেন 'রবীন্দ্রনাথ ঠাকুর' গ্রন্থে বলেছেন, "উপনিষদ পাঠ করে সেই তত্ত্বাদি সমূহের তাৎপর্য উপলব্ধি করার বহু পূর্বেই বালক রবীন্দ্রনাথের অবোধচিত্তে অনির্বচনীয় আনন্দরসের পূর্ব স্পর্শ লাগিয়া ছিল তাহার ইঙ্গিত পাই জীবনস্মৃতিতে উল্লিখিত গায়ত্রী মন্ত্র জপে চোখে জল করার ঘটনায়।" রবীন্দ্রনাথের ভাষায় বলা যায় —

"হৃদয় আজি মোর কেমনে গেল খুলি।

জগত আসি সেথা করিছে কোলাকুলি।"^২

এইভাবে বিশ্বচেতনের সাথে আত্মিক চেতনার সম্বন্ধ স্থাপনে প্রয়াসী হয়েছিলেন বালক রবীন্দ্রনাথ।

তবে রবীন্দ্রনাথের অধ্যাত্মচিন্তা উপনিষদের আনন্দদর্শন এবং বৈষ্ণব সাধনার লীলাবাদের দ্বারা বিশেষভাবে



Recent developments in the solvent-free synthesis of heterocycles

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Heterocyclic molecules exhibit significant importance as they possess pharmacological, biological, and industrial applications. Although several excellent synthetic routes have been established for heterocyclic molecules, sustainable synthetic procedures such as microwave, ultrasound, grinding, photochemical, and thermodynamic route maps are needed to be explored further. Furthermore, these techniques become more eco-compatible when they produce value-added products in the absence of solvent. The advantages of these methodologies are to generate a library of small molecules, which will eventually combine to form complex bioactive molecules. In this review, we have emphasized recent studies (2010 to 2022) on the solvent-free conditions of various heterocycles (N, O, S), which have been synthesized *via* oxidation, reduction, condensation, and conjugated reactions. In this literature survey, glimpses of methodologies with their advantages, mechanistic considerations, and limitations are highlighted. These sustainable, and economically feasible routes will pave the way for a revolutionary corridor in the near future.

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1. Introduction

Heterocyclic compounds have occupied a special place in the largest classical divisions of organic chemistry due to their immense importance not only in biological and industrial purposes but also in the development of human society. In the drug industry, 80% of compounds originated from heterocycles, and hence the synthesis of these compounds is directly related to the pharmaceutical industries.¹ Consequently, synthetic chemist continuously included their research for the

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সূচিপত্র

নরেন্দ্রনাথ মিত্রের ছোটগল্প : আঞ্চলিক পটভূমির বহুমান্বিতিক বর্ণালি কালীশঙ্কর রায়	১৫
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the highest high tide on a new moon day¹⁷. Notably, the Fifth Assessment Report of the Intergovernmental Panel on Climate Change stated that in the North Indian Ocean region, frequency of tropical storms will remain unaltered in the coming decades, with increasingly extreme rainfall events occurring near storm centres¹⁸. Management plans for the LDWB, therefore, should prepare the region for embracing more storms like the *Amphan* in near future.

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Shortening seed germination time for *Borassus flabellifer* using compost pit seed pretreatment

Palmyra or the Asiatic palm (*Borassus flabellifer*) is a multipurpose palm belonging to the Arecaceae family. It is native to the tropical regions of Africa, Asia and New Guinea. Among the five species of *Borassus*, *B. aethiopum* (found in Africa), *B. flabellifer* (found distributed in the coastal areas of the Indian Ocean) and *B. sondaicus* (restricted to mainland Indonesia) are of livelihood and economic importance^{1–3}. All its plant parts find use in rural households, starting from its liquid endospermous fruit, neera (sap extracted from the inflorescence), tubers, culm, petiole to its leaf lamina^{4,5}. It is dioecious and flowering occurs from March to April. The sex of palm is identifiable after its first flowering, which occurs 12–20 years after sow-

ing. The female inflorescence has 6–12 bunches, and each bunch bears an average of 15–25 fruits. The fruits are smooth, having a leathery, brown outer covering that turns black at maturity⁶. Within the fruit is a fibrous mesocarp with a yellow or orange pulp⁷.

Palmyra is mainly propagated through seeds that are rectangular in shape, 4.5 in long, 4 in wide, and 1.75 in thick in the middle⁷. Palmyra fruits are difficult to dehusk as the fibres tightly adhere to the seeds. In palmyra, it is the hypocotyl that emerges first, growing deep into the ground (sometimes more than 1 m) before the roots and pseudo leaves appear. Germination in palmyra is of tubular type, where plumule emergence occurs from the proximal end of the growing

cotyledon away from the seed. This structure is known as the cotyledonary tube or apocolon. Herein, we refer to germination as the emergence of the hypocotyl.

In the nursery, palmyra seeds are either sown in seedbeds or in mounds of soil to facilitate easy transplantation. Palmyra seeds are hard to germinate; it takes around 60–90 days for germination. Pseudo leaves start emerging in 9–12 months from the date of sowing⁷.

India has nearly 102 million palmyra palms distributed across Tamil Nadu (TN), Maharashtra, Karnataka, Kerala, Odisha and West Bengal. About half of the palmyra population in the country is concentrated in TN, where it is the state tree⁸. On the other hand, reports have

Synthesis of Multifused Pyrrolo[1,2-*a*]quinoline Systems by Tandem Aza-Michael–Aldol Reactions and Their Application to Molecular Sensing Studies

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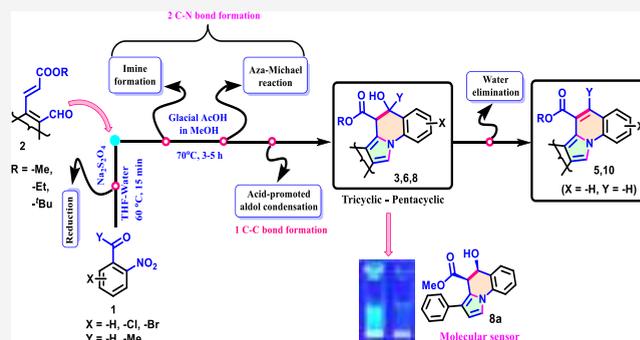
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ABSTRACT: Herein, we have presented a weak acid-promoted tandem aza-Michael–aldol strategy for the synthesis of diversely fused pyrrolo[1,2-*a*]quinoline (tricyclic to pentacyclic scaffolds) by the construction of both pyrrole and quinoline ring in one pot. The described protocol fabricated two C–N bonds and one C–C bond in the pyrrole-quinoline rings which have been sequentially formed under transition-metal-free conditions by the extrusion of eco-friendly water molecules. A ketorolac drug analogue has been synthesized following the current protocol, and one of the synthesized tricyclic pyrrolo[1,2-*a*]quinoline fluorophores has been used to detect highly toxic picric acid via the fluorescence quenching effect.



INTRODUCTION

Aza-Michael addition and aldol condensation are two well-documented reactions in organic synthesis as these reactions have been considerably used in the construction of C–N and C–C bond formation.¹ The combination of two reactions in a tandem fashion is an attractive tool for the construction of N-heterocycles in a single click reaction.² The transition-metal-free cascade Michael–aldol reactions have been considered as economical and environmentally friendly processes.³ The combination of these two reactions was applied to construct different N-bridged heterocycles and various natural products such as steroids (estradiol methyl ether) and pentacyclic anticancer agents (marmycin A and B).^{4,5} On the other hand, pyrrolo[1,2-*a*]quinolone scaffolds are important for their natural occurrences as well as their biological activities including antibacterial, antiviral, antioxidant, antihypoxia, anticancer, multidrug-resistance reversing, cytotoxic, and HIV-1 integrase inhibitory activities as depicted in Figure 1.⁶ Besides the biological applications, fluorescence properties of these heterocycles have received great attention in the past decades because of their applications in bioimaging, drug discovery, clinical diagnostics, and organic optoelectronic devices.⁷ Furthermore, multisubstitutions such as Ar–OH, carbonyl, and carboxyl groups in the fluorophore help in the manifestation of molecular sensing properties.⁸

Due to the tremendous biological and photophysical importance of pyrrolo[1,2-*a*]quinolone scaffolds, researchers have developed a large number of protocols for the synthesis of such compounds.^{9–11} However, there is no report on the

formation of tricyclic to pentacyclic rings in a single operation. There are some precedents (Scheme 1) to construct either pyridine,⁹ pyrrole,¹⁰ or both the moieties¹¹ for the synthesis of pyrrolo[1,2-*a*]quinolone from suitable precursors but in most of the cases either the pyridine or pyrrole moiety has been used as a starting material. However, in a few pieces of literature, it has been shown that both the rings of pyrrole and isoquinoline were formed in a one-pot methodology. However, in most of the cases, they used chlorinated solvents as the reaction media for a prolonged time. Herein, we have designed a protocol for the synthesis of pyrrolo[1,2-*a*]quinoline (tricyclic to pentacyclic) in a single-pot Michael–aldol reaction within a short reaction time under green conditions. The coupling reactions were performed with two substrates 2-nitrobenzaldehyde 1a and 3-(2-formylcycloalkenyl)-acrylic ester derivatives 2 in the presence of the weak organic acid catalyst AcOH in MeOH. The generation of nontoxic byproducts is another attraction of this protocol.

3-(2-formylcycloalkenyl)-acrylic ester derivatives with two reactive functional groups (α,β -unsaturated ester and aldehyde) have been explored for the synthesis of heterocyclic

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সারসংক্ষেপ: পুরুষতান্ত্রিক সমাজে নারীর অবস্থান আবহমানকাল থেকেই উনমানবের মতো; তাঁকে অবমানবও বলা যায়। যাবতীয় নেতিবাচক অভিধা দিয়ে নারীকে চিহ্নিত করার একটা মৌল প্রবণতা আমাদের সমাজে রয়েছে। পুরুষতন্ত্রের শাসনজনিত নিগড়ে চাপে নারীর মানবিক অস্তিত্ব কী ক'রে বারবার বিপন্ন হয়েছে তা সংবেদনশীল অনুভূতিস্বদ্ধ মানুষের ভাবনায় আমরা রূপায়িত হতে দেখেছি। গীতা চট্টোপাধ্যায়ের কবিতায় আমাদের সমাজের বৃহত্তর প্রেক্ষিতে নারীর বিভিন্ন অবস্থানের সঙ্গে তাঁর ন্যূন অবমানবের রূপটিও ধরা পড়েছে। সন্দেহপ্রবণ এই সমাজ মেয়েদের কী নিষ্করণভাবে প্রশ্নার্ত ক'রে তোলে, ক'রে তোলে নানানতর অসংগত অভিযোগে অভিযুক্ত— তার একটা রূপচিত্র গীতা চট্টোপাধ্যায়ের কবিতায় আমরা দেখেছি। এই নিবন্ধে এই বিষয়ে খানিকটা বলবার অবকাশ পেয়েছি।

মূলশব্দ : নারী, পুরুষতন্ত্র, শাসন, নারীবাদ, যৌনতা।

গীতা চট্টোপাধ্যায়কে (১৯৪১-২০১৯) দ্বিধাহীনভাবে 'মহাকবি' আখ্যায় আখ্যায়িত করা যায়। কারণ, একজন কবিকে মহাকবি আখ্যায় আখ্যায়িত করার জন্য যে-সমস্ত লক্ষণের প্রয়োজন হয় তার সবটাই বোধহয় তিনি আয়ত্ত করতে পেরেছিলেন। একদা কবি শিদলক্ষ্মি তাঁর বন্ধু দত্তয়েভক্ষিকে লিখেছিলেন : "মহাকবির লক্ষণ কী জানো ? তাঁকে ধুলোয় ফেলে দিয়ে টানো, তাঁকে কাদায় ফেলে দিয়ে মাড়াও, তাঁকে যৎপরোনাস্তি কষ্ট দাও, তাঁর আত্মা কখনও আত্মসমর্পণ করবে না। তিনি সর্বদা সত্যসন্ধী, নিত্য ন্যায়পরায়ণ।" গীতা চট্টোপাধ্যায় আমৃত্যু শিদলক্ষ্মি কথিত মহাকবি হয়ে ওঠার লক্ষণগুলিকে মেনে চলেছিলেন। কবিতায় দৃঢ়ভাষ্যে লিখেছিলেন : "আমি বরং শিরও দেব,/ স্বধর্মকে কখনো না।"^১ অন্য একটি কবিতায় প্রতিবাদ-দীপিত-বাচনে লিখেছিলেন : "প্রতিমার সামনে আর চড় মারবে সাধ্য আছে কারো/ নির্বিবেক বাংলাদেশে গাল বাড়িয়েছি, কই মারো ?"^২ এই দার্ট ব্যক্তিত্বই তাঁর অন্যতম চারিত্রিক বৈশিষ্ট্য এবং তাকে অবলম্বন করেই তিনি একান্ত আপন স্বাতন্ত্র্যে অননুকরণীয় নৈপুণ্যে কবিজীবন কাটিয়েছিলেন। তাঁর কবিতায় নারীদের কথা বিভিন্ন মাত্রায় চিহ্নিত হয়ে ফিরে ফিরে এসেছে। সেই সব নারীদের বিভিন্ন রূপাবয়বের চালচিত্র তিনি যে-ভাবে এঁকেছিলেন, সেই বিষয়টিকে সংক্ষেপে তুলে ধরার চেষ্টা করব।