Published Research Article from 2019 onwards (included in UGC Care list)

Sl No.	Title of Paper	Author	Department	Journal	Year	Link
1	Effects of fractional and two-temperature parameters on stress distributions for an unbounded generalized thermoelastic medium with spherical cavity	Md Abul Kashim Molla	Mathematics	Arab Journal of Basis and Applied Science	2019	https://www.tandfonline.com/doi/full/10.1080/25765299.2019.1621511

Published Research Article from 2020 onwards (included in UGC Care list)

Sl No.	Title of Paper	Author	Department	Journal	Year	Link
1	সপ্তদশ লোকসভা নির্বাচন (২০১৯): মুর্শিদাবাদ জেলার নির্বাচনী ফলাফলের একটি পর্যালোচনা	Avijhit Saha	Political Science	Itikatha	2020	https://www.bangiyaitikatha.in
2	Hunger as a Metaphor of Emasculation in Bhabani Bhattacharya' He Who Rides a Jourr Tiger	Saswata Kusari	English	Asian Quarterly: An International Journal of Contemporary issues	2020	https://www.iasepune.in/aq/
3	Adsorption and anti-corrosion characteristics of vanillin Schiff bases on mild steel in 1 M HCl: experimental and theoretical study	Sanjoy Satpati	Chemistry	RSC Advances	2020	https://pubs.rsc.org/en/content/articlehtml/2020/ra/c9ra07982c
4	Waves in generalized thermo-viscoelastic infinite continuum with cylindrical cavity due to three-phase-lag time-nonlocal heat transfer	Md Abul Kashim Molla	Mathematics	Journal of Thermal Stress	2020	https://www.tandfonline.com/doi/abs/10.1080/01495739.2020.1749196
5	Threats of plastic pollution and awareness among	Supratim Mukherjee	Mathematics	Eco. Env. & Cons	2020	http://www.envirobiotechjournals.com/EEC/v26i420/EEC-65.pdf

	common people: A multi attribute problem					
6	Bis-benzothiazoles as efficient corrosion inhibitors for mild steel in aqueous HCl: Molecular structure-reactivity correlation study	Sanjoy Satpati	Chemistry	Journal of Molecular Liquids	2020	https://www.sciencedirect.com/science/article/abs/pii/S0167732220313453
7	বিপ্লবে বারুদের গন্ধ নেই সুভাষ মুখোপাধ্যায়ের সমকালিনতা ও বিশ্বজনীনতা	Avijhit Saha	Political Science	Anustup	2020	https://anustup.org.in/
8	Influence of position of hydroxyl group of flavonoids on their binding with single stranded polyriboadenylic acid: A spectroscopic evaluation	Susmita Chowdhury	Chemistry	Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy	2020	https://www.sciencedirect.com/science/article/pii/S1386142520309872?casa_token=kVvg9uVNwZcAAAAA:LqbOWbdcUmCMgG6xMZ_fgTCLhMnnKdwaoN5WXlkzS1oL1zIguTJzIw_p62I8FWj4QLKJqjLhIg
9	Federalism at the Crossroads: Crisis of the Linguistic Minorities in India	Pritin Dutta	Political Science	Rupkatha Journal on Interdisciplinary Studies in Humanities	2020	http://rupkatha.com/V12/n5/rioc1s24n2.pdf
10	A Spectroscopic Approach towards the Comparative Binding Studies of the Antioxidizing Flavonol Myricetin with Various Single-Stranded RNA	Susmita Chowdhury	Chemistry	Chemistry Select	2020	https://chemistry-europe.onlinelibrary.wiley.com/doi/epdf/10.1002/slct.202003601

Published Research Article from 2021 onwards (included in UGC Care list)

Sl No.	Title of Paper	Author	Department	Journal	Year	Link
1	Amino acid and cinnamaldehyde conjugated Schiff bases as proficient corrosion inhibitors for mild steel in 1 M HCl at higher temperature and prolonged exposure: Detailed electrochemical,	Sanjoy Satpati	Chemistry	Journal of Molecular Liquids	2021	https://www.sciencedirect.com/science/article/abs/pii/S0167732220373190

	adsorption and theoretical study					
2	Probing blood plasma samples for the detection of diabetes using SERS aided by PCA and LDA multivariate data analyses	Sumit Kumar Das	Physics	New Journal of Chemistry	2021	https://pubs.rsc.org/en/content/articlehtml/2021/nj/d0nj04508j?casa_token=7DPB5wXsq68AAAAA:9AsfUtZur317LPcR6q-kRjND9BjE0H9L_SgP5q5f5qr60TFiDbikB-ztUS8iTfHDHKiRE-NGIQWk4w
3	One-pot facile synthesis and electrochemical evaluation of selenium enriched cobalt selenide nanotube for supercapacitor application.	Ajoy Mandal	Physics	Ceramics International	2021	https://www.sciencedirect.com/science/article/abs/pii/S0272884221004508
4	ক্ষেত্রসমীক্ষার আলোকে লোকঔষধ ও চিকিৎসা: তবু একলব্য	Nitish Ghosh	Bangla	Tabu Akolabya	2021	https://portal.issn.org/resource/ISSN/0976-9463
5	Variational principle, uniqueness and reciprocity theorems for higher order time-fractional four-phase-lag generalized thermoelastic diffusion model	Md Abul Kashim Molla	Mathematics	Mechanics Based Design of Structures and Machine	2021	https://www.tandfonline.com/doi/full/10.1080/15397734.2021.1882311?casa_token=OcqObQe2aRAAAAAA%3A14yPTmiMzVV4Nu2nfpLWlAb54W_SNtdifnzFE1jJbwjgDQ6-k73wkTFVCB3Z5TTwHgSyJFfhPdp-
6	Nitrogen vacancy and hydrogen substitution mediated tunable optoelectronic properties of g-C3N4 2D layered structures: applications towards blue LED to broad-band photodetection.	Ajoy Mandal	Physics	Applied Surface Science	2021	https://www.sciencedirect.com/science/article/abs/pii/S0169433221008497
7	Interface engineering of moisture-induced ionic albumen dielectric layers through self-crosslinking of cysteine amino acids for low voltage, high-performance organic field-effect transistors.	Ajoy Mandal	Physics	Nanoscale	2021	https://pubs.rsc.org/en/content/articlelanding/2021/nr/d1nr02759j/unauth

8	Fuzzy Membership Function Evaluation by Non-Linear Regression: An Algorithmic Approach	Supratim Mukherjee	Mathematics	Fuzzy Information and Engineering	2021	https://www.tandfonline.com/doi/full/10.1080/16168658.2021.1911567
9	Silver nanodot decorated dendritic copper foam as a hydrophobic and mechano-chemo bactericidal surface.	Ajoy Mandal	Physics	Langmuir	2021	https://pubs.acs.org/doi/abs/10.1021/acs.langmuir.1c00698
10	শান্তি প্রতিষ্ঠা, মানবাধিকার রক্ষা এবং আজকের আফগানিস্তান	Avijhit Saha	Political Science	Aparjan	2021	https://aparjan.com/2021/09/30/september2021-avsaar/
11	গান্ধীজীর সত্যাগ্রহ: একটি নৈতিক এবং রাজনৈতিক অস্ত্র	Raghunath Roy	History	Ebong Mohua	2021	https://abcdindex.com/Journal/Ebong-Mahua-(print-only)-NA
12	Comparative binding studies on the interaction of the indoloquinoline alkaloid cryptolepine with the B and the non-canonical protonated form of DNA: A spectroscopic insight	Susmita Chowdhury	Chemistry	Biochimica et Biophysica Acta (BBA) - General Subjects	2021	https://www.sciencedirect.com/science/article/pii/S0304416521001525?casa_token=kDThpgnjoYUAAAAA:sFnmi_AbRrBKGv56vx5145shIcsqVcILg3ztZzwC2UwpJM8kgwDSjVL33u_TRwHU93kPRDP46A
13	রাষ্ট্র, অতিরাষ্ট্র এবং স্ট্যান স্বামী	Avijhit Saha	Political Science	Aparjan	2021	
14	The alkaloid cryptolepine as a source of polyadenylate targeting therapeutic agent: Induction of self-assembly in the polyadenylate moiety	Susmita Chowdhury	Chemistry	Archives of Biochemistry and Biophysics	2021	https://www.sciencedirect.com/science/article/pii/S0003986121002915?casa_token=8Nut1O3T-TAAAAAA:5XFZILwrwFTr-Dvb8GegDkFjSXZhLg6GEXy26I2wF8fjp1W5dXG6cZXEap-MS0qhLCtbuRLzxg
15	বাংলা সাহিত্যে আফগান প্রসঙ্গ অনুসন্ধান	Shubhadip Debnath	Bangla	Aparjon	2021	https://aparjan.com/2021/09/30/september2021-shdear/
16	Time-Nonlocal Six-Phase-Lag Generalized Theory of Thermoelastic Diffusion with Two-Temperature	Md Abul Kashim Molla	Mathematics	Waves in Random and Complex Media	2021	https://www.tandfonline.com/doi/full/10.1080/17455030.2021.1974601?casa_token=qv8o5ATo3tQAAAAA%3AQk-vhijs2EavSdcUIv0IwzZHzElvF4sMcnk6EY

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Sl No.	Title of Paper	Author	Department	Journal	Year	Link
1	সদর্থক অন্তর্ঘাতের দুই সেনানী: সুবিমল-নবারুণ	Shubhadip Debnath	Bangla	Jonpod Prayas	2022	
2	ত্রিদোষ তত্ত্ব ও হিউমোর্যাল থিয়োরির প্রেক্ষিতে গোসানী-মঙ্গল : তবু একলব্য	Nitish Ghosh	Bangla	Tabu Akolabya	2022	https://portal.issn.org/resource/ISSN/0976-9463
3	Atomic-Scale Imaging and Nano-Scale Mapping of Cubic α-CsPbI3 Perovskite Nanocrystals for Inverted Perovskite Solar Cells.	Ajoy Mandal	Physics	ACS Applied Materials & Interfaces	2022	https://pubs.acs.org/doi/abs/10.1021/acsami.1c20794
4	Application of Memory Dependent Derivatives on Three Phase Lag Theory with Two Temperature for an Unbounded Generalized Thermoelastic Medium Having Spherical Hole	Md Abul Kashim Molla	Mathematics	Journal of the Calcutta Mathematical Society	2022	https://acrobat.adobe.com/id/urn:aaid:sc:AP:ef542403-f214-4303-b9be-41b6f20e8244
5	The Weaver Community of Murshidabad District: an overview	Avijit Saha	Political Science	International Journal of Integrated Research and Development	2022	https://www.ijird.org/
6	Anti-corrosive propensity of naturally occurring aldehydes and 1-(3-aminopropyl)imidazole condensed Schiff bases: Comparison on the effect of extended conjugation over electron donating substituents	Sanjoy Satpati	Chemistry	Journal of Molecular Structure	2022	https://www.sciencedirect.com/science/article/abs/pii/S0022286022013394
7	Diffusion-induced ingress of angiotensin-converting enzyme2 into charge	Ajoy Mandal	Physics	ACS Sensor	2022	https://pubs.acs.org/doi/abs/10.1021/acssensors.2c01287

	conducting path of pentacene channel for efficient detection of SARS-CoV-2 in saliva samples.					
8	Fabrication of gold nanoparticles tethered in heat-cooled calf thymus-deoxyribonucleic acid Langmuir-Blodgett film as effective surface-enhanced Raman scattering sensing platform	Sumit Kumar Das	Physics	Front. Chem	2022	https://www.frontiersin.org/articles/10.3389/fchem.2022.1034060/full
9	Self-assembled gold nanoparticles on the serpentine networks of Calf Thymus-DNA Langmuir-Blodgett films as efficient SERS sensing platform: Fabrication and its application in thiram detection	Sumit Kumar Das	Physics	Materials Chemistry and Physics	2022	https://www.sciencedirect.com/science/article/pii/S0254058422014468?casa_token=ZUPY4_c_HQoAAAAA:K4vQWBHyCv_5RTQUnR_vRwPZSC8nZMKJOhl2eQcdC2YaAGO8Cs_FxzfLZok3ZERZozloO42teg
10	Two-Temperature Generalized Piezo-Thermoelastic Problem with Eringen's Non-local Effect and Memory-Dependent Derivatives under Three Phase Lag Heat Transfer	Md Abul Kashim Molla	Mathematics	Waves in Random and Complex Media	2022	https://www.tandfonline.com/doi/full/10.1080/17455030.2022.2161023?casa_token=sQYWd-aDGA4AAAAA%3AtjO-uTGU7Cj36F-b_hIldALjRUPvH03-8OIQ-Vb2pitXwiby3ZSs3ZUL1Gr16scE94VdzL1MjGTR

Published Research Article from 2023 onwards (included in UGC Care list)

Sl No.	Title of Paper	Author	Department	Journal	Year	Link
1	Interaction of newly synthesized dipeptide Schiff bases with mild	Sanjoy Satpati	Chemistry	Materials Chemistry and Physics	2023	https://www.sciencedirect.com/science/article

	steel surface in aqueous HCl: Experimental and theoretical study on thermodynamics, adsorption and anti-corrosion characteristics					/abs/pii/S0254058422015061
2	Effect of the Heterocyclic Groups on the Anti-corrosion Performance of Heterocyclic Schiff Bases of Benzothiazole for Mild Steel in 1 M Aqueous HCl	Sanjoy Satpati	Chemistry	Journal of Bio- and Tribo-Corrosion	2023	https://link.springer.com/article/10.1007/s40735-023-00746-9
3	Diffusion-Induced Thickness Thinning of Spin-Coated Films in Crystalline Grain Boundaries: A Process of Amorphization	Ajoy Mandal	Physics	Advance Materials Interfaces	2023	https://onlinelibrary.wiley.com/doi/full/10.1002/admi.202202293
4	Experimental and theoretical investigation on the anti-corrosion characteristics of pyridine-substituted benzothiazole derivatives for mild steel in aqueous HCl	Sanjoy Satpati	Chemistry	Physical Chemistry Chemical Physics	2023	https://pubs.rsc.org/en/content/articlelanding/2023/cp/d3cp01392h/unauth
5	MOF-Assimilated High-Sensitive Organic Field-Effect Transistors for Rapid Detection of a Chemical Warfare Agent.	Ajoy Mandal	Physics	ACS Applied Materials & Interfaces	2023	https://pubs.acs.org/doi/abs/10.1021/acsami.3c05185
6	Evaluation of Covid-19 pandemic effects in Indian tourism	Supratim Mukherjee	Mathematics	Mathematics in Engineering, Science & Aerospace (MESA)	2023	https://web.p.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=20413165&AN=164270749&h=5IQtzLGps07FXKJlCTew%2besweCNT9QIVlzY4EidbTAVh0AQs2JKWfk7f5Z3grTf2K%2b0n%2fNtVGDZXuDicsIsLPQ%3d%3d&crl=c&resultNs=AdminWebAuth&resultLocal=ErrCrlNotAuth&crlhashurl=login.aspx%3fdirect%3dtrue%26profile%3dehost%26scope%3dsite%26authtype%3dcrawler%26jrnl

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7	New insights into self-structure induction in poly (rA) by Quinacrine through non-classical intercalation: Spectroscopic and theoretical perspectives	Susmita Chowdhury	Chemistry	International Journal of Biological Macromolecules	2023	https://www.sciencedirect.com/science/article/abs/pii/S0141813023030854

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ORIGINAL ARTICLE

Effects of fractional and two-temperature parameters on stress distributions for an unbounded generalized thermoelastic medium with spherical cavity

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ABSTRACT

Effects of fractional and two-temperature parameters on the distribution of stresses of an unbounded isotropic thermoelastic medium with spherical cavity are studied in the context of the theory of two-temperature generalized thermoelasticity based on the Green-Naghdi model III using fractional order heat conduction equation. The surface of the cavity is considered to be free from traction and is subjected to a smooth and time-dependent-heating effect. A spherical polar coordinate system has been used to describe the problem and the resulting governing equations are solved in Laplace transform domain. Numerical Laplace transform inversion method has been then applied to get the stresses in time domain. The numerical estimates of the distributions of stresses are obtained and are presented graphically to study the effects of fractional and two-temperature parameters.

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Two-temperature generalized thermoelasticity; Green-Naghdi model III; time-fractional heat conduction; spherical cavity

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1. Introduction

Because of two major imperfections of the classical uncoupled theory of thermoelasticity, it became essential to make them modified. The first imperfection was the absence of elastic term in the heat conduction equation for which the theory failed to explain the phenomenon of heat generation due to elastic changes and conversely, elastic changes due to heat supply in thermoelastic solids. The parabolic nature of the heat conduction equation was the second imperfection recommending the infinite speed of propagation of thermal waves throughout the body (Peshkov, 1944). This means that, at any point of the body, thermal effect is realised instantaneously after the heat supply, which is not practically tenable. The elimination of the first imperfection was due to Biot (1955), who introduced an elastic term in the heat conduction equation. This theory is known as classical coupled theory of thermoelasticity. Still this theory was suffering from a second imperfection. To remove the second imperfection several developments and modifications were carried out by several researcher in different times. These modified theories are known as the generalized theory of thermoelasticity. The major contributions towards the formulation and development of generalized theory of thermoelasticity was due to Lord and Shulman (1967); Green and Lindsay (1972); Green and Naghdi (1991, 1992, 1993); Tzou (1995); Choudhuri (2007). For details one can refer to Ignaczak and Ostoja-Starzewski (2010) and Chandrasekharaiah (1986, 1998). It is to be noted that generalized theory of thermoelasticity can be applied to deal with practical problems where high heat fluxes appear for very short time-intervals, which generally occur in laser units, energy channels and nuclear reactors, etc. Many works have been carried out using these theories in the recent past, a few of which are mentioned hereunder. Abd-alla and Abbas (2002) have solved a magneto-thermoelastic problem for an infinitely long, perfectly conducting transversely isotropic cylinder using the theory of generalized thermoelasticity. Abbas and Youssef (2012) have established a generalized thermoelasticity model of temperature dependent materials and used it to solve a thermal shock problem of a generalized thermoelastic half-space by employing the finite element method. Abbas and Abo-Dahab (2014) have solved a thermal shock problem in generalized

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প্রবন্ধ

সপ্তদশ লোকসভা নির্বাচন (২০১৯): মুর্শিদাবাদ জেলার নির্বাচনী ফলাফলের একটি পর্যালোচনা

অভিজিৎ সাহা*

(*প্রাপ্ত: ৮ জুলাই ২০১৯ খ্রি., গৃহীত: ১২ অক্টোবর, ২০১৯ খ্রি.*)

সারসংক্ষেপ

আলোচ্য প্রবন্ধটিতে সপ্তদশ জাতীয় লোকসভা নির্বাচনের (২০১৯) পরিপ্রেক্ষিতে মুর্শিদাবাদ জেলার তিনটি লোকসভা কেন্দ্রের ফলাফলকে পর্যালোচনা করা হয়েছে। নির্বাচনী ফলাফলকে বিশ্লেষণ করার জন্য যে সমস্ত পদ্ধতি ও মাপকাঠি অনুসরণ করা দরকার, আলোচ্য প্রবন্ধে উক্ত মাপকাঠিগুলিকে যতটা সম্ভব অনুসরণ করার চেষ্টা করা হয়েছে। প্রবন্ধটির মূল উদ্দেশ্য হল, প্রাপ্ত ফলাফলের ভিত্তিতে জেলার রাজনৈতিক বিন্যাসকে উপলব্ধি করা এবং এই নির্বাচনী ফলাফল যদি জেলার রাজনৈতিক বিন্যাসে কোনোরূপ মৌলিক পরিবর্তন নিয়ে আনতে সমর্থ হয়, তাহলে সেই রাজনৈতিক পরিবর্তনের ঝোঁকটিকেও চিহ্নিত করার চেষ্টা করা। মূলত চারটি অংশে বিভক্ত করে প্রবন্ধটি আলোচিত হয়েছে। এগুলি হল—(ক) সর্বভারতীয় লোকসভা নির্বাচনের পরিপ্রেক্ষিতে জেলার নির্বাচনী ফলাফলকে পর্যালোচনা করা; (খ) পশ্চিমবঙ্গের নির্বাচনী ফলাফলের পরিপ্রেক্ষিতে সংশ্লিষ্ট জেলার নির্বাচনী ফলাফলকে বিশ্লেষণ করা; (গ) উক্ত নির্বাচনে জেলার স্থানীয় ও নিজস্ব রাজনৈতিক সমীকরণ কতখানি ক্রিয়াশীল ছিল তার ওপর আলোকপাতের চেষ্টা করা; (ঘ) সাম্প্রতিক নির্বাচনী ফলাফল জেলার রাজনৈতিক সংস্কৃতিতে কোনোরূপ পরিবর্তন আনতে পেরেছে কিনা—সেটাও পর্যালোচনার মধ্যে রাখা হয়েছে। সবশেষে, উপরোক্ত মাত্রাগুলির পরিপ্রেক্ষিতে জেলার নির্বাচনী ফলাফলগুলিকে চিহ্নিত করার চেষ্টা করা হয়েছে।

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HUNGER AS A METAPHOR OF EMASCULATION IN BHABANI BHATTACHARYA'S *HE WHO RIDES A TIGER*

Sawata Kusari*

In a typically heteropatriarchal society, man's position in the society is almost always dictated by his ability (or inability) to be a breadwinner. In Manliness and Its Discontents, Martin Summers argues the same. It is with this desire to have a 'manly' aura, Kalo, the protagonist of Bhabani Bhattacharya's He Who Rides the Tiger, decides to escape the village and his poverty and goes to the big city in expectation of financial escalation. However, after repeated failures to do so, Kalo, realizing more that he would fail as a man without being economically potent, decides to ride the tiger—a symbol for wealth and power and also of manliness. This paper, using the theoretical framework of Masculinity studies, especially that of R.W. Connell, would seek to explore how various shades of masculinities are very often inexorably linked with various economic conditions.

Key Words: *Poverty, Hunger, Masculinity, Hegemony, Caste*

One of the most devastating effects of colonialism in India was perceived in 1943 when Bengal suffered its worst famine. However, historians

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and critics have shown that this famine was not a natural calamity; rather it has been deemed as a man-made disaster. Rakhi Chakrabarty points the role of Winston Churchill behind this catastrophic event. She writes:

> Winston Churchill, the hallowed British War prime minister who saved Europe from a monster like Hitler was disturbingly callous about the roaring famine that was swallowing Bengal's population. He casually diverted the supplies of medical aid and food that was being dispatched to the starving victims to the already well supplied soldiers of Europe. When entreated upon, he said, "Famine or no famine, Indians will breed like rabbits." The Delhi Government sent a telegram to him painting a picture of the horrible devastation and the number of people who had died. His only response was, "Then why hasn't Gandhi died yet?" (Para 7)

The utter recklessness of Churchill is a ghastly reminder of how the white men dehumanized the natives. Many Bengali intellectuals, through various creative mediums, have showcased this catastrophic event. And Bhabani Bhattacharya is undoubtedly one of the most prominent voices to bring out the catastrophic magnitude of this man-made disaster. Bhattacharya was one of the earliest social realists of Indian literature and remained unapologetically so throughout his life. M.K Naik writes, "Bhattacharya believes that 'Art must teach, but unobstrusively, by its vivid interpretation of life. Art must preach, but only by being a vehicle of truth" (223). This paper would strive to show, using the lenses of gender studies and masculinity studies, how Bhattacharya's exploration of the issue of hunger, with special reference to his finest work, *He Who Rides a Tiger*, in many ways,

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Adsorption and anti-corrosion characteristics of vanillin Schiff bases on mild steel in 1 M HCl: experimental and theoretical study†

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Herein, two Schiff base derivatives of vanillin and divanillin with 2-picolylamine, namely, 2-methoxy-4-((pyridin-2-ylmethylimino)methyl)phenol (compound **A**) and 3,3′-dimethoxy-5,5′-bis-((pyridin-2-ylmethylimino)methyl)-[1,1′-biphenyl]-2,2′-diol (compound **B**), respectively, were synthesized. Additionally, their adsorption characteristics and corrosion inhibition behavior were compared for mild steel in 1 M HCl using electrochemical impedance spectroscopy, potentiodynamic polarization and weight loss methods. Compound **B** was found to impart a better anti-corrosive effect (around 95% inhibition efficiency at 313 K) than compound **A**. The inhibitors act as effective mixed-type inhibitors and exhibit Langmuir-type adsorption behaviour. The kinetic–thermodynamic parameters together with the data obtained from density functional theory (DFT) and molecular dynamics (MD) simulations illustrate the mechanism of corrosion and mode of adsorption of both inhibitors on the metal surface. The better corrosion mitigation propensity of the dimeric form of the inhibitor (compound **B**) over the monomeric form (compound **A**) was tested experimentally and explained according to the theoretical data.

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Introduction

The application of suitable corrosion inhibitors for the control of corrosion in metals and alloys is very important.[1–4] However, due to ecological concerns, the use of inorganic inhibitors is gradually being restricted. This has resulted in a surge of studies involving organic corrosion inhibitors. Organic compounds containing N, S, and O atoms generally show good inhibition efficiency for mild steel in acidic media.[5–12] In addition to various heterocycles,[13] amines[14] and imines,[15] different other classes of organics, such as amino acids,[16,17] vitamins,[18] polysaccharides,[19] surfactants,[20] polypeptides,[21] lipids,[22] polyphenols[1] and others, have been reported to act as efficient corrosion inhibitors. Schiff bases are versatile compounds, which are synthesized *via* the condensation of primary amines and carbonyl compounds, and used widely in pharmaceuticals, agrochemicals and materials science.[23–25] In this work, we aimed to investigate the corrosion inhibition properties of two newly synthesized Schiff base derivatives of vanillin and divanillin with 2-picolylamine for mild steel in 1 M HCl.

Vanillin, a biomass-derived phenolic aldehyde, is widely used as a flavoring agent in foods, beverages and pharmaceuticals owing to its anti-microbial and anti-oxidant properties.[26] It was first extracted from vanilla beans, which are primarily obtained from the orchid *Vanilla planifolia*. The synthetic production of vanillin from the abundant lignin *via* metal-catalyzed air oxidation converts it into a potential renewable feedstock chemical.[27,28] Herein, we provide further value to vanillin and explore its potential for applications in a new arena of green corrosion inhibitors, which are essentially of bio-origin and less toxic to the environment. To date, vanillin has been tested for its anti-corrosive propensity for aluminum in acid solutions.[29] However, since vanillin itself failed in this effort for ferrous metal, it was derivatized into a Schiff base, *i.e.*, 2-methoxy-4-((pyridin-2-ylmethylimino)methyl)phenol (compound **A**). Further, we synthesized divanillin, which was subsequently converted to another Schiff base, 3,3′-dimethoxy-5,5′-bis(((pyridin-2-ylmethyl)imino)methyl)-[1,1′-biphenyl]-2,2′-diol (compound **B**). The molecular formulae of these two Schiff bases are shown in Fig. 1. Compound **B** is essentially the dimeric form of compound **A**. One of our main intentions of

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† Electronic supplementary information (ESI) available: NMR, FTIR and mass spectra of the synthesized inhibitors, potentiodynamic polarization plots and impedance spectra in the presence of the inhibitors at different temperatures, variation in the free energy of adsorption with temperature, Arrhenius plots, electronic distribution in the frontier molecular orbitals for the protonated forms of the inhibitors, closest distance between the inhibitor atoms, metal surface data and various other relevant data. See DOI: 10.1039/c9ra07982c

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Waves in generalized thermo-viscoelastic infinite continuum with cylindrical cavity due to three-phase-lag time-nonlocal heat transfer

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ABSTRACT

Generalized thermoelastic interactions due to three-phase-lag time-nonlocal heat transfer in a Kelvin-Voigt type infinitely extended visco-thermoelastic continuum with cylindrical cavity has been investigated. The two-temperature generalized thermoelasticity theory has also been taken into account. The problem has been solved in the domain of Laplace on the assumption that the surface of the cavity is free from traction and is subjected to a smooth and time-dependent-heating effect. Laplace inversion of the transformed solutions has been carried out numerically. The obtained numerical data for different considerations are plotted in graphs to study the effects of time-nonlocal parameter, two-temperature parameter and visco-thermoelastic relaxation parameter on different thermoelastic quantities of physical interest.

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Introduction

Thermoelasticity theories are divided into two sections, classical thermoelasticity theories and generalized thermoelasticity theories. Classical thermoelasticity theories are also partitioned into classical uncoupled thermoelasticity theories and classical coupled thermoelasticity theories [1]. Both classical uncoupled and coupled thermoelasticity theories suffer from the crucial imperfection that the heat conduction equation of these theories recommends an unrealistic observation of unbounded speed of thermal wave propagation [2]. To prevail over this untenable observation, generalized thermoelasticity theories were introduced surpassing the classical thermoelasticity theories. First impressive contribution to this new horizon of thermoelasticity theories was due to Lord and Shulman [3]. Later on Green and Lindsay [4], Green and Naghdi [5–7], Tzou [8], S. K. Roy Choudhuri [9] and several other researchers developed different generalized thermoelasticity theories. The works of Ignaczak and Ostoja-Starzewski [10] and Chandrasekharaiah [11, 12] may be referred for details in this perspective. From the experimental view-points, it is evident that the theories of generalized thermoelasticity are more suitable than the classical theories of thermoelasticity to cope with short-lived practical problems with excessive heat fluxes which occur generally in nuclear power plant and laser beam etc.

Thermoelasticity theories for elastically deformable continuum accommodate two different sorts of temperatures [13–16], represented by θ, ϕ and respectively known as the thermodynamic temperature and the conductive temperature. θ appears for thermal processes and ϕ appears for

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Threats of plastic pollution and awareness among common people: A multi attribute problem

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ABSTRACT

Pollution is a global issue. It does not consider the international borders or any other human restricted conditions while spreading. Specially Plastic Pollution has been a recent topic of deep concern due to its immense capacity of causing Environmental threats. This work searches for the logical consistency between the threat and the awareness of the threat among common people. Uncertainty based logical tools have been used to determine the nature of the Multi Attribute Problem.

Key words: *Plastic pollution, Fuzzy logic, MADM, Grey sets, Fuzzy sets, TFN.*

Introduction

Fuzzy logic accommodates semantics for multivariate logic. Normally crisp sets are Cantorian collections consisting of core elements, but Fuzzy sets are like Russellian classes, based on membership grades criteria. Because Fuzzy sets are locally subjective, while assigning membership degrees, at least one membership degree has to be made subjective and also it relies on expert's choice, i.e., in broad sense it is context dependent. Fuzzy logic is a concept derived from the branch of mathematical theory of Fuzzy Sets. Unlike the basic Aristotelian theory that recognizes statements as only "true" or "false" (i.e., 1 or 0) as represented in digital computers, Fuzzy logic is capable of expressing Linguistic terms such as "may be false" or "sort of true". Fuzzy Logic allows one to emulate the human reasoning process, quantify the imprecise information, provide decision based on vague and incomplete data and arrive at a definite conclusion. The logic underlying Fuzzy set theory is multivalent. In general, a multivalent logic can be regarded as a calculus of either on the level of credibility of propositions or on the truth values of the Fuzzy predicates. In most of the multivalent logics there is no longer an excluded middle law; this environment can be rendered as either the absence of decisive belief in one of the sides of an alternative or the imbrications of contrastive Fuzzy concepts.

The threats of plastic pollution are now a global issue. Almost in every Country, regular awareness programs are being arranged and executed to resist the threat. In this work, the aim is to evaluate country wise threats of Plastic Pollution by Fuzzy Multi Attribute Decision Making. In section 2, preliminaries on Fuzzy Sets and Fuzzy Logic are discussed. Section 3 briefly describes the model of Fuzzy Multi Attribute Decision Making Problem. In Section 4, some analytical results are revealed. Section 5 concludes the findings.

Fuzzy Logic and Fuzzy Sets

A Fuzzy set is normally expressed as a collection of elements with a continuum of grades of membership. It is characterized by a membership function,

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Bis-benzothiazoles as efficient corrosion inhibitors for mild steel in aqueous HCl: Molecular structure-reactivity correlation study

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ABSTRACT

Three different bis-benzothiazole (BBT) derivatives namely 2,6-bis(2-benzothiazolyl)pyridine (BBTP), bis(2-benzothiazolylmethyl)sulphide (BBTMS), and 1,2-bis(benzothiazolyl)ethylene (BBTE) are synthesized and characterized. Corrosion mitigation performance of these bis-benzothiazole derivatives have been inspected for mild steel in aqueous 1 M HCl using electrochemical and gravimetric methods. Corrosion inhibition potentiality of these inhibitors are in the order BBTP > BBTMS > BBTE. This is further substantiated from SEM images. Mixed type corrosion inhibition for all the inhibitors is affirmed from potentiodynamic polarization study. Effect of temperature and exposure time is also evaluated employing gravimetric method. Following Langmuir adsorption isotherm, thermodynamic parameters related to adsorption process are enumerated. Adsorption data together with activation parameters are used to deduce nature of adsorption process of these inhibitors on metal surface. Density functional theory (DFT) and molecular dynamics (MD) simulation are done to explain experimentally obtained result from theoretical view point. Observed corrosion inhibition trend is found to be related to spatial orientation of inhibitor molecules in their most stable energy states in aqueous medium as well as to their intrinsic molecular parameters.

1. Introduction

Inhibition of corrosion of metals in acidic media by heterocyclic organic bases remains an active field of research for many years now. Among these, azoles find a special interest due to good corrosion inhibition power, cost effectiveness, relatively low toxicity, bio-degradability, and solubility in acidic aqueous media. Accordingly, different azoles like indole, imidazole, benzimidazole, triazole, benzotriazole, pyrazole, tetrazole, and their derivatives have been studied [1–9]. Effect of different molecular parameters on corrosion mitigation like molecular volume, unsaturation, heteroatoms, energies of frontier molecular orbitals (FMO) and other intrinsic molecular parameters have been investigated in details. Our group has reported some interesting result on the effect of spatial orientation, particularly how it affects the energies of FMOs, and the nature of interaction with the metal surface employing benzimidazole (BI) derivatives for mild steel in aqueous HCl [8,9]. Here, we intend to extend our work for benzothiazole (BT) derivatives.

BTs are very important aromatic heterocyclic compounds having a 5-membered 1,3-thiazole ring fused to a benzene ring and its heterocyclic moiety is mostly substituted at the unique methyne center of the thiazole ring. Its applications comprise diversified fields; from medicinal chemistry to material science [10,11]. In addition, BTs are known for imparting good corrosion protection to different metals under varied conditions [12–17]. Still, corrosion mitigation study involving bis-benzothiazole (BBT) derivatives is scarce. Also, structure-reactivity correlation involving a series of structurally comparable BT derivatives requires further elaboration. From this aspect, in the present work we have used three different BBT derivatives, where each BT group is separated from each other by a pyridine (in BBTP), or dimethylene sulphide (in BBTMS), or ethylene (in BBTE) groups (*vide* Table 1). Effect of these spacer groups on corrosion inhibition of mild steel in 1 M HCl is investigated in details using electrochemical and weight loss methods. Thermodynamic parameters of adsorption and activation parameters of corrosion reaction are evaluated. From DFT study, we obtain intrinsic molecular parameters. Effect of spatial molecular configuration in the most stable energy state and evaluated intrinsic molecular parameters are examined to decide on their effect on the extent and mode of adsorption of these BBT derivatives on mild steel surface in acidic medium. Among the mineral acids, HCl is used profoundly in many industrial processes, such as steel pickling, electroplating, cleansing algae and zebra mussels accumulated on any underwater structure, activating oil wells, for maintaining acidity in

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৫৪ বর্ষ তৃতীয়-চতুর্থ সংখ্যা

অনুষ্টুপ

গ্রীষ্ম-বর্ষা ও প্রাক্-শারদীয় যুগ্মসংখ্যা ২০২০

বিপ্লবে বারুদের গন্ধ নেই
সুভাষ মুখোপাধ্যায়ের সমকালিনতা ও বিশ্বজনীনতা

অভিজিৎ সাহা

প্রগতিশীল রাজনীতি হল তাই, যা ঐতিহাসিক হাল-হকিকত এবং কোনো আচরণ বা অভ্যাসের সুনির্দিষ্ট বিধিবিধান সনাক্ত করে থাকে; অপরদিকে অন্য রাজনীতি শুধুমাত্র আদর্শিক প্রয়োজন, একস্বরিক সংকল্প এবং ব্যক্তিগত উদ্যোগের অবাধ প্রসারকে মেনে নেয়।

মিশেল ফুকো, *History, discourse and discontinuity*

আলোচ্য প্রবন্ধটিতে সুভাষ মুখোপাধ্যায়ের সাহিত্যকীর্তির নানানদিক উপলব্ধি করার চেষ্টা করা হয়েছে। এক্ষেত্রে সমগ্র প্রবন্ধটিকে কতকগুলি পর্যায়ে ভাগ করে আলোচনা করা হয়েছে। প্রথম ভাগে সুভাষ মুখোপাধ্যায়ের লেখার প্রেক্ষিত, দ্বিতীয় পর্যায়ে কবির কাব্যভাবনা, তৃতীয় পর্যায়ে তাঁর গদ্যভাবনা, চতুর্থ আর শেষ পর্যায়ে আজকের দিনে সুভাষপাঠের পদ্ধতি ও প্রাসঙ্গিকতাকে তুলে ধরার চেষ্টা করা হয়েছে। আর এই সবেরই মূল লক্ষ্য হল সুভাষপাঠের এক ক্ষুদ্র প্রচেষ্টা।

১
সুভাষ মুখোপাধ্যায় ও তৎকালীন পরিস্থিতি

প্রথম বিশ্বযুদ্ধের (১৯১৪-১৯১৮) অব্যবহিত পরেই সুভাষ মুখোপাধ্যায়ের (১৯১৯-২০০৩) জন্ম। প্রথম বিশ্বযুদ্ধ নানান রকম শর্ত, চুক্তি/সন্ধির মাধ্যমে শেষ হলেও এর মধ্যেই ভবিষ্যতের অনেক সংকট নিহিত ছিল, এমনকি আরও একটি বিশ্বযুদ্ধের ইঙ্গিত। প্রথম বিশ্বযুদ্ধের পরবর্তী সময়ে প্রায় এক দশক পরেই প্রথম অর্থনৈতিক মন্দা (১৯২৯-১৯৩৯) দেখা দেয়। এই আর্থিক মন্দার প্রভাব কবির পরিবারের ওপর পড়েছিল। যার উল্লেখ কবি তাঁর আত্মজীবনীমূলক উপাখ্যানে ব্যক্ত করেছেন।[১] বিশ্বজুড়ে চলা আর্থিক মন্দা রাজনৈতিক ক্ষেত্রে সমগ্র ইউরোপ জুড়ে এক

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Influence of position of hydroxyl group of flavonoids on their binding with single stranded polyriboadenylic acid: A spectroscopic evaluation

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ABSTRACT

Single stranded polyriboadenylic acid [poly (rA)] has been accepted widely as a suitable drug target owing to its vital role in the development of cancer since it controls gene expression during cell growth and differentiation. The biological properties of poly (rA) depend on its structural morphology. Pharmacologically active flavonoids can act as suitable binders to poly (rA) and significantly change its biophysical properties. Different factors favour flavonoid-poly (rA) binding. In our present work we have explored the role played by the position of hydroxyl groups in the flavonoids namely 3, 5, 6 and 7 hydroxyflavones in their course of interaction with poly (rA). A range of spectroscopic experiments reveal that 3HF binds best to poly (rA) among the four chosen flavonoids. This is probably due to the presence of a hydroxyl group in '3' position that enables it to exhibit ESIPT phenomenon which is missing for the other used flavonoids.

1. Introduction

The discovery of nucleic acid structures has revolutionized drug designing [1,2]. Their study has helped scientists to understand the basis of most of the diseases and how to treat them. In most organisms DNA is the carrier of hereditary unit [3] and hence most researches involve in the studies of structural and functional aspects of drug-DNA interactions. However during the last two decades there has been an inclination towards drug-RNA interaction [4]. This came as a consequence of the role played by RNA in most virus related deadly diseases namely HIV-AIDS, hepatitis, etc. [5,6]. But the exact mechanism of drug-RNA interaction has not been explicitly illustrated so far.

RNA exists in different polymorphic forms in nature depending upon sequence and environmental conditions and single helical structure is the most abundant one. Among these, polyriboadenylic acid, hereafter, poly (rA) has been observed to have numerous biological functions [7,8]. Poly (rA) shows a pH dependent conformational change [9–11]. It exists as a double helical structure at acidic pH but at neutral pH the single stranded structure is predominant [12,13]. This is confirmed from X-ray diffraction and circular dichroism. The gene expression during cell growth and differentiation is determined by polyadenylate [14]. Most eukaryotic mRNAs have a lengthy polyadenylate tail which serves a significant role in its maturity, stabilization and also in the translation process [15]. The polyadenylate tail prevents the enzymatic degradation of mRNAs in the cytoplasm [16]. Prokaryotes on the other hand do not have polyadenylate sequences. Thus, the longevity of eukaryotic mRNA over prokaryotic mRNA can be attributed to the presence of polyadenylate tails [17]. Poly (rA) has been found to be associated with a number of diseases. According to the reports of Green and Cartas, the genome of RNA tumour viruses contains polyadenylate sequences [18]. The polyadenylation of mRNA is catalysed by the enzyme poly A polymerase (PAP). In a recent study it was found that Neo-PAP, a human origin PAP, is dramatically expressed in cancer cells [19]. Thus, study of small molecules that can bind to poly (rA) in mRNA tail and may possibly interfere with its maturation and delay or rupture the encoded protein synthesis can open a new genre of therapeutic agents. This apart, polyadenylic acid has potential to develop G-Quadruplex structures [20] which play a significant role in immunoglobulin heavy chain switching [21].

Flavonoids are a multifunctional group of plant secondary metabolites that not only benefits the floral kingdom but has also contributed a lot towards modern day drug designing [22,23]. Their small size and planar structure make their binding to nucleic acids highly compatible. They have found a place as a part of dietary substituent since a long time. But it was their biological attributes that brought them into limelight. They have a wide range of biological activities ranging from antioxidising [24], anti-bacterial [25], anti-viral [26], anti-tumour [27], anti-inflammatory properties etc. [28]. They are well-known free radical scavengers responsible for DNA damage and tumours [29,30]. Studies show that their anti-oxidant property may be attributed to their extent and position of hydroxylation [31]. Flavonoids like quercetin and naringin are known to inhibit CYP3A4 which is the most abundant P450 enzyme in liver responsible for metabolism of carcinogens and medicines. This property has made them quite sought after as anti-

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Federalism at the Crossroads: Crisis of the Linguistic Minorities in India

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Abstract
Polyglot federations face a challenge in reconciling between the national identities and regional identities. Demand for a second States Reorganisation Commission (SRC) in India in 2015 by some groups bears testimony to this fact. On the question of political remapping in post-independence period, the constitutional ancestors sought to save India from another religious bigotry and the menace of casteism. The emergence of language as a viable alternative gained momentum in Nagpur session (1920) of the Indian National Congress (INC). But subsequent years encountered with a difficulty in adopting territorial solution for accommodating India's multilingual identities. Pre-constitutional, extra-constitutional and constitutional arrangements have faced the challenge of linguistic accommodation. Dar Commission warned the risk of federal remapping with existing linguistic pocket corridors in the states. Inter-state migration has proliferated the problem over the years. Even the SRC could not provide adequate safeguards for large number of linguistic minorities living in all states (Kerala becomes exception with 97.03% linguistic majorities). There new minority emerged and accommodated but with limits. Census report of 2011 shows India having 19,569 languages which stood 1369 after linguistic scrutiny. Territorial machinations appear inadequate to satisfy all linguistic groups but only to incur huge expenditure. Indian federalism seems deficient in non-territorial power sharing which has succeeded in countries like Belgium in the form of Consociational representation. With its promise of inclusivity by means of a possible alternative it demands the attention of the policy makers as well as the academia.

Keywords: Polyglot federations, political remapping, States Reorganisation Commission, linguistic minorities, Consociational Representation

Introduction

India with her vast multi-ethnic diversities has been commendably successful in maintaining a federation, as compared to the developed federal systems of the first world. Somewhat surprisingly, federal paradigm has been reduced to a half-cultivated discipline among the pupils of constitutional and political studies in India where federalism is meant to be a politico-administrative mechanism in a large region. Administrative decentralization may be possible without having a federated system, but remains hostile where demography of the region is enriched with vibrant diversity. This diversity lies with one's identity ranging from caste, religion, region, culture to language. India like any other multi-ethnic and polyglot federation seeks to accommodate her diverse identities with her national identity. After the fatal consequences of religion and caste, language appeared to be an obvious choice in the process of such accommodation which remains to be a challenge for any federal governance.

Biological Chemistry & Chemical Biology

A Spectroscopic Approach towards the Comparative Binding Studies of the Antioxidizing Flavonol Myricetin with Various Single-Stranded RNA

Susmita Chowdhury, Sutanwi Bhuiya, Lucy Haque, and Suman Das*[a]

RNA based drugs have come to limelight owing to the major role played by RNA in the development of many viral diseases. Molecules which can effectively bind with RNA can induce morphological changes in RNA which further modifies its biological properties. Flavonoids are phytochemicals having a wide range of pharmacological properties and are known to interact with DNA. We have used RNA instead of DNA and aimed at establishing a comparison of binding of three single stranded forms of RNA homopolymers namely polyriboadenylic acid [poly(rA)], polyuridylic acid [poly(rU)] and polycytidylic acid [poly(rC)] with the flavonol myricetin (herein after MTN), our probe of interest. A series of spectroscopic experiments like spectrophotometry, spectrofluorimetry and circular dichroism studies indicate a stronger binding of myricetin with poly(rA) followed by poly(rU) and finally poly(rC). This was confirmed from the construction of Scatchard plot using the Mc-Ghee von Hippel equation for cooperative binding. The magnitude of the order of binding was 10^3 M^{-1} at 25 °C in all the cases. It is to be noted that most eukaryotic mRNAs have a poly adenylate tail. Binding of MTN to poly(rA) in virulent cells could effectively alter the encoded protein synthesis and reduce chances of occurrence of the disease.

1. Introduction

Flavonoids are Nature's doctor with the exemption of fees. They are phytohormones, more specifically; secondary metabolites belonging to the polyphenolic class and are abundant in citrus fruits, apple, olive oil, tea, red wine, berries and soy.[1] They act as potent anti-proliferators and free radical scavengers - properties that have long mesmerized the scientists and encouraged them to indulge in flavonoid dependent drug designing.[2] Myricetin, (hereafter, MTN) [IUPAC{3, 5, 7-Trihydroxy-2-(3, 4, 5-trihydroxyphenyl)-4-chromenone}], is a widespread flavonol. Its structure is analogous to fisetin and kaempferol only differing in the number of hydroxyl groups [Figure 1]. It has diverse pharmacological functions including antioxidizing as well as pro-oxidizing properties, anti-viral, anti-carcinogenic, mutagenic, anti-atherosclerotic[3–5] anti-inflammatory, anti-diabetic and neuroprotective activities.[6–8] It is also reputed to aid prevention of platelet aggregation.[9,10] Its antioxidizing properties are attributed to the hydrogen donating ability resulting from the multiple hydroxyl groups attached to the aromatic rings.[11] Research says that bivalent cations such as Fe^{2+}, Zn^{2+} and Ni^{2+} increase chances of lipid oxidation in cooked fish which degrades its nutritional value; this oxidation process is arrested in presence of MTN.[11] Studies in mice have revealed that MTN increases muscle strength and tolerance to reduced temperatures.[12] MTN is useful in inducing apoptosis in carcinogenic liver cells and can benefit the cancer treatment sector.[13] It has an important role in the inhibition of DNA/RNA replication and repair.[14]

Recent advances have revealed the indispensable role of RNA in vital cellular processes *viz.* transcription, translation and a trail of processes leading to protein formation.[15] The role played by RNA in the progression of critical diseases like HIV AIDS, Hepatitis C and cancer earned it an overwhelming importance.[16] RNAs undergo allosteric conformational changes carving out suitable pockets for specific drug recognition.[17] Biological relevance of single-stranded RNA (hereafter ss-RNA) having different sequences namely polyadenylic acid [poly(rA)], polyuridylic acid [poly(rU)], polycytidylic acid [poly(rC)] *etc.* have been documented in the literature. Poly(rA) is present in the mRNA (messenger RNA) tail. When this tail is bound to a drug, the encoded protein synthesis gets altered.[18,19] Marshall Nirenberg discovered that poly(rU) encodes the homopolypeptide phenylalanine which has significant effects on depression, pain and skin disorders.[20] Adenylate and uridylate also play an imperative role in supervising gene expression during cell growth and differentiation and in immune response.[21,22]

A lot of research has been carried out on flavonoid-DNA interaction owing to easy availability of DNA in nature and much is known about its structure.[23–26] Flavonoids like quercetin and kaempferol show high binding affinity towards DNA and RNA duplexes.[27] Another flavonoid luteolin has been found to stabilize the Hoogsteen paired strand in triple helical RNA.[28] Compared to DNA, knowledge on structure and

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Amino acid and cinnamaldehyde conjugated Schiff bases as proficient corrosion inhibitors for mild steel in 1 M HCl at higher temperature and prolonged exposure: Detailed electrochemical, adsorption and theoretical study

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ABSTRACT

Three Schiff bases composing of cinnamaldehyde and three different amino acids, namely glycine (CGSB), histidine (CHSB) and tryptophan (CTSB) have been synthesized and investigated for their anti-corrosion propensity on mild steel in 1 M HCl. Both gravimetric and electrochemical experimentation establish the CTSB as superior inhibitor, while the CGSB as the least effective among the three. Effectiveness of the Schiff bases is tested upto 60 °C for an exposure of 6 h in HCl. Effect of various exposure times, maximum being 96 h, is also investigated at a fixed temperature of 30 °C. All the three inhibitors impart appreciable extent of corrosion inhibition efficiency under these extreme conditions. Thermodynamic adsorption and kinetic parameters ascertain chemisorption of these mixed-type corrosion inhibitors on mild steel. Mode and extent of interaction between Schiff bases and mild steel are evaluated from quantum mechanical calculation and molecular dynamics simulation.

1. Introduction

Evaluating structure-reactivity correlation remains an important aspect towards devising new and efficient organic corrosion inhibitors for potential industrial application [1–7]. Organic inhibitors available from bio-resources, including essential oils, have gained special attention for their sustainable availability, relative low cost and, most importantly environmental benign characteristics; and are termed as so-called green corrosion inhibitors [8–17]. Cinnamaldehyde, a major constituent of cinnamon oil, is an aromatic compound with a benzene ring and an aldehyde group attached to an unsaturated C = C bond at both ends. This unique combination has bestowed cinnamaldehyde some special properties conducive for its application in medicine [18], as well as in material science as corrosion inhibitor in high acid concentration and at elevated temperature [19–21]. To enhance solubility of cinnamaldehyde in aqueous medium and also to improve its other biological activities, cinnamaldehyde is derivatized in many ways, including formation of Schiff bases [22]. Some of these Schiff bases have been tested for anti-corrosion effectiveness [23–25]. But, no report on the corrosion mitigation by cinnamaldehyde and an amino acid conjugated Schiff base is available till now. As a matter of fact, such study involving an amino acid Schiff base is very limited. Whatever literature suggests includes benzaldehyde and vanillin as the corresponding aldehyde precursor [26,27]. Amino acids, in general provide relatively lower degree of protection from corrosion for mild steel in aqueous HCl [28]. A Schiff base derived from an amino acid and cinnamaldehyde is expected to yield significant corrosion protection, as it will possess high electron density due to the aromatic moieties and heteroatoms like nitrogen, in addition to C = C and the imine (C = N) bonds. This should facilitate bonding with the metal through transfer a part of excess charge. To accomplish this, we have selected three different amino acids, namely glycine, histidine and tryptophan, which represents gradual enhancement of structural complexity. Corresponding Schiff bases are shown in Table 1 along with their IUPAC nomenclature.

The main objectives of this work are to elucidate the influence of structural factor, spatial orientation, and intrinsic molecular properties of these synthesized Schiff bases towards their adsorption characteristics on mild steel in aqueous HCl (1 M) and the extent of corrosion protection of the metal. In addition, how the conjugation of two naturally available products influence the corrosion inhibitory effect for prolonged time and at higher temperature will be interesting to investigate.

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Probing blood plasma samples for the detection of diabetes using SERS aided by PCA and LDA multivariate data analyses†

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The present paper reports the fabrication of an effective and reproducible SERS-active substrate for detecting individuals with "normal", "moderately high" and "very high" diabetic conditions from the enhanced vibrational signatures of their respective label-free blood plasma samples. The SERS-active substrate has been fabricated by entrapping gold nanoparticles in the Langmuir-Reverse Schaefer film matrix of 5-CB liquid crystal molecules. The chemical composition of the as-fabricated substrate has been unveiled from the XPS spectrum, while the morphological features of the substrate are explored using FESEM and AFM images. The SERS efficacy of the substrate is primarily tested with 4-mercaptopyridine molecules. The experimental observations are supported by multivariate data analyses. The as-fabricated substrate is proved to have the unique efficacy to detect the SERS spectra of many types of molecules present in blood plasma samples, whose upregulation in diabetic patients is correlated with their glucose levels. We believe that the as-prepared SERS-active substrate can be used as a suitable alternative not only for detecting glucose levels indirectly from blood plasma samples but also in other real-world diagnostic applications.

1. Introduction

Diabetes of both type-I and type-II is a fatal disease and is increasingly affecting not only aged individuals but is also reported to be significantly prevalent in children and in young adults these days. Uncontrolled diabetes is considered to be a "silent killer" and is known to promote serious complications in vital organs like the heart and kidneys. Moreover it can lead to blindness, tissue damage, brain strokes and lower limb dysfunctions.[1,2] According to the recent report of the World Health Organization (WHO), about 422 million people are living with diabetes worldwide accounting for around 1.6 million mortalities each year.[3] There are several methods such as electrochemical,[4,5] hexokinase,[6] colorimetric conductimetry,[7] laserpolarimetry[8] and flurosence[9,10] techniques that have been developed so far in monitoring glucose levels in blood.

Home monitoring and diagnostic laboratories commonly use enzymatic and hexokinase (HK) methods to detect glucose levels in blood. Enzymatic methods are the underlying techniques that are being applied in self-monitoring blood glucose (SMBG) and continuous-glucose-monitoring (CGM) devices to detect glucose levels directly from blood samples collected by pricking the fingers. The enzymatic and HK techniques are indirect methods of detecting glucose, relying on electrical signals and optical density (OD) measurements, respectively. Both techniques have their respective merits and demerits and are extensively discussed in various literature.[4–6,11,12] However, neither of these techniques involve direct detection of glucose nor provide information about the vibrational signatures of detected glucose molecules, which are considered to be scientifically more precise and at times deterministic towards successful detection of blood glucose levels.[13–18]

In this regard, surface enhanced Raman scattering (SERS) spectroscopy has emerged as a wonderful analytical tool and has the power to detect vibrational signatures of molecules at trace concentrations down to the single molecule detection limit.[19–23] It involves large enhancements of Raman signals from molecules when they are adsorbed in the proximity of the plasmonic nanoparticles. The enhancement occurs due to the generation of gap plasmons on the SERS-active substrates, which in turn results from the excitation of surface like surface

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One-pot facile synthesis and electrochemical evaluation of selenium enriched cobalt selenide nanotube for supercapacitor application

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ABSTRACT

The present study emulates a one-pot facile synthesis of selenium-enriched CoSe nanotube using a chemical bath deposition (CBD) procedure. Schematic incorporation of 3D Ni foam current collectors as substrates for the growth of CoSe–Se nanotubes helped us achieve a binder-less thin film coating. The controlled synthesis of CoSe–Se nanotube was carried out by optimizing the temperature and time of the deposition. CoSe–Se nanotubes were grown on a porous Ni foam substrate using lithium chloride as a shape directing agent. The study found that the one dimensional structure of the nanotubes with porous nature results in an uninterrupted network of electroactive sites. Due to the superior conductivity, the as-fabricated material exhibited excellent rate capability and a higher degree of electrolyte ion diffusion across the CoSe–Se crystal structure. The CoSe–Se@Ni foam electrodes exhibited a specific capacitance of 1750.81 F g^{-1} at 1 A g^{-1}. The electrode exhibited excellent cycling stability and showed a capacitance retention of 95% after 4000 charge-discharge cycles. Finally, an asymmetric supercapacitor (ASC) device was fabricated with the as-synthesized CoSe–Se@Ni foam electrode as the cathode, activated carbon@Ni foam electrode as the anode, and a thin filter paper separator soaked in 1 M aqueous KOH electrolyte solution. The ASC device showed a specific capacitance value of 106.73 F g^{-1} at 0.5 A g^{-1}, and achieved an energy density of 37.94 Wh kg^{-1} at a power density of 475.30 W kg^{-1}. The ASC device was utilized in an extended potential window of 1.6 V. The fabricated device displayed exceptional cycling stability with a capacitance retention of 93% after 5000 charge-discharge cycles.

1. Introduction

Excessive exploitation of fossil fuels for energy requirements of human civilization has resulted in ecological imbalance and pollution-related detrimental effects. To overcome the problems extensive studies are underway for sustainable and alternate energy sources [1–3]. Also, due to numerous ecological factors, renewable sources of energy suffer from discontinues energy supply. Hence to utilize the non-conventional sources of energy continuously the energy-storing devices play a key role. Batteries and supercapacitors have established themselves as efficient energy storage devices. Supercapacitors in contrast to batteries exhibit properties like better operational life, excellent rate of charge-discharge cycles, safe operation, and exceptionally high power density values [4]. Further, they are not only economical but also easy to fabricate. Lately, supercapacitor electrodes made up of porous carbon, metal oxides, metal sulfides, and conductive polymer-based materials have been widely reported [5,6]. But the reported materials have their inherent associated shortcomings. Supercapacitor electrodes made up of carbon evince moderate specific capacitance value. In case of conducting polymer and metal oxide-based

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তরুএকলব্য

বিশেষ সংখ্যা

লোকসংস্কৃতি ও লোকসাহিত্য

UGC Approved Peer-Reviewed Research Journal on Arts and Humanities

সম্পাদনায়
দীপঙ্কর মল্লিক • দেবারতি মল্লিক

দি গৌরী কালচারাল অ্যান্ড এডুকেশনাল অ্যাসোসিয়েশন

৪১

TABU EKOLABYA
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তবু একলব্য

কলা ও মানববিদ্যা বিষয়ক গবেষণা পত্রিকা
২৬ বর্ষ • ৪১ সংখ্যা • ২০২১

TABU EKALABYA

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সমাজ-সংস্কৃতি-সাহিত্য গবেষণাকেন্দ্র

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মূল্য : ৪০০ টাকা

লোকসংস্কৃতি ও লোকসাহিত্য

ক্ষেত্রসমীক্ষার আলোকে লোকঔষধ ও চিকিৎসা

নীতীশ ঘোষ

ওঝা, গুণিন, দাইমা প্রভৃতি সম্প্রদায় লোকচিকিৎসক নামে পরিচিত। এই সম্প্রদায়ের মানুষজন যে ধরণের ঔষধ ব্যবহারে অভ্যস্ত, তাই হল লোকঔষধ। স্মরণাতীত কাল থেকে মানুষ আপদে-বিপদে, বিভিন্ন প্রকারের রোগ যন্ত্রণার হাত থেকে রেহাই পেতে এই লোকচিকিৎসকদের শরণাপন্ন হয়েছে। ভুলের পর ভুল শোধন এবং গোষ্ঠীগত ব্যবহারে সাফল্যপ্রাপ্তি লোকঔষধ প্রচলনের অন্যতম মানদণ্ড। পরে ধীরে ধীরে জন্ম হয়েছে লোকজ চিকিৎসার পরিশীলিতরূপ। বর্তমান সময়ে এই লোকঔষধ ও লোকচিকিৎসার স্বরূপ ও অবস্থানটি কেমন, মুর্শিদাবাদ জেলার খরগ্রাম থানার নির্দিষ্ট কতগুলি গ্রামঞ্চলের উপর ভিত্তি করে ক্ষেত্রসমীক্ষার আলোকে উক্ত বিষয়গুলির অনুসন্ধান এই গবেষণাপত্রটির মূল ভরকেন্দ্র। কতগুলি জিজ্ঞাসাকে সামনে রেখে ক্ষেত্রসমীক্ষা করা হয়েছে। যেমন—

১. লোকচিকিৎসা প্রণালীর সাথে যুক্ত হওয়ার কারণ কী
২. কতদিন ধরে এই পেশার সঙ্গে যুক্ত আনুমানিক কতজনের চিকিৎসা করেছেন সাফল্যের হার কেমন
৩. তার আয়ের উৎস কী চিকিৎসক হিসেবে কী ধরনের পারিশ্রমিক নেওয়া হয় বা পারিশ্রমিকের পরিমাণ
৪. লোকচিকিৎসকের কী কী গুণ থাকা আবশ্যক
৫. কোন্ কোন্ রোগের চিকিৎসা করে থাকেন
৬. কী ধরনের ঔষধ ও চিকিৎসা প্রণালী ব্যবহার করা হয়ে থাকে
৭. তাঁদের মতে এই চিকিৎসার বর্তমান অবস্থান ও ভবিষ্যৎ
৮. মানুষের সার্বিকরূপে ভালো থাকার ক্ষেত্রে তাদের মতামত গ্রহণ

এই মূল কতগুলি জিজ্ঞাসাকে সামনে রাখতে গিয়ে উঠে এসেছে গুণিনদের আর্থ-সামাজিক প্রেক্ষাপট। যা আমাদের আলোচনাকে অন্য মাত্রা দিতে সক্ষম। লোকচিকিৎসকগণের সঙ্গে সাক্ষাৎকার পরবর্তী আলোচনায় তুলে ধরা হয়েছে। তার উপর ভিত্তি করে সাম্প্রতিক সময়ের নিরিখে লোকঔষধ ও লোকচিকিৎসাকেন্দ্রিক একটি সিদ্ধান্তে আসার চেষ্টা করা হয়েছে। সাক্ষাৎগ্রহণকালীন যে যে রোগ, লোকঔষধ ও লোকচিকিৎসাপদ্ধতি জানা গেছে, সেগুলি হলো—

➲ **দুফুর্যা জ্বর** : এই ধরনের জ্বরে আক্রান্ত রোগীরা সাধারণত সকালের দিকে ভালো

MECHANICS BASED DESIGN OF STRUCTURES AND MACHINES
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Variational principle, uniqueness and reciprocity theorems for higher order time-fractional four-phase-lag generalized thermoelastic diffusion model

Md Abul Kashim Molla and Sadek Hossain Mallik

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ABSTRACT

In the present paper, a variational principle is derived for the recently introduced higher order time-fractional four-phase-lag generalized thermoelastic diffusion model for a linear, isotropic and homogeneous thermoelastic diffusive continuum. Then uniqueness of the solution for the governing field equations of the considered model is proved under suitable conditions. Finally a reciprocity theorem is obtained for the said model.

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Four-phase-lag generalized thermoelastic diffusion; higher order time-fractional Caputo derivative; reciprocity theorem; uniqueness theorem; variational principle

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1. Introduction

Generalized thermoelasticity, a new mile-stone in the theories of thermoelasticity, prevails over the vital imperfections of classical theories of thermoelasticity. Lord and Shulman (1967) are the two pioneers who contributed first heavily to the coupled thermoelasticity by introducing generalized theory of thermoelasticity through alteration of the parabolic nature of the heat conduction equation to hyperbolic nature. They did this revolutionary change in the nature of the heat conduction equation by incorporating a relaxation time parameter in the Fourier's law of heat conduction and in doing so, the unrealistic phenomenon of infinite speed of thermal wave propagation was replaced by practical observation of finite speed of propagation of thermal waves. Later on a bunch of generalized thermoelastic theories viz., Green-Lindsay theory (Green and Lindsay 1972), Green-Naghdi theories (Green and Naghdi 1991, 1992, 1993), dual-phase-lag theory (Tzou 1995) and three-phase-lag theory (Choudhuri 2007) were introduced. Several works related to these theories are available in the articles (Abbas, Abd-Alla, and Othman 2011; Abbas, 2014; Abbas and Abo-Dahab 2014; Abbas and Zenkour 2014; Hobiny and Abbas 2017, 2018; Othman and Eraki 2017; Biswas 2019; El-Attar, Hendy, and Ezzat 2019; Kalkal, Gunghas, and Deswal 2020; Mondal and Kanoria 2020; Saeed, Abbas, and Marin 2020). It is to mention that generalized thermoelastic theories are more acceptable in compare to the classical thermoelastic

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Nitrogen vacancy and hydrogen substitution mediated tunable optoelectronic properties of g-C_3N_4 2D layered structures: Applications towards blue LED to broad-band photodetection

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ABSTRACT

Graphitic carbon nitride (g-C_3N_4), a 2D-organic semiconductor, has rapidly emerged as a potential alternative to the 2D-inorganic semiconductors in photocatalysis, but rare studies have been made hitherto about its applicability in optoelectronic devices. Considering the specific requirements of light-emitting diodes with efficient recombination of injected-carriers and photodetector devices with better charge separation, this work deals with synthesizing two variants of g-C_3N_4 samples with exclusively modified optical/electronic properties while keeping its basic structural framework. One sample is two-coordinated nitrogen deficient g-C_3N_4 (Nd-gCN) having very high photoluminescence (PL) and the other is hydrogen substituted g-C_3N_4 (H-gCN) exhibiting vanishingly low PL and ≈0.66 eV smaller bandgap than Nd-gCN. Role of nitrogen-vacancy and hydrogen substitution towards modulating optical/electronic properties of g-C_3N_4 are studied by combining experiments and density functional theory. Following strong luminescence, Nd-gCN sample manifests visibly blue emission in light-emitting devices; contrarily H-gCN sample shows potential in demonstrating efficient broadband photodetection. Besides moderate self-powered feature, photodetectors perform best at –5.0 V, corresponding to the highest responsivity R_λ = 0.34 A/W, EQE_λ = 59 % and response time (0.18/0.29 sec). Efficient broadband photodetection performance of the heterojunction-devices is ascribed to the conjunct effects of drastic reduction in photogenerated carrier recombinations (PL quenching) and broadening of absorption regime facilitated by reduced bandgap and Si self-absorption.

1. Introduction

In the field of optoelectronics, considering major three classes of devices, such as photodetectors, light-emitting diodes (LEDs) and photovoltaics, two-dimensional (2D) layered materials have gathered comprehensive interest as a key element for next-generation devices owing to their unique properties emerging from atomic-level thickness, smaller than the mean free path that allows ballistic transportation of the carriers including electrons, holes, excitons, and phonons [1–4]. In the last few decades' extensive research on 2D prototype optoelectronic devices [5–13] has been carried out with graphene and beyond, particularly 2D transition metal dichalcogenides (TMDs), hexagonal boron nitride (h-BN) [5], and black phosphorus [6]. Despite the considerable success that has already been witnessed in series of inorganic 2D layered materials, there are few challenges and drawbacks, such as, lack of cost-effective large-scale production, printable and

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Interface engineering of moisture-induced ionic albumen dielectric layers through self-crosslinking of cysteine amino acids for low voltage, high-performance organic field-effect transistors†

Suman Mandal,[a] Ajoy Mandal,[a] Shiv Prakash Verma[b] and Dipak K. Goswami *[a,b]

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The interface roughness between the semiconducting and dielectric layers of organic field-effect transistors (OFETs) plays a crucial role in the charge transport mechanism through the device. Here we report the interface engineering of a moisture induced ionic albumen material through systematic control of the temperature-dependent self-crosslinking of cysteine amino acids in the dielectric layer. The evolution of the surface morphologies of albumen and pentacene semiconducting films has been studied to achieve a smooth interface for enhanced charge transport. A structural transition of pentacene films from crystalline dendrite to amorphous was induced by the higher surface roughness of the albumen film. The devices showed a high transconductance of 11.68 μS at a lower threshold voltage of −0.9 V.

Introduction

During the last few decades, organic electronics have taken a paradigm shift due to the significant improvements achieved in the performance of organic field-effect transistors (OFETs). The low-power consumption, cost-effective, lightweight and easily processable natures of OFETs have received tremendous attention due to their suitability in diverse fields of applications, such as radio-frequency identification tags (RFID),[1,2] display technology,[3–5] integrated circuits,[6,7] electronic skins,[8,9] memory devices,[10–12] and various sensors and detectors.[13–17] In general, charge transport through organic semiconducting films is poor due to the weak interaction between the molecules. However, the charge transport through OFETs takes place through charge accumulation at the interface between the semiconductor and dielectric layer. Therefore, the formation of a well-defined interface is crucial for the fabrication of high-performance OFETs. The rough interfaces of the semiconductor/dielectric layers may introduce excess trap densities that can significantly reduce the device's carrier mobility.[18,19] Therefore, systematic engineering of this interface is essential for the fabrication of high-performance OFETs. The higher capacitance of the gate dielectric layer is also necessary to reduce the operating voltage. Besides, the thickness of the gate dielectric layer defines the capacitance that controls the charge accumulation at the semiconducting/dielectric interface. Therefore, this interface crucially decides the transconductance (g_m), which is related to the field-effect carrier mobility of the devices. Several polymer based dielectric materials are used as dielectric layers to fabricate high performance flexible OFETs.[20–22] However, the operating voltages of many of these OFETs are relatively high (>5 V) and the devices also suffer from higher leakage currents. Therefore, crosslinking of the polymer dielectric materials using various crosslinking agents is employed to reduce the operating voltage and leakage current.[23–25]

Biodegradable materials, such as proteins, like gelatin, keratin, and silk protein, have been used as a dielectric layer to achieve low operating voltage OFETs.[26–29] Interestingly, the reported protein-based OFETs showed very high performance in terms of carrier mobility, although the transconductance of the device is relatively poor. The overestimation of carrier mobility has recently been an issue for higher carrier mobility based OFETs.[30] The calculation of carrier mobility can be affected by various parameters, like contact resistances, the frequency-dependent capacitance of the gate dielectric, and the presence of kinks or double slopes in the transfer curves.[30,31] A biopolymer-based dielectric material very often contains ions and polar groups, which induce slow polarization under the gate field. Therefore, the responses of such polar and ionic components are significantly high at a lower frequency operation.[31] So, the device mobility should be measured considering the capacitance at the low-frequency region for such types of biopolymer-based OFETs. However, it is challenging to

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Fuzzy Membership Function Evaluation by Non-Linear Regression: An Algorithmic Approach

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ABSTRACT

In most researches on fuzzy sets and its application, it is found that the consideration of membership function is predetermined and mostly linear in nature. Extraction and evaluation of non-linear fuzzy membership function that can update itself with in different paradigms is still a matter of great concern to researchers. Here, we discuss 33 different membership function evaluation methodologies published between 1971 and 2016. In a approach to solve the problem, this paper presents a novel algorithm based non-linear fuzzy membership function evaluation scheme with the help of regression analysis and algebra. Three different case studies are done to check the applicability and tractability of the method. A comparative analysis with recent literature justifies the robustness of the proposed method.

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Fuzzy sets; membership function; membership curve; non-linear regression

1. Introduction

A fuzzy set is a collection of elements with a continuum of grades of membership. It is characterized by membership function, which assigns to each object a grade of membership in the real interval *[0, 1]*. The notion of a fuzzy set provides a convenient point of departure for the construction of a conceptual framework used in ordinary sets, and, may prove to have a much wider scope of applicability, particularly in the fields of pattern classification, information processing and statistical process control.

Essentially, such a framework provides a natural way of dealing with problems in which the source of imprecision is the absence of sharply defined criteria of class membership. For most control-oriented problems, it is assumed that the membership functions are linear and usually triangular. However, for other problems, these triangular membership functions are not appropriate, as they do not represent accurately the linguistic terms, which are being modeled. Therefore, it will have to elicit directly from the expert.

The number of possible membership functions should not be arbitrary. As the number of membership functions increases, the precision of the system may increase too; but its relevance will decrease. In the limit, when the number of membership functions approaches the number of data, a fuzzy system becomes a numeric system.

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Silver Nanodot Decorated Dendritic Copper Foam As a Hydrophobic and Mechano-Chemo Bactericidal Surface

Suvani Subhadarshini, Rashika Singh, Ajoy Mandal, Satyajit Roy, Suman Mandal, Samik Mallik, Dipak K. Goswami, Amit K. Das, and Narayan C. Das*

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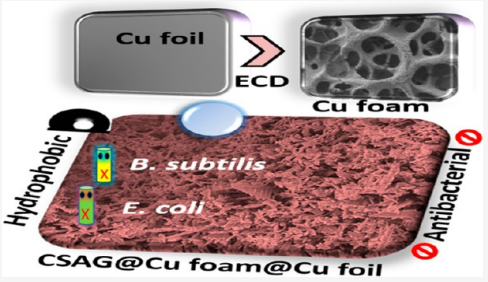
ABSTRACT: The present work investigates the time-dependent antibacterial activity of the silver nanodot decorated dendritic copper foam nanostructures against *Escherichia coli* (Gram-negative) and *Bacillus subtilis* (Gram-positive) bacteria. An advanced antibacterial and antifouling surface is fabricated utilizing the collective antibacterial properties of silver nanodots, chitosan, and dendritic copper foam nanostructures. The porous network of the Ag nanodot decorated Cu foam is made up of nanodendrites, which reduce the wettability of the surface. Hence, the surface exhibits hydrophobic nature and inhibits the growth of bacterial flora along with the elimination of dead bacterial cells. The fabricated surface exhibits a water contact angle (WCA) of 158.7 ± 0.17°. Specifically, we tested the fabricated material against both the Gram-positive and Gram-negative bacterial models. The antibacterial activity of the fabricated surface is evident from the growth inhibition percentage of bacterial strains of *Escherichia coli* (72.30 ± 0.60%) and *Bacillus subtilis* (48.30 ± 1.71%). The micrographs obtained from scanning electron microscopy (SEM), transmission electron microscopy (TEM), and atomic force microscopy (AFM) of the treated cells show the damaged cellular structures of the bacteria, which is strong evidence of successful antibacterial action. The antibacterial effect can be attributed to the synergistic mechano-chemo mode of action involving mechanical disruption of the bacterial cell wall by the nanoprotrusions present on the Cu dendrites along with the chemical interaction of the Ag nanodots with vital intracellular components.



1. INTRODUCTION

Bacterial infections have successfully rooted themselves in society and are one of the leading causes of death worldwide. To cope with the present situation, common antibacterial materials are often used frequently and excessively, resulting in further intricate outcomes like bacterial resistance against common antibacterial agents and biofouling.[1] Research and development of strategically engineered nanomaterials that offer superior inhibition and resistance to bacterial colonization have achieved great attention due to their growing demand in domestic, medical, and industry-based applications.[2,3] Silver- and copper-based nanomaterials have attracted considerable attention due to their nontoxic nature toward healthy human cells and toxic attributes toward pathogenic organisms, with the former having greater efficiency than the latter.[4−11]

Metal nanodots/nanoclusters belong to the subnanometer terrain bridging the gap between molecules and nanoparticles. Their notable physiochemical properties have fascinated many research groups to work in the field of metal nanocluster synthesis.[12] Metal nanodots are 0D nanomaterials and belong to a family of subnanometer-sized entities mostly comprising a few atoms that are also called quantum clusters.[13] Intense quantum confinement effects due to the comparable size of the nanoclusters with the Fermi wavelength of the electron is manifested in the properties such as size-dependent fluorescence, size-dependent band gap, excellent photoluminescence, discretization of the electron energy levels, nonlinear optics, etc.[14] Excellent biocompatibility, antibacterial quality, innocuous effect, and miniature size of noble metal nanodots have made them promising candidates in the field of biomedical applications.[15] The antibacterial nature of silver nanodots, which is yet another outstanding property, has not been fully scrutinized. Recently, very few reports have focused on the antibacterial property of silver nanodots, namely, silver nanodots@kevlar,[16] silver nanodots silica composite on stainless steel,[17] silver nanodots−silica bioactive glass,[18] silver nanodots incorporated silk fibers,[19] polyethylenimine@silver nanodots,[20] antibacterial 29-atom silver clusters,[21] silver nanocluster bombs,[22] silver nanodots@colistin-loaded polydopamine,[23] and silver nanodot reservoir.[24] The biggest challenge associated with Ag nanodots is their low long-term stability. Thus, nanodots have been dispersed in different matrixes like polymers or silica to improve their stability. In the

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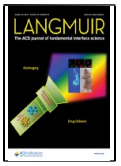

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সম্পাদক – দেবাশিস দত্ত
প্রচ্ছদ – অর্ঘ্য বন্দ্যোপাধ্যায়

প্রচ্ছদকাহিনি – আফগানিস্তান

প্রচ্ছদকাহিনি | প্রবন্ধ

আফগানিস্তানের বর্তমান পরিস্থিতি এবং সাংহাই কো-অপারেশন অর্গানাইজেশন ও তার সদস্য রাষ্ট্রের ভূমিকা – ড. বিমলেন্দু ঘোষ

আফগানে সাবধানে : বিশ্ব-রাজনীতির নতুন আঙ্গিক – ড. প্রতীপ চট্টোপাধ্যায়

আফগানিস্তান : একটি ব্যর্থ রাষ্ট্রের সমাজ-নৃতাত্ত্বিক পর্যালোচনা : সুচরিতা চট্টোপাধ্যায়

শান্তি প্রতিষ্ঠা, মানবাধিকার রক্ষা এবং আজকের আফগানিস্তান : অভিজিৎ সাহা

আফগানিস্তান ফ্যান্টাসি – সংহতির ব্যাকরণ ও নিপাতন : তাহমিদাল জামি

ঠাণ্ডা যুদ্ধ ও যুদ্ধোত্তর রাজনীতির কবলে আফগানিস্তান : ড. শঙ্কর কুমার বিশ্বাস

আফগান সমস্যা ও পরিবর্তিত বিশ্ব রাজনীতির প্রেক্ষাপটে ভারতের বৈদেশিক নীতি : শুভাশীষ চক্রবর্তী

আজকের আফগানিস্তান এবং ভারতীয় রণকৌশল : আলিউল হক

আফগানিস্তান – অতীত ও ভবিষ্যৎ : সংগ্রাম চক্রবর্তী

তালিবানবিরোধী নারী জাগরণের কোলাজ : শঙ্কর রায়

জনতার প্রতিরোধের মধ্যেই আফগানিস্তানে চলছে তালিবান জমানা : নিত্যানন্দ ঘোষ

আফগানিস্তানের শিক্ষাব্যবস্থা: আলো-আঁধারির এক ইতিহাস : ডঃ রাজীব সাহা

আফগান নারীর অধিকার : বর্তমান ও ভবিষ্যৎ – অরিত্র ঘোষ

আজকের কাবুল : অবশ্যম্ভাবীর স্বাভাবিক পরিণতি –

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সম্পাদক
ডা. মদনমোহন বেরা

কে. কে. প্রকাশন
গোলকুঁয়াচক, মেদিনীপুর, প. বঙ্গ।

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রঘুনাথ রায়

সারসংক্ষেপ:

সত্যাগ্রহ নামক দর্শনটি গান্ধীজীর সারা জীবনব্যাপী আর্দশ, মুল্যবোধ ও নৈতিকতার ওপর ভিত্তি করে দাড়িয়েছিল। এই দর্শন কিভাবে নৈতিক ও রাজনৈতিক অস্ত্র হিসাবে পরিণত করেছিল সেই বিষয়টি এই আলোচনায় উপস্থাপন করা হয়েছে। পাশাপাশি সত্যাগ্রহের অর্থ, বৈশিষ্ট্য, ধরণ, সত্যাগ্রহীর আচরণাবলী, কর্তব্য, আন্দোলন প্রভৃতি দিকগুলি তুলে ধরে হয়েছে। সামগ্রিকভাবে সত্যাগ্রহকে গান্ধীজী কিভাবে একটি নৈতিক ও রাজনৈতিক অস্ত্র প্রয়োগ করেছিলেন তার ইতিহাস তুলে ধরা হয়েছে।

শব্দসূচক:

সত্যাগ্রহ, মুল্যবোধ, নৈতিক, রাজনৈতিক অস্ত্র।

প্রতিপাদ্য বিষয় :

গান্ধীজীর জীবনদর্শন ও সত্যাগ্রহ বিষয়-দুটি একে অপরের পরিপূরক। সত্যাগ্রহ কথাটিকে সারা পৃথিবীতে তিনিই জনপ্রিয় করে তুলেছিলেন। সত্যাগ্রহ নামক অভিনব শক্তি দ্বারা গান্ধীজী যে কোনো দ্বন্দের সমাধান করতে চেয়েছিলেন। নৈতিক, সামাজিক ও রাজনৈতিক প্রতিটি ক্ষেত্রেই এই সত্যাগ্রহের প্রয়োগ করেছেন। গান্ধীজীর সত্যাগ্রহের উৎস ও স্বরূপ কী ? সেগুলি আলোচনা করার পরিপেক্ষিতে সত্যাগ্রহ পন্থাকে মূল্যায়ন করার চেষ্টা করা হয়েছে। পাশাপাশি গান্ধীজীর জীবন কাহিনী, হিন্দ-স্বরাজ, হরিজন, ইয়ং ইন্ডায়া'য় সত্যাগ্রহর অর্থ, সত্যাগ্রহের বৈশিষ্ট্য, সত্যাগ্রহীর গুণাবলী বা কর্তব্য, এছাড়া দক্ষিণ আফ্রিকায় ও ভারতবর্ষে সত্যাগ্রহ আন্দোলন প্রভৃতিও আলোচনা করা হয়েছে। উক্ত বিষয়গুলির ওপর ভিত্তি করেই সত্যাগ্রহ কিভাবে নৈতিক ও রাজনৈতিক অস্ত্র হিসাবে পরিণত করেছিল সেই বিষয়টি উপস্থাপন করা

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Comparative binding studies on the interaction of the indoloquinoline alkaloid cryptolepine with the B and the non-canonical protonated form of DNA: A spectroscopic insight

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Keywords:
Alkaloid-nucleic acid interaction
DNA polymorphism
Non-cooperative binding
Conversion of protonated DNA
Spectroscopy

ABSTRACT

Background: Low pH induced nucleic acid polymorphism and the interaction of naturally occurring small molecules with different polymorphic forms of DNA have been the focus in developing new drugs. Recent studies have revealed that low pH plays an active role in growth and development of cancer cells. Our target is to find whether and how the indoloquinoline alkaloid cryptolepine (CRP) interact with different polymorphic forms of natural DNA, in hope to explore this group of alkaloids as new therapeutics.

Methods: Multiple spectroscopic techniques that include UV–visible absorption spectrophotometry, fluorimetry, CD spectroscopy along with thermal melting studies were employed to characterize the interaction between the alkaloid cryptolepine with the B and protonated forms of DNA.

Results & conclusions: Cryptolepine has been found to interact with either forms of DNA. The nature of binding is non-cooperative in both cases. Data show that the affinity of CRP to B form of DNA is relatively higher than that for the protonated form of DNA. Circular dichroic studies reveal that the alkaloid converts the left handed protonated DNA into bound right handed form. Fluorescence quenching experiments reveal that cryptolepine intercalates within the DNA base pairs. Thermal melting studies show that the alkaloid stabilises the DNA structures.

General significance: Such non-B DNA structures are often present at the 'mutation hotspots' that are associated with genetic instability related diseases such as cancer. The ability of cryptolepine to interact to such non-B DNA structures makes it a useful substrate in the designing of potential chemotherapeutic agents.

1. Introduction

The well-defined structure and biological functions of DNA make it an effective chemotherapeutic target by various small molecules [1–4]. The last few decades have seen a lot of biomedical efforts directed to uncover a range of drug-DNA interactions [5,6]. Researches have revealed that apart from the canonical B form of DNA several other alternative non-B DNA structures can be specifically targeted by the drugs. These non-B DNA polymorphic structures are often present at the 'mutation hotspots' that are associated with genetic instability related diseases like cancer [7–11]. One such non-canonical form of DNA is the protonated form of DNA which can exist under low pH and low temperature conditions [12,13]. Unlike the B form of DNA, the protonated form of DNA is left-handed and characterized by Hoogsteen base-pairing rather than the typical Watson-Crick base-pairing that is present in the B DNA structure. Spectrophotometric studies have revealed that protonation mainly occurs at the cytosine which causes the native DNA structure to alter [14]. Pulleyblank et al. suggested that the structures of protonated form of DNA, $d(TC)_n.d(GA)_n$ is sufficiently similar to that of *Z*-DNA. They may interact with antibody binding sites leading to similar conformations and hence can be recognized by the same antibody [15,16]. The H-bonding in A:T base pairs differ significantly from that of C:G base pairs. It is seen that under mild acidic conditions, the A:T base pairs can be used as molecular rectifiers. This action can be regulated by regulating the pH [17]. Although the protonated form of DNA is not exactly found in living bodies, it can serve as a model system to study the effect of low pH on DNA conformation and its impact on drug binding [18]. The roles played by the non-B forms of DNA can be studied with the help of molecular probes that can interact with such structures and in turn alter their functions. Alkaloids are one such category of small

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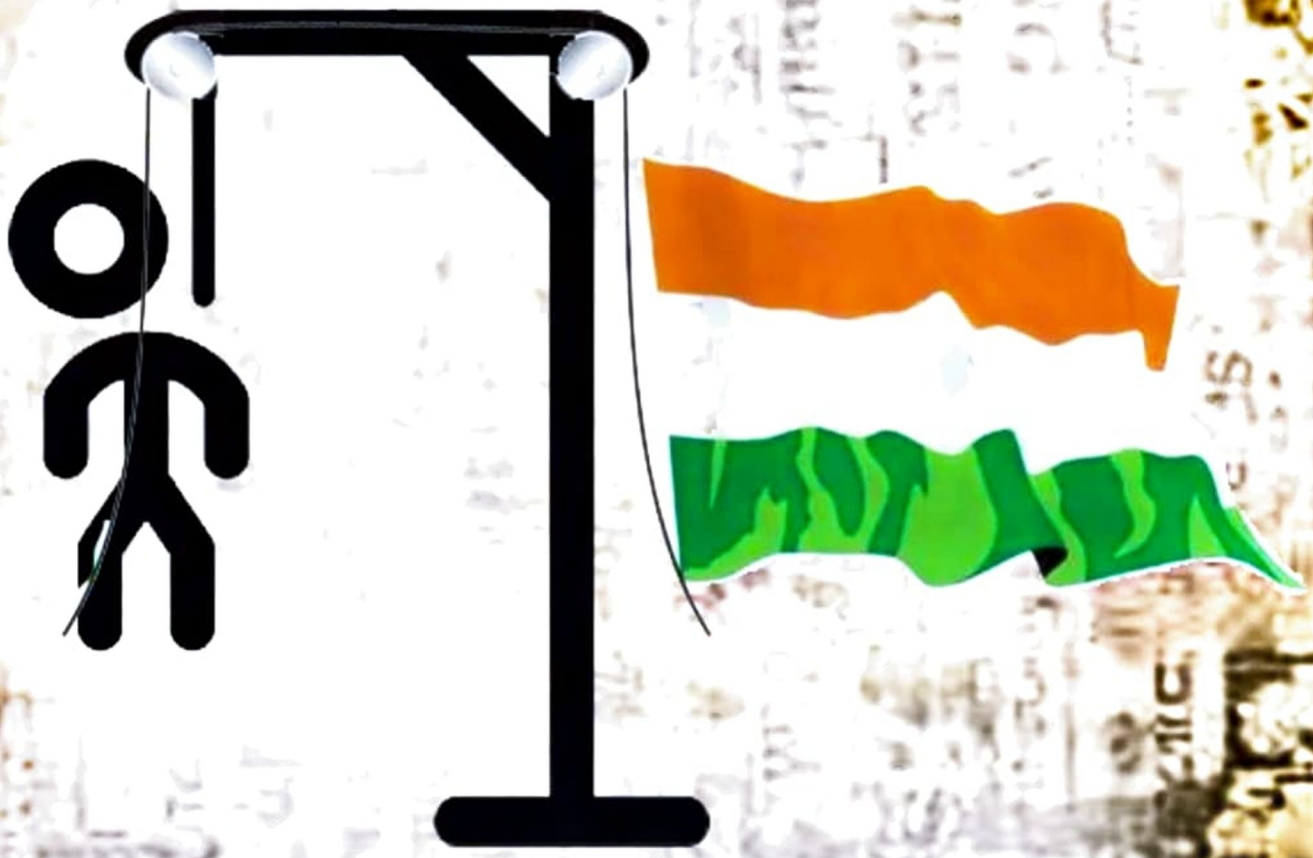
স্বাধীনতা এবং ইউএপিএ সংখ্যা



UAPA

The fourth shade of the tricolor

অপরজন অগাস্ট ২০২১

প্রচ্ছদকাহিনী – স্বাধীনতা এবং ইউএপিএ

প্রচ্ছদকাহিনি | প্রবন্ধ

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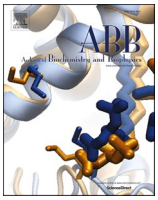

The alkaloid cryptolepine as a source of polyadenylate targeting therapeutic agent: Induction of self-assembly in the polyadenylate moiety

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ARTICLE INFO

Keywords:
Single-stranded polyriboadenylic acid
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Self-assembly
Cooperative binding

ABSTRACT

RNAs have become a well-known target for chemotherapeutic agents in the recent years. The tails of most eukaryotic m-RNA are characterized by the presence of a long polyadenylate sequence which plays an important role in its growth and maturation. This lays emphasis on development of molecular probes that target the polyadenylate sequence. Cryptolepine (hereafter, CRP) is an indoloquinoline alkaloid well known for its anti-malarial activities. A series of spectroscopic experiments namely absorption studies, fluorimetric studies and circular dichroism studies show that cryptolepine binds with single-stranded polyriboadenylic acid (hereafter, ss-poly (rA)) with a binding constant of $\sim 5 \times 10^3\ M^{-1}$ at 25 °C. Moreover thermal denaturation experiments show that the bound form of polyriboadenylic acid shows a characteristic transition profile. Such a profile is indicative of the ability of cryptolepine to induce self-assembly in the polyriboadenylic acid sequence on binding to it. Such ability of CRP to modulate the structural conformation of poly (rA), which in turn may cause functional aspects of the RNA to change, may give us a chance to develop effective alkaloid based chemotherapeutic agents.

1. Introduction

The unique structural morphology of RNA and its ability to bind small molecules makes it a useful target in therapeutic science [1]. It plays an unparalleled role in vital cellular processes like transcription, translation and a long trail of processes leading to protein formation [2,3]. The shift in RNA based drug designing came after the discovery of the role played by RNA in viral diseases like HIV-AIDS, hepatitis etc. [4,5]. Polyriboadenylic acid [hereafter poly (rA)], has gained considerable interest because of its significant role in controlling gene expression, stability and maturation of RNA [6,7]. The structure of poly (rA) is a major factor that governs its biophysical properties [8]. Poly (rA) shows a pH dependent conformational change [9]. At acidic pH it exists as a double helical structure formed by two parallel intertwined strands but at neutral pH the single-stranded structure is predominant. This has been confirmed in earlier studies like X-ray diffraction and spectropolarimetric experiments [9]. The poly (rA) tail is a long chain of adenine nucleotides that is added to the 3′-end of the primary RNA transcript during the transcription of a specific gene in eukaryotic cells [10]. This tail prevents the enzymatic degradation of mRNAs in the cytoplasm. Such a poly (rA) sequence is absent in prokaryotes. Thus, the longevity of eukaryotic mRNA over prokaryotic mRNA can be attributed to the presence of polyadenylate tails [11–13]. The poly adenylation of mRNA is catalysed by the enzyme poly A polymerase (PAP). Neo PAP in humans is associated with cancerous cells [14]. Poly (rA) exists as a double helix only under acidic pH but not under physiological pH. So molecules that can bind and modulate the structure of poly (rA) under physiological pH may interfere with PAP and alter the encoded protein synthesis. Such molecules can be used in the development of chemotherapeutic drugs.

Alkaloids are one such category of small molecules which can bind to RNA [15–17]. They are plant secondary metabolites (PSMs) characterised by the presence of nitrogen. They belong to different classes according to their pharmacokinetics and structure [18]. In the recent years there has been an inclination towards phytohormone based drugs because of their high compatibility and lower toxicity [19,20]. Their planar structure ensures their easy incorporation into nucleic acid motifs leading to binding. Cryptolepine (Fig. 1), a medicinally active indoloquinoline alkaloid, is isolated from the roots of the shrub *Cryptolepis sanguinolenta* found in the Central and Western regions of Africa [21]. It has a lot of potential as an anti-malarial, anti-bacterial, and anti-hyperglycemic agent [22–24]. Studies show that the alkaloids extracted from *Cryptolepis sanguinolenta* can act as potent inhibitors of SARS CoV and SARS CoV-2 viral proteins [25,26]. Also both

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সম্পাদক — দেবাশিস দত্ত

প্রচ্ছদ — অর্ঘ্য বন্দ্যোপাধ্যায়

সম্পাদকীয় (https://aparjan.com/2021/09/30/september2021-editorial/)

প্রচ্ছদকাহিনি — আফগানিস্তান

প্রচ্ছদকাহিনি | প্রবন্ধ

নেপথ্য কথন – প্রসঙ্গ আফগানিস্তান : বরুণ বন্দ্যোপাধ্যায় (https://aparjan.com/2021/09/30/september2021-babaar/)

শান্তি ও গণতন্ত্র পুনর্গঠনের নেপথ্যে থাকা রাজনৈতিক-অর্থনীতি : প্রসঙ্গ আফগানিস্তান – কৌশিক চট্টোপাধ্যায় (https://aparjan.com/2021/09/30/september2021-kachar/)

আফগানিস্তানের অর্থনৈতিক অবস্থা: প্রথমের পতন ও দ্বিতীয়র উত্থান পর্বে : ড. বিশ্বম্ভর মণ্ডল (https://aparjan.com/2021/09/30/september2021-bimoar/)

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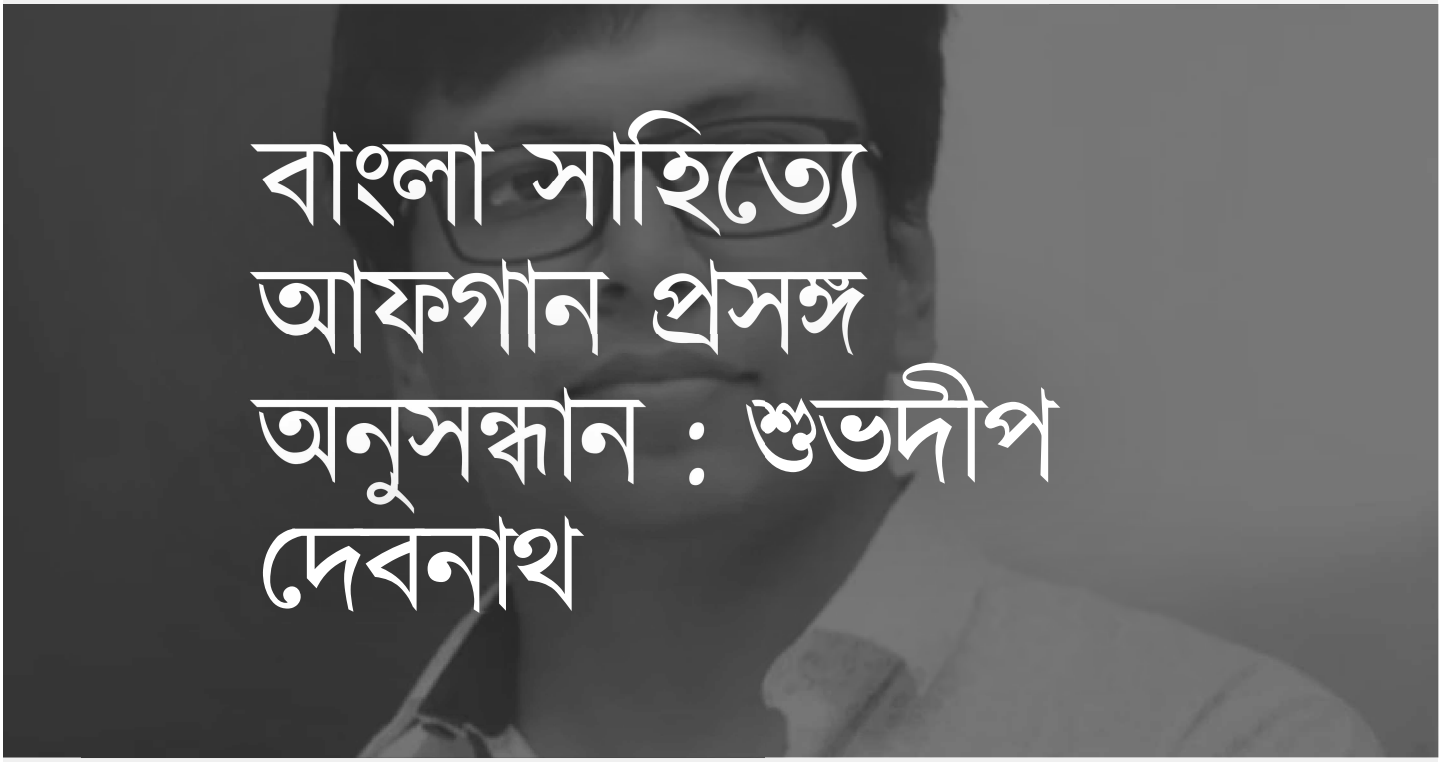

চলতি বছরের আগস্ট মাসে ন্যাটো কর্তৃক সেনা প্রত্যাহার ঘোষণার সঙ্গে সঙ্গে আন্তর্জাতিক মানচিত্রে আফগানিস্তান আবার খবরের শিরোনামে চলে আসে। মার্কিন সেনা বিদায় নেওয়ার আগেই আফগানিস্তানের সিংহ ভাগ অঞ্চল চলে যায় তালিবানদের দখলে। গত কয়েক দশক ধরে তালিবানি ক্রিয়াকলাপের যে নমুনা বিশ্ববাসী প্রত্যক্ষ করে এসেছে,তালিবানদের ক্ষমতা দখলের ঘটনায় সেই দুঃসহ স্মৃতি আবার ফিরে আসছে। যদিও আফগানিস্তানের ইতিহাসের দিকে লক্ষ করলে এই ক্ষমতা দখলের রাজনীতি কোনো বিচ্ছিন্ন ঘটনা বলে মনে হবে না। ভারতের উত্তর-পশ্চিম সীমান্তবর্তী এই দেশ ভৌগোলিক কারণে বারংবার বিদেশি আক্রমণের শিকার হয়েছে, বিভিন্ন শক্তিশালী রাষ্ট্র আন্তর্জাতিক ক্ষেত্রে নিজেদের গুরুত্ব বজায় রাখার জন্য আফগানিস্তানকে ‘করিডর’ হিসাবে ব্যবহার করেছে, সোভিয়েত রাশিয়া এবং আমেরিকার ঠাণ্ডা যুদ্ধে ‘গিনিপিগ’ হয়ে উঠেছে আফগানিস্তান। গত শতকের সাতের দশকের শেষ দিকে ইসলামিক মৌলবাদী গোষ্ঠীর বাড়বাড়ন্ত রোধ করতে কমিউনিস্ট সোভিয়েত ইউনিয়ন আফগানিস্তানের আভ্যন্তরীণ রাজনীতিতে সরাসরি হস্তক্ষেপ করে। সঙ্গে সঙ্গে আসরে অবতীর্ণ হয় ধনতন্ত্রের প্রতিভূ মার্কিন যুক্তরাষ্ট্র। সোভিয়েত ইউনিয়নের শক্তি খর্ব করতে শুরু হয় তীব্র মৌলবাদী ইসলাম ধর্মের অপপ্রচার। পাকিস্তান এবং আমেরিকার প্রত্যক্ষ মদতে জন্ম হয় কট্টর মৌলবাদী সংগঠন তালিবানের। নিরন্তর বৈদেশিক শক্তির হস্তক্ষেপ আর গৃহযুদ্ধে ক্ষ[illegible] হতে

তুলে আনেন; তালিবানদের শত অত্যাচারের পরও সেখানকার গুরুদ্বার-মন্দিরের টিকে থাকার অজানা কাহিনী বয়ান করেন।

আসলে আফগানিস্তানের মত সকল অর্থে সম্পূর্ণ বিপরীতধর্মী একটি দেশ সম্পর্কে বাঙালির চিরকালই এক অদম্য কৌতূহল রয়েছে। আর সৈয়দ মুজতবা আলীর সৌজন্যে ভ্রমণ পিপাসু বাঙালি পাঠকের কাছে এই দেশ যেন মানস ভ্রমণের এক অবিচ্ছেদ্য অঙ্গ হয়ে উঠেছে। কাজেই বিশ্ব রাজনীতির দোলাচলতায় আফগানিস্তান যখনই খবরের শিরোনামে উঠে আসে বাঙালি তখনই নস্টালজিক হয়ে পড়ে। তাই গল্প-উপন্যাস-স্মৃতিকথা-ভ্রমণ সাহিত্য কিংবা রম্য রচনা— বাঙালির লেখনীতে বারেবারে ফিরে এসেছে আফগান প্রসঙ্গ। ভবিষ্যতে এই ধারা আরও পুষ্ট হবে এবং সমস্ত দুর্যোগ কাটিয়ে আফগানিস্তান আবার স্বমহিমায় ফিরবে এই আশা নিয়েই আমাদের আলোচনা সাঙ্গ করছি।

তথ্যসূত্র:-

১. রবীন্দ্রনাথ ঠাকুর, গল্পগুচ্ছ, শ্রাবণ ১৪১০, পৃষ্ঠা ১১২
২. সৈয়দ মুজতবা আলী, দেশে বিদেশে, পৌষ ১৩৬৪, পৃষ্ঠা ৪৮
৩. ঐ, পৃষ্ঠা ৬১
৪. ঐ, পৃষ্ঠা ৭১
৫. ঐ, পৃষ্ঠা ৭৯-৮০
৬. সৈয়দ মুজতবা আলী, শবনম, আগস্ট ২০০০, পৃষ্ঠা ৩৯
৭. ঐ, পৃষ্ঠা ৬৫
৮. রামনাথ বিশ্বাস, আফগানিস্তান, ১৯৪২, পৃষ্ঠা ১৪
৯. ঐ, পৃষ্ঠা ২২
১০. ঐ, পৃষ্ঠা ১৩৩
১১. সুস্মিতা বন্দ্যোপাধ্যায়, কাবুলিওয়ালার বাঙালি বউ, ১৯৯৭, পৃষ্ঠা ৯-১০
১২. ঐ
১৩. পান্থজন, কাবুলের পথে পথে, পৃষ্ঠা ১৬
১৪. ঐ, পৃষ্ঠা ৩৮
১৫. অমিতাভ রায়, কাবুলনামা, পৃষ্ঠা ১০৮-১১০
১৬. ঐ, পৃষ্ঠা ১০৭

[***লেখক*** **–** সহকারী অধ্যাপক, বাংলা বিভাগ, তেহট্ট গভর্নমেন্ট কলেজ, নদীয়া।]

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Time-nonlocal six-phase-lag generalized theory of thermoelastic diffusion with two-temperature

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ABSTRACT

A mathematical model for time-nonlocal six-phase-lag generalized thermoelastic diffusion with two-temperature is proposed for a linear, isotropic and homogeneous thermoelastic diffusive continuum by considering modified Fourier's law of heat conduction together with modified Fick's law of mass diffusion. The modified Fourier's law includes temperature gradient and thermal displacement gradient among the constitutive variables whereas the modified Fick's law includes chemical potential gradient and the chemical potential displacement gradient among the constitutive variables. The Fourier's law of heat conduction is replaced by a fractional-order approximation to a modification of the Fourier's law with three different phase lags for the heat flux vector, the temperature gradient and the thermal displacement gradient whereas the Fick's law of mass diffusion is replaced by a fractional-order approximation to a modification of the Fick's law with three different phase lags for the mass flux vector, the chemical potential gradient and the chemical potential displacement gradient. The proposed model includes some of the existing thermoelastic diffusion models as special cases. A variational principle is derived and a uniqueness theorem is proved. Finally, a dynamic reciprocity theorem is established for the proposed generalized thermoelastic diffusion model.

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Generalized thermoelastic diffusion; time-nonlocal six-phase-lag; two-temperature thermoelasticity; variational principle; uniqueness theorem; reciprocity theorem

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1. Introduction

Generalized thermoelasticity, a new milestone in the theories of thermoelasticity, prevails over the crucial imperfections of the classical theories of thermoelasticity. Lord and Shulman [1] are the two pioneers who contributed first heavily to the coupled thermoelasticity by introducing generalized theory of thermoelasticity through alteration of the parabolic nature of the heat conduction equation to hyperbolic nature. They did this revolutionary change in the nature of the heat conduction equation by incorporating a relaxation time parameter in the Fourier's law of heat conduction, and in doing so, the unrealistic phenomenon of infinite speed of thermal wave propagation was replaced by practical observation of finite speed of propagation of thermal waves. Later on, a bunch of generalized thermoelastic theories [2–7] were introduced. The three-phase-lag generalized thermoelastic theory is the most general form of almost all other generalized

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বিকাশ শীল সম্পাদিত

জনপদপ্রয়াস

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অলংকরণ
সুবীর কয়াল

সংযোগ
শীলবাগান, ফুলপুকুর রোড
চুচুড়া ৭১২১০১
হুগলি
মুঠো ফোন : ৬২৯১০৬৯৮৬৫

সূচী

সদর্থক অন্তর্ঘাতের দুই সেনানী: সুবিমল-নবারুণ

শুভদীপ দেবনাথ

সভ্যতার প্রাথমিক পর্বে মানুষ যে নিয়মতান্ত্রিকতায় সভ্যতাকে সুসংহত করতে চেয়েছিল, সেই নিয়মই যখন সৃষ্টিশীলতায় বাধা তৈরি করল, সংঘাতের সূচনা সেই পর্যায় থেকেই। ছোটো-বড়ো নিয়মনীতিকে মান্যতা দিয়ে যে প্রতিষ্ঠানের জন্ম হল, কালক্রমে সেই প্রতিষ্ঠানই হয়ে উঠল স্থিতিশীলতার ধারক ও বাহক। ক্ষমতাকে কেন্দ্রীভূত করে প্রতিষ্ঠানই হয়ে উঠল সমাজের নিয়ন্ত্রক। সভ্যতা যত আধুনিক হচ্ছে সমাজের প্রতিটি ক্ষেত্রে প্রতিষ্ঠান ততই শক্তিশালী হয়ে উঠছে। নিজ শ্রেণিস্বার্থ বজায় রাখার জন্য যে কোনো ধরনের বিরোধিতাকে নস্যাৎ করাই হয়ে উঠছে তার মূল লক্ষ্য। শিল্প-সংস্কৃতির জগতেও প্রতিষ্ঠানের খবরদারি বিচ্ছিন্ন কোনো বিষয় নয়,বাজার অর্থনীতির সৌজন্যে যে খবরদারি ক্রমশ মহীরূহ হয়ে উঠেছে। এই ক্রিয়ারই বিপরীতমুখি প্রতিক্রিয়া স্বরূপ প্রতিষ্ঠান বিরোধিতার ক্ষেত্র প্রস্তুত হয়। সর্ব ক্ষমতা সম্পন্ন প্রতিষ্ঠানের বিরুদ্ধে ব্যক্তি বিশেষের প্রতিবাদ একটু একটু করে পরিচিতি পেতে থাকে। প্রচারসর্বস্ব প্রাতিষ্ঠানিক সাহিত্যের সমান্তরালে এই শ্রেণির সাহিত্য প্রচেষ্টা মননশীল পাঠকের চেতনাকে আলোড়িত করতে থাকে। বাংলা সাহিত্যে যে প্রাতিষ্ঠানিকতা পাঠকের মধ্যবিত্ত মানসিকতাকে সযত্নে লালিত করছিল, প্রতিষ্ঠান বিরোধী অন্তর্ঘাত সেই মানসিকতায় আঘাত হানে। প্রাতিষ্ঠানিকতার প্রাচীরে সদর্থক অন্তর্ঘাত সৃষ্টিকারী এমনই দুই সাহিত্যিকের প্রতিষ্ঠান বিরোধী মানসিকতার স্বরূপ উন্মোচনই আমাদের অন্বিষ্ট।

বাংলা সাহিত্যে প্রতিষ্ঠান বিরোধিতার প্রসঙ্গ উত্থাপিত হলে যে ব্যক্তিনাম সর্বাগ্রে উপস্থিত হয় তাহল সুবিমল মিশ্র (১৯৪৩)। ১৯৬০-এর গোড়া থেকেই বাংলা সাহিত্যে প্রতিষ্ঠানের স্বরূপ প্রকাশ পেতে থাকে, কিন্তু সুবিমল মিশ্রের আগে প্রতিষ্ঠান বিরোধিতা নিয়ে কোনো তাত্ত্বিক সমালোচনা বাংলা সাহিত্যকে আলোড়িত করেনি। সুবিমল মিশ্রের প্রথম গল্পগ্রন্থ 'হারাণ মাঝির বিধবা বৌয়ের মড়া বা সোনার গান্ধীমূর্তি' প্রকাশিত হয় ১৯৭১ সালের জুন মাসে। প্রথম উপন্যাস 'আসলে এটি রামায়ণ চামারের গল্প হয়ে উঠতে পারতো' প্রকাশিত হয় ১৯৮২ সালে। এই সময়পর্ব জুড়ে অর্থাৎ গোটা সাতের দশক বিভিন্ন লিট্‌ল্‌ ম্যাগাজিনে প্রকাশিত হতে থাকে প্রতিষ্ঠান বিরোধিতা সংক্রান্ত সুবিমল মিশ্রের প্রবন্ধ। সাত ও আটের দশকে প্রকাশিত বিভিন্ন প্রবন্ধ ও সাক্ষাৎকার নিয়ে ১৯৮৮ সালে বাণীশিল্প কর্তৃক প্রকাশিত হয় সুবিমল মিশ্রের প্রথম প্রবন্ধ গ্রন্থ 'সুবিমলের বিরুদ্ধে সুবিমল এবং উস্কানিমূলক অনেককিছুই, আপাতভাবে'। নানা কারণে এই

ত্রিদোষ তত্ত্ব ও হিউমোর‍্যাল থিয়োরির প্রেক্ষিতে গোসানী-মঙ্গল

নীতীশ ঘোষ

উত্তরবঙ্গে বিশেষত কোচবিহার অঞ্চলে সাহিত্য সাধনার যে প্রবাহ শুরু হয়, তার প্রধান কেন্দ্র ছিল রাজদরবার। কিন্তু তার পাশাপাশি রাজ আনুকূল্য নিরপেক্ষ একটি সাহিত্যধারা গড়ে উঠতে থাকে। এই ধারার অন্যতম উজ্জ্বল নিদর্শন রাধাকৃষ্ণ দাস বৈরাগী বিরচিত 'গোসানী-মঙ্গাল' কাব্য। গ্রন্থটির প্রথম প্রকাশক ব্রজচন্দ্র মজুমদার বিজ্ঞাপনে 'গোসানী-মঙ্গাল'কে কোচবিহারের আদিকাব্য বলে দাবি করেছিলেন। গোসানী-নামধেয় লৌকিক দেবী চণ্ডীকে কেন্দ্র করে অষ্টাদশ শতকের শেষভাগে কাব্যখানি রচিত হয়। ঐতিহাসিক ও লৌকিক তথ্যে পরিপুষ্ট এই কাব্যখানি কোচবিহারের সাহিত্যসাধনার সোনালি ফসল। এই কাব্যের শিরায় শিরায় কোচবিহারের আঞ্চলিক মানুষের রীতি-নীতি ও ভাবচেতনার প্রাণস্পন্দন ধ্বনিত হয়েছে। এই 'গোসানীমঙ্গাল' কাব্য থেকে আমরা তৎকালীন সমাজচিত্রের একটি পরিষ্কার রূপরেখা অঙ্কন করতে পারি। কাব্যে উল্লিখিত কোচবিহার অঞ্চলের তৎকালীন মানুষের স্বাস্থ্যভাবনা ও লোকচিকিৎসা পদ্ধতিকে তুলে ধরা হয়েছে। প্রাসঙ্গিকভাবে আয়ুর্বেদ শাস্ত্রের ত্রিদোষ তত্ত্ব ও পাশ্চাত্যের Humoral Theory-র আলোকে প্রাপ্ত লোকচিকিৎসা পদ্ধতিকে বিশ্লেষণের চেষ্টা করা হয়েছে। উক্ত বিষয়গুলিই এই প্রবন্ধটির মূল ভরকেন্দ্র।

মানব শরীর ক্ষিতি, অপ, তেজ, মরুৎ ও ব্যোম এই পঞ্চ উপাদানের সমবায়ে গঠিত। আমাদের দেহের গঠন, বৃদ্ধি, পরিণমন এমনকী বিভিন্ন রোগ প্রতিরোধ ও নিরাময়ের সব স্তরেই এই পঞ্চ উপাদানের প্রভাব প্রত্যক্ষগোচর। একটি বীজের মহিরুহে পরিণতিতে যেমন মাটি, জল, উষ্ণতা, বায়ু ও মুক্ত পরিবেশ দরকার, ঠিক তেমনি এই একই কথা মানব শরীরের ক্ষেত্রেও প্রযোজ্য। প্রকৃতি আমাদের দেহকে এমনভাবে নির্মাণ করেছে যে, এর ভিতরেই রয়েছে আত্মরক্ষা ও রোগ থেকে আরোগ্যলাভের উপায় ও কৌশল। প্রকৃতির সঙ্গে সম্পর্ক ছিন্ন করে, প্রকৃতির নিয়মকে লঙ্ঘন করার ফলেই আমাদের স্বাস্থ্যাবনতি ঘটে এবং রোগ-ব্যাধি আক্রমণ করে। পরিবেশের বাহ্যিক উপাদানের গ্রহণ ও বর্জনের ওপর ভিত্তি করে দেহের সাম্যাবস্থা নিয়ন্ত্রণই সুস্বাস্থ্য রক্ষার অন্যতম কৌশল। পঞ্চ ইন্দ্রিয়ের দ্বারা আমরা যেমন পরিবেশের বিভিন্ন উপাদানকে গ্রহণ করি, তেমনি শরীর অভ্যন্তরস্থ অবাঞ্ছিত উপাদানকে

43

TABU EKALAVYA

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প্রাপ্তিস্থান : দে'জ, দিয়া, দে বুক স্টোর (দীপু), পাতিরাম, ধ্যানবিন্দু, পাতাবাহার

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তবু একলব্য

২৬ বর্ষ • ২ সংখ্যা
ক্রমিক ৪৩

TABU EKALAVYA

An International Peer-reviewed & Refereed Research Journal
কলা ও মানববিদ্যা বিষয়ক গবেষণাধর্মী রেফার্ড
ও
পিয়ার-রিভিউড ত্রৈমাসিক পত্রিকা

৪৩

মঙ্গলকাব্য

বিশেষ সংখ্যা

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

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Research Article

Atomic-Scale Imaging and Nano-Scale Mapping of Cubic α-$CsPbI_3$ Perovskite Nanocrystals for Inverted Perovskite Solar Cells

Somnath Mahato,*,⊥ Arup Ghorai, Ajoy Mondal,⊥ Sanjeev Kumar Srivastava, Mantu Modak, Shreyasi Das, and Samit K Ray*

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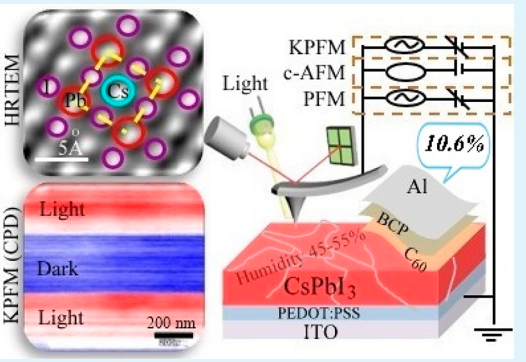
ABSTRACT: Colloidal synthesized cubic α-$CsPbI_3$ perovskite nanocrystals having a smaller lattice constant (a = 6.2315 Å) compared to the standard structure, and nanoscale mapping of their surfaces are reported to achieve superior photovoltaic performance under 45−55% humidity conditions. Atomic scale transmission electron microscopic images have been utilized to probe the precise arrangement of Cs, Pb, and I atoms in a unit cell of α-$CsPbI_3$ NCs, which is well supported by the VESTA structure. Theoretical calculation using density functional theory of our experimental structure reveals the realization of direct band to band transition with a lower band gap, a higher absorption coefficient, and stronger covalent bonding between the Pb and I atoms in the $[PbI_6]^{4-}$ octahedral, as compared to reported standard structure. Nanoscale surface mapping using Kelvin probe force microscopy yielding contact potential difference (CPD) and conductive atomic force microscopy for current mapping have been employed on α-$CsPbI_3$ NCs films deposited on different DMSO doped PEDOT:PSS layers. The difference of CPD value under dark and light illumination suggests that the hole injection strongly depends on the interfaces with PEDOT:PSS layer. The carrier transport through grain interiors and grain boundaries in α-$CsPbI_3$ probed by the single-point c-AFM measurements reveal the excellent photosensitivity under the light conditions. Finally, inverted perovskite solar cells, employing α-$CsPbI_3$ NCs film as an absorber layer and PEDOT:PSS layer as a hole transport layer, have been optimized to achieve the highest power conversion efficiency of 10.6%, showing their potential for future earth abundant, low cost, and air stable inverted perovskite photovoltaic devices.



KEYWORDS: *cesium lead iodide, atomic resolution TEM, KPFM, c-AFM, inverted perovskite solar cells*

1. INTRODUCTION

In 2020, the certified power conversion efficiency (PCE) of organic−inorganic hybrid perovskite solar cells has reached above 25%, revealing their potential to compete with silicon photovoltaic technology.[1,2] However, the stability of organic−inorganic perovskites due to high volatility of hydrophilic organic A-site cations (e.g., $CH_3NH_3^+$) still remains a critical concern.[3,4] To overcome this bottleneck, all-inorganic cesium lead halide ($CsPbX_3$:X = I, Br, and Cl) perovskite films and nanostructures have been under intense investigation, due to the remarkable improvement in their stability, for application in high performance optoelectronic devices such as solar cells, light emitting diodes, photodetectors, and two-dimensional/three-dimensional (2D/3D) perovskite heterojunctions under the ambient condition.[5−8] Especially colloidal synthesized cesium lead iodide ($CsPbI_3$) nanocrystals (NCs) show a great potential as a new class of stable photoactive perovskite material for low-cost, high-performance, next-generation photovoltaic devices.[9−11] It has easier processability, higher absorption in the visible spectrum, lower bandgap, and better photostability in the ambient condition, as compared to other halide perovskites.[12,13] Among four existing phases (α-cubic, β-tetragonal, γ-orthorhombic, and δ-orthorhombic) of $CsPbI_3$ NCs,[14,15] α-cubic phase is more stable due to its low surface-to-volume ratio without any octahedral inclination or lattice distortion in $[PbI_6]^{4-}$ octahedra as well as in the unit cell.[16,17] However, the stability of α-$CsPbI_3$ is still a concern due to its phase transition from the radiative cubic (α-phase) to the nonradiative orthorhombic (δ-phase) crystals structure, under exposure to the light, humidity, and temperature.[18] To date, several groups have made enormous efforts to synthesize and postsynthesis modifications to improve the stability of α-$CsPbI_3$ in ambient conditions. The choice of surface passivation using different ligands by controlling their shape and size is an alternative approach to stabilize perovskite

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Anti-corrosive propensity of naturally occurring aldehydes and 1-(3-aminopropyl)imidazole condensed Schiff bases: Comparison on the effect of extended conjugation over electron donating substituents

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ABSTRACT

Schiff bases prepared by condensation of 1-(3-aminopropyl)imidazole and three different naturally occurring aldehydes, namely salicylaldehyde, vanillin and cinnamaldehyde (ISSB, IVSB and ICSB, respectively) are tested as corrosion inhibitors for mild steel in 1 M HCl. Comparative effects of extended conjugation and +R effect bestowed by the electron donating group are explored towards the extent of corrosion protection of mild steel. ICSB, having extended conjugation, stands out to be the most efficient one. At 1 mM concentration, it imparts nearly 99% inhibition efficiency at 40 °C after 48 h of exposure of mild steel in 1 M HCl. DFTB+ study reveals the active centers of inhibitor molecules responsible for bi-directional electron transfer with metal surface. Irreversibility test with ICSB layer formed after exposure in 1 M HCl for 24 h having 1 mM ICSB, provides 78% inhibition efficiency to mild steel when exposed to the uninhibited 1 M HCl for 3 h. From detailed temperature dependence study, thermodynamics and kinetic parameters are obtained, which are instrumental to ascertain the nature of adsorption of the studied inhibitors.

1. Introduction

A variety of Schiff bases have been investigated for their potential anti-corrosive activities both for ferrous and non-ferrous metals and alloys in recent past [1–14]. Schiff bases possess several characteristics conducive for corrosion mitigation. However, in many cases the reported inhibition efficiencies are not very high. In some instances, the inhibitory effect does not last long, particularly at elevated temperature. These shortcomings are associated with the insolubility of Schiff bases, as well as instability of the inhibitor layer in highly acidic medium under prolonged exposure or at higher temperature. In addition, report on the irreversibility test for corrosion inhibitors, *i.e.*, how long the inhibitor layer can sustain in the aggressive uninhibited acid solution, is really scarce [15]. This is an important aspect in regard to applicability of inhibitors in real situation. Most of the works involving Schiff bases as corrosion inhibitors focus on the effect of multiple imine bonds, presence of electron donating/withdrawing groups, aromatic moieties, heteroatoms, aliphatic chain length etc. [1–14]. Some studies have pointed out better performance of the Schiff bases having extended conjugation, which results into higher electron density on the imine group [3,16–18]. In the present work, we intend to present a comparative study between the effect of extended conjugation and that of electron donating substituents. For this, we have used structurally comparable inhibitor molecules and took mild steel as the test material and 1 M aqueous HCl as the corrosive medium. Mild steel is one of the most widely used structural materials because of its strength, malleability, ductility, weldability, machinability, and most-importantly cost effectiveness [19] As it is very prone towards corrosion, protecting mild steel, particularly from mineral acid environment like HCl is still a challenge [19]. There are diversified uses of mineral acids like HCl. These include chemical processing, pickling, acid de-scaling, oil-well acidifying processes and many others [20]. During these processes, as well as during transportation and storage of acid, application of suitable corrosion retardant is a pre-requisite.

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The Weavers' Community of Murshidabad District: An Overview

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Abstract

The main aim of this article or research work is to explore the social, economic, and political life and conditions of the Weavers' community of the Murshidabad district in the state of West Bengal. As a student and researcher of social science as well as political science, such kind of research work should be treated as an unavoidable task and especially, those who come from a social science background cannot deny his responsibility in this regard. Weavers as a productive group and their contribution to society are immense. Thus, we have tried to explore the social, economic, and political aspects of the Weavers' community. To do it, we have followed and used various techniques of research methods as much as possible. For this purpose, this article is divided into nine parts. These are: i) introduction; ii) statement of the main theme; iii) objectives of the study; iv) historical & theoretical context of the study: v) research questions; vi) research methodology; vii) findings; viii) research gap; ix) conclusion.

***Keywords**: Weavers', Community, Social, Economic, Political, Production-Management, Trade union.*

(Paper published on 1st June, 2022.)

Introduction

In this research work, the researcher has tried to analyse the socio-economic and political conditions and overall lifestyle of the weavers' community scattered across Murshidabad district in the state of West Bengal. In the study or research in any area of social science, communities or groups situated in various strata of society— are very important. The prime responsibility of any scholar of social science is to highlight the conditions or roles of those communities which are directly or indirectly associated with the work of social production. No social scientist can deny this role of his/her. This is no exception for the scholar here. This kind of research that deals with those who are associated and are involved in social production must identify two things at the outset: a) identification of the community on which the research would be carried out and b) to create an understanding of the community with its problems, needs, and demands. The weaving industry is an indigenous and eco-friendly industry. The weavers are scattered across the Murshidabad district and these weavers can broadly be categorized into three groups: i) Hereditary weavers, those who depend on others, especially on *Mahajans*, ii) Labour weavers, iii) *Samiti* weavers. The socio-economic and political conditions of these three groups of weavers are completely different because they all

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APPLICATION OF MEMORY DEPENDENT DERIVATIVES ON THREE PHASE LAW THEORY WITH TWO-TEMPERATURE FOR THE UNBOUNDED GENERALIZED THERMOELASTIC MEDIUM HAVING SPHERICAL HOLE

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AND SADEK HOSSAIN MALLIK[3,*]

(*Received 1 March 2022*)

Abstract. In this work a theory of two temperature generalized thermoelasticity in the context of three-phase-lag model with memory dependent derivative is constructed using Taylor's series expansion. The theory is then implemented to study the thermoelastic interactions in an isotropic infinite medium with spherical cavity where thermal and mechanical loadings are prescribed. State space method is used to find the solution of the problem in the Laplace transform domain. Numerical solution for thermophysical quantities are obtained and plotted in graphs to investigate the influence of pertinent parameters.

Key Words and Phrases: Two-Temperature Generalized Thermoelasticity; Three-Phase-Lag Model; Memory-Dependent Derivative; State Space Approach; Vector-Matrix Differential Equation.

2010 Mathematics Subject Classification: 74F05

1. Introduction. Generalized thermoelasticity, a new mile-stone in the theories of thermoelasticity, prevails over the vital imperfections of classical theories of thermoelasticity. Lord and Shulman (1967) are the two pioneers who contributed first heavily to the coupled thermoelasticity by introducing generalized theory of thermoelasticity through alteration of the parabolic nature of the heat conduction equation to hyperbolic nature. They did this revolutionary change in the nature of the

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Article

Diffusion-Induced Ingress of Angiotensin-Converting Enzyme 2 into the Charge Conducting Path of a Pentacene Channel for Efficient Detection of SARS-CoV-2 in Saliva Samples

Ajoy Mandal, Samik Mallik, Sovanlal Mondal, Suvani Subhadarshini, Riya Sadhukhan, Tanmay Ghoshal, Suman Mitra, Mousam Manna, Suman Mandal, and Dipak K. Goswami*

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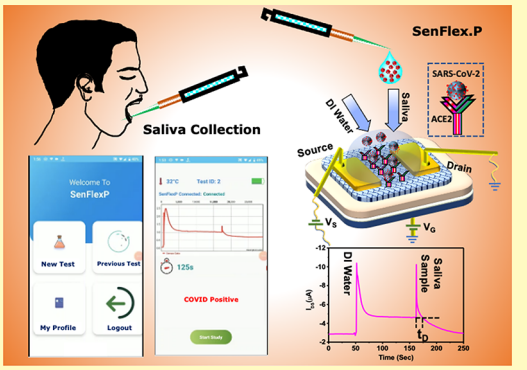
ABSTRACT: Rapid and accurate identification of a pathogen is crucial for disease control and prevention of the epidemic of emerging infectious like SARS-CoV-2. However, no foolproof gold standard assay exists to date. Nucleic acid-based molecular diagnostic tests have been established for identifying COVID-19. However, viral RNAs are highly unstable in handling with poor laboratory procedures, leading to a false negative that accelerates the spread of the disease. Detection of the spike protein (S1) of the SARS-CoV-2 virus through a proper receptor, commonly used in antigen-based rapid testing kits, also suffers from false-negative predictions due to decreasing viral titers in clinical specimens. Organic field-effect transistor (OFET)-based sensors can be highly sensitive upon properly integrating receptors in the conducting channel. This work demonstrates how angiotensin-converting enzyme 2 (ACE2) molecules can be used as receptor molecules of the SARS-CoV-2 virus in the OFET platform. Integration of ACE2 molecules into pentacene grain boundaries has been studied through the statistical analysis of rough surfaces in terms of lateral correlation length and interface width. The uniform coating of ACE2 molecules has been confirmed through growth studies to achieve better ingress of the receptors into the conducting channel at the semiconductor/dielectric interface of OFETs. We have observed less than a minute detection time with 94% sensitivity, which is the highest reported value. The sensor works with a saliva sample, requiring no sample preparation or virus transfer medium. A prototype module developed for remote monitoring confirms the suitability for point-of-care (POC) application at large-scale testing in more crowded areas like airports, railway stations, shopping malls, etc.



KEYWORDS: *COVID-19, SARS-CoV-2, field-effect transistor, angiotensin-converting enzyme 2 (ACE2), biosensor*

The massive impact of coronavirus (COVID-19) infection on human health has continued through new mutants since its outbreak in 2019.[1,2] Although the mortality rate has subsided in the recent mutants, the disease predominantly affects the respiratory system, leading to many pulmonary dysfunction-related diseases.[3,4] Quick detection of the COVID-19 virus (SARS-CoV-2) has become crucial for the termination of the SARS-CoV-2 infection chain. Several potential and practical detection techniques have been developed, such as reverse transcription-polymerase chain reaction (RT-PCR),[5,6] clustered regularly interspaced short palindromic repeats (CRISPR),[7] loop-mediated isothermal amplification (LAMP),[8,9] computed tomography (CT),[10] and Fourier-transform infrared spectroscopy (FTIR).[11] However, in most cases, these detection methods require a more sophisticated primer and probe design, multistep reactions, many reagents, trained technicians to run the machines, bulky instruments involving time-consuming procedures, etc.[12] The typical sensitivity of these techniques is also limited to about 81%.[13] Nevertheless, these techniques are not adequate to detect at a large scale, which is of utmost necessity to stop the spread. Therefore, developing a rapid, cheap, easy-to-use, high-accuracy, and point-of-care (POC) testing method is urgently needed. Several antigen-based test kits are being used.[14−16] Among the many antigen-based COVID-19 diagnosis methods, the field-effect transistor (FET)-based biosensors have many advantages, such as high sensitivity, ultrafast response, high selectivity, and the requirement of a small volume of analytes for the test.[17−20] FET also offers biodegradability, potential flexibility, and biocompatibility and involves low-cost fabrication.[21,22] These devices are, in most cases, fabricated on 1D or 2D structures as conducting

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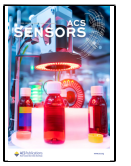

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Fabrication of gold nanoparticles tethered in heat-cooled calf thymus-deoxyribonucleic acid Langmuir-Blodgett film as effective surface-enhanced Raman scattering sensing platform

Rajdeep Sinha[1†], Sumit Kumar Das[2†], Manash Ghosh[3] and Joydeep Chowdhury[1*]

[1]Department of Physics, Jadavpur University, Kolkata, India, [2]Department of Physics, Government General Degree College, Tehatta, India, [3]Department of Spectroscopy, Indian Association for the Cultivation of Science, Kolkata, India

SERS active substrate fabricated through self-assembly of Gold nanoparticles on the disjointed networks of Heat-cooled Calf Thymus DNA (HC-Ct DNA) Langmuir-Blodgett (LB) film has been reported. Adsorption kinetics of HC-Ct DNA molecules at the air-water interface has been studied explicitly. The UV-Vis electronic absorption spectra in conjunction with the FESEM images collectively suggest the presence of H- type aggregated domains most likely owing to plane-to-plane self-association of the HC-Ct DNA molecules aligned vertically on the surface of the LB film. Elemental composition and the morphological features of the as-prepared substrate (APS) are explored from XPS analysis and the FESEM, AFM images respectively. The SERS efficacy of the APS has been tested with trace concentrations of 4-Mercaptopyridine molecule. Finally, this SERS active substrate has also been used for the detection of malathion at ultrasensitive concentrations.

KEYWORDS

calf thymus DNA, Langmuir-Blodgett film, gold nanoparticles, SERS, malathion detection

1 Introduction

Surface-enhanced Raman scattering (SERS) spectroscopy has now emerged as a fascinating analytical tool for the detection of molecules at trace concentrations in the limit of single molecule regime (Nordlander et al., 2004; Kneipp et al., 2008; Hernandez-Sanchez et al., 2018; Tian et al., 2022). The reason behind the colossal enhancements of Raman bands is now been attributed to the collective response from the electromagnetic (EM) and charge transfer (CT) mechanisms, of which the former

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Self-assembled gold nanoparticles on the serpentine networks of Calf Thymus-DNA Langmuir-Blodgett films as efficient SERS sensing platform: Fabrication and its application in thiram detection

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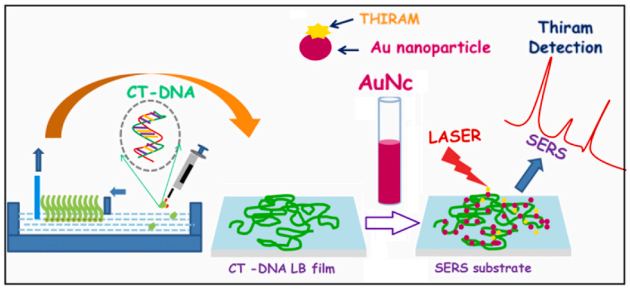
HIGHLIGHTS

- Fabrication of SERS active substrate from the Langmuir-Blodgett film of CT-DNA.
- Relaxation kinetics of CT-DNA molecules at the air-water interface studied.
- FESEM images of CT-DNA film exhibit complex pattern of serpentine networks.
- SERS active substrate used for thiram detection at ultrasensitive concentration.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Langmuir-Blodgett film
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Thiram detection

ABSTRACT

Fabrication of efficient SERS active substrates from the Langmuir-Blodgett (LB) films of Calf Thymus-DNA (CT-DNA) molecule after incubation into gold nanocolloid for 24 h has been presented. Relaxation kinetics of CT-DNA molecules at the air-water interface has been explicitly studied. The experimental observations from UV–Vis electronic absorption spectra together with the FESEM and AFM images of CT-DNA molecule organized in LB film collectively suggest the presence of H-type aggregated domains due to plane-to-plane self-association of the CT-DNA molecules on the surface of the LB film. XPS spectrum of the as prepared substrate has been unveiled to identify its chemical compositions while their morphological features are explored from the FESEM and AFM images. The SERS efficacy of the substrate has been tested with the 4-Mercaptopyridine (4-MPy) molecule at trace concentration. SERS enhancement factors ranging from 10^6–10^7 orders of magnitude have been evaluated for the characteristic bands of the 4-MPy molecule. The substrate not only exhibits appreciable spectral reproducibility, but it also confirms its stability and uniformity. The as prepared SERS active substrate has also been used for thiram detection at ultrasensitive concentration.

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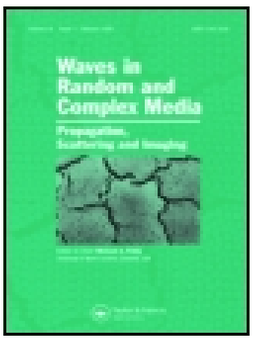

Waves in Random and Complex Media

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A two-temperature generalized piezo-thermoelastic problem with Eringen's non-local effect and memory-dependent derivatives under three-phase-lag heat transfer

Nasiruddin Mondal, Md Abul Kashim Molla & Sadek Hossain Mallik

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A two-temperature generalized piezo-thermoelastic problem with Eringen's non-local effect and memory-dependent derivatives under three-phase-lag heat transfer

Nasiruddin Mondal, Md Abul Kashim Molla and Sadek Hossain Mallik

Department of Mathematics & Statistics, Aliah University, Kolkata, India

ABSTRACT

This article deals with piezo-thermoelastic interactions in a homogeneous, isotropic generalized thermoelastic semi-infinite medium whose boundary is assumed to be traction free and subjected to a thermal loading. This study has been carried out in the context of two-temperature three-phase-lag generalized theory of thermoelasticity considering Eringen's non-local theory and memory-dependent derivatives. The governing equations of the problem are solved in Laplace transform domain by applying state space approach. The inversion of Laplace transform of the solutions has been done numerically. Numerical solutions obtained for different thermophysical quantities are represented in graphs to study the effects of different relevant parameters.

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Two-temperature generalized piezo-thermoelasticity; Eringen's non-local elasticity; three-phase-lag model; memory-dependent derivative; state space approach; vector–matrix differential equation

2010 MATHEMATICS SUBJECT CLASSIFICATION
74F05

1. Introduction

Generalized thermoelasticity, a new milestone in the theories of thermoelasticity, prevails over the vital imperfections of classical theories of thermoelasticity. Lord and Shulman [1] are the two pioneers who contributed first heavily to the coupled thermoelasticity by introducing generalized theory of thermoelasticity through alteration of the parabolic nature of the heat conduction equation to hyperbolic nature. They did this revolutionary change in the nature of the heat conduction equation by incorporating a relaxation time parameter in the Fourier's law of heat conduction and in doing so, the unrealistic phenomenon of infinite speed of thermal wave propagation was replaced by practical observation of finite speed of propagation of thermal waves. Later on a bunch of generalized thermoelastic theories viz., Green–Lindsay (G-L) theory [2], Green–Naghdi (G-N) theories [3–5], dual-phase-lag theory [6] and three-phase-lag theory [7] were introduced. To know in detail, one can go through the works of Ignaczak [8] and Chandrasekharaiah [9,10]. It is to mention that generalized thermoelastic theories are more acceptable in compared to the classical thermoelastic theories to tackle real-life oriented problems with high heat fluxes and very short interval of time, which generally occur in nuclear reactors, energy channels , LASER beams, etc.

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Interaction of newly synthesized dipeptide Schiff bases with mild steel surface in aqueous HCl: Experimental and theoretical study on thermodynamics, adsorption and anti-corrosion characteristics

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Highlights

- Dipeptide Schiff bases act as cathodic inhibitors for mild steel in aqueous HCl.
- The aromatic ring in the dipeptide backbone provides best inhibitory effect.
- DFT study interconnects electronic properties with inhibitory performance.
- Planar orientation of Schiff bases on metal surface is predicted by MD simulation and DFTB+calculation.
- Inhibitor to metal change transfer is proposed comparing PDOS curves for bonded and non-bonded inhibitor.

Abstract

Adsorption behavior and anti-corrosion propensity of three newly synthesized dipeptide Schiff bases are investigated using mild steel submerged in aqueous 1 M HCl. Electrochemical techniques (potentiodynamic polarization and electrochemical impedance spectroscopy) as well as gravimetric method are employed to ascertain the effect of concentration, temperature and immersion time on corrosion inhibition performance of the inhibitors. It is revealed that the Schiff base condensed between glycyl-L-tyrosine and indole-3-carboxaldehyde (GTI) imparts better inhibitory effect (greater than 98% inhibition efficiency) than those condensed between the same aldehyde and glycyl glycine

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Effect of the Heterocyclic Groups on the Anti-corrosion Performance of Heterocyclic Schiff Bases of Benzothiazole for Mild Steel in 1 M Aqueous HCl

Aditya Suhasaria[1] · Sanjoy Satpati[1,2] · Subhas Ghosal[1] · Sukalpa Dey[3] · Dipankar Sukul[1]

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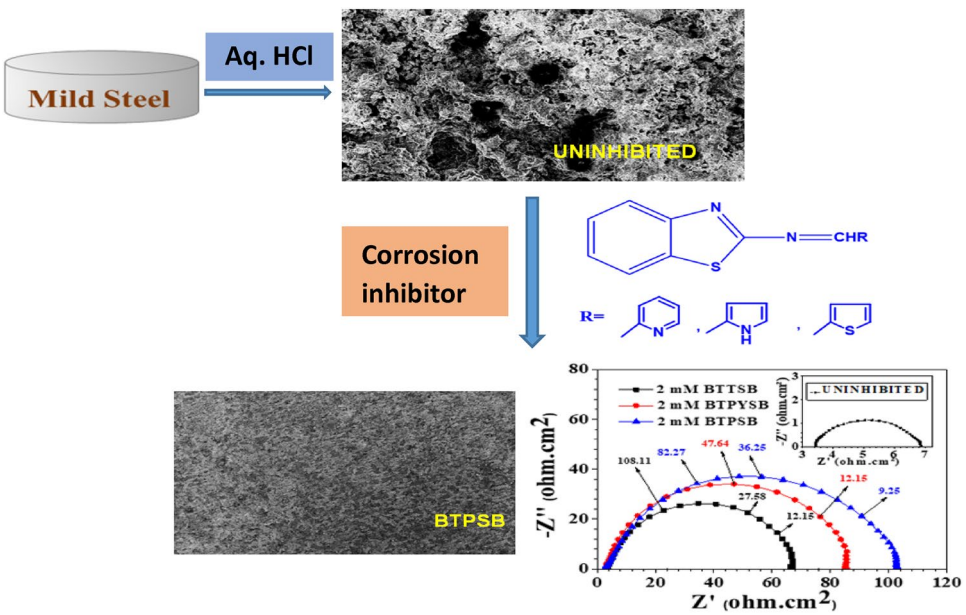
Abstract

Three different heterocyclic Schiff bases of benzothiazole were prepared through condensation of 2-amino benzothiazole with pyrrole-2-carboxaldehyde, pyridine-2-carboxaldehyde, and thiophene-2-carboxaldehyde, separately (abbreviated as BTPSB, BTPYSB and BTTSB, receptively). Their anti-corrosive propensity towards mild steel in 1 M aqueous HCl were tested using both electrochemical and gravimetric estimations. Effects of temperature and immersion time were also evaluated. BTPSB is found to be superior inhibitor among the three resulting in more than 97% of inhibition efficiency of mild steel when exposed for 48 h in aqueous HCl at 30 ℃. This is corroborated in terms of interaction energy as obtained from molecular dynamics (MD) simulation study. Benzothiazole (BT) Schiff bases act as mixed type inhibitor and their adsorption on mild steel surface are governed by different interactions, like van der Waals, electrostatic (physisorption) as well as charge transfer or sharing (chemisorption). From density functional theory (DFT) calculation and Fukui indices values of atoms, mode of interaction between the inhibitor molecules and Fe metal surface was ascertained.

Graphical Abstract



Keywords Mild steel · Benzothiazole Schiff base · Heterocyclic group · Corrosion inhibition · Density functional theory · Molecular dynamics simulation

Extended author information available on the last page of the article

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Diffusion-Induced Thickness Thinning of Spin-Coated Films in Crystalline Grain Boundaries: A Process of Amorphization

*Ajoy Mandal, Suman Mandal, Shiv Prakash Verma, Samik Mallik, Subhendu Sekhar Bag, and Dipak K. Goswami**

Complex molecular-level interactions of receptor molecules with semiconducting channels are often engineered to achieve higher sensitivity. However, integrating receptors in the sensor's semiconducting channel introduces deformation in crystallinity leading to poor device performance. In this work, the authors have shown how the growth of a peptide-based receptor molecule in the grain boundaries of pentacene semiconducting films can be controlled to maintain crystallinity with better integration. Pentacene has a bulk and a thin-film crystallographic phases with ≈5.8% higher lattice constant. As the receptor molecules diffuse into the grain boundaries, they systematically start impairing the thin-film crystalline phase to bulk depending on the amount of mass transport, ushering to a complete amorphization at higher doses of diffusion. A statistical analysis of rough surfaces has been conducted to study the evolution of thin-film morphology, which is connected to the diffusion of the spin-coated film. Besides, a thickness thinning of the spin-coated film is observed due to diffusion-related mass transport into grain boundaries, which has been explained with a new thickness thinning rate equation. The damage in the crystalline quality is confirmed qualitatively with residual compressive strain developed due to the diffusion of molecules into grain boundaries.

1. Introduction

Organic semiconductors (OSCs) molecules are primarily used as an active channel for fabricating organic field-effect transistors (OFETs). However, OFETs are often used to fabricate various sensors after integrating receptor molecules into conducting channels predominantly by selective surface-funcionalization techniques. Such methods are limited mostly to nanowire or 2D material-based conducting channels, leading to sensor fabrication complexity for scaling up. However, grain boundaries of semiconducting channel can be used for receptor integration to get easy access to the conducting channel using thin-film growth technique. In such cases, the performance of the OFET-based sensors depends on the growth, structure, and crystalline quality of the organic semiconducting films, as the interaction of receptor molecules with semiconductors can significantly affect charge conduction.[1,2] Besides, the crystalline quality of the conducting channel is often modified due to the diffusion of receptor molecules into grain boundaries, rendering compressive strain into films, and impairing molecular structures. Achieving a balance between better receptor integration at the cost of structural damage is paramount. In this regard, a proper understanding of the growth of receptor molecules into the semiconducting channel is very crucial in developing better OFET-based sensors. Over the last few decades, several theoretical models have been developed to correlate thin-film growth with different scaling exponents.[3–5] These scaling exponents determine surface roughness, correlation length, roughness exponent, etc. In most cases, these

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Experimental and theoretical investigation on the anti-corrosion characteristics of pyridine-substituted benzothiazole derivatives for mild steel in aqueous HCl†

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Three new 2-(2-pyridyl)benzothiazole derivatives, namely 2-(benzothiazol-2-yl)pyridin-3-amine (APYBT), 2-(benzothiazol-2-yl)pyridin-5-ol (HPYBT) and 2-(pyridin-2-yl)benzothiazole (PYBT), have been synthesized. Those are tested for their potentiality to impart corrosion resistance to mild steel exposed to 1 M aqueous HCl. Both electrochemical and gravimetric experiments establish the studied benzothiazole (BT) derivatives as promising corrosion inhibitors, with APYBT standing out as the most effective one exerting more than 97% inhibition efficiency at 1 mM concentration. PYBT exerts the least inhibitory performance. The electron donating property of the amine group present on the pyridine moiety in APYBT could be responsible for the superiority of APYBT as a corrosion inhibitor among the three. A potentiodynamic polarization study revealed that the inhibitors could retard both the cathodic and anodic reactions. The adsorption of the inhibitors on metal surfaces follows the Langmuir adsorption isotherm. SEM images provide visual confirmation of the protection of mild steel surfaces from corrosion in the presence of the studied benzothiazole (BT) derivatives. The interaction pattern between the mild steel and the inhibitors is explored using results derived from density functional theory (DFT) calculations. Variation of the interaction energy as obtained from molecular dynamics (MD) simulation confirms the corrosion inhibitory trend. Fukui index calculation enables the role played by the substituent group towards the relative electron donation/acceptance properties of the atoms present at the different parts of the inhibitor molecule.

Introduction

Corrosion leads to the deterioration of a material, resulting from its chemical reaction with the environment. Metals thus adopt a more stable form, such as oxide, hydroxide, or sulphide. Corrosion leads to the degradation of various desirable properties of materials and shortens their shelf-life. However, as corrosion is thermodynamically spontaneous, only preventive measures can be employed. In addition to various other methods, like cathodic protection, the application of a corrosion inhibitor is another cost-effective and practical method. Suitable organic inhibitors by virtue of the presence of π-bonds and lone electron pairs on the heteroatoms, like N, O and S, are adsorbed on the metal surface and block the cathodic or anodic reaction sites, or both.[1–9] However, due to their environmentally harmful effects, heavy metal-based inorganic corrosion inhibitors are now under a process of gradual replacement with relatively environmentally benign organic inhibitors. A recent report showed that a mixture of rare earth metal ions, like Ce^{3+}, in conjugation with amino acids, like cysteine, provides remarkable resistivity to corrosion of Al alloys in a saline environment.[10] In recent years, there has been a tremendous surge in research employing various categories of organic corrosion inhibitors. This includes different heterocyclic bases, like thiazoles, benzothiazoles, benzotriazoles, imidazoles, benzimidazoles, benzoxazoles and many others.[11–16] The examination of corrosion protection for mild steel in acidic environments is of primary interest among the researchers in this field. Steel is the most important structural and engineering material. High compressive and tensile strength, ductility and weldability, malleability, and above all relatively low cost

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† Electronic supplementary information (ESI) available: NMR, FTIR, mass spectra, EIS spectra, adsorption isotherms, Arrhenius plots, and Fukui indices. See DOI: https://doi.org/10.1039/d3cp01392h

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Research Article

MOF-Assimilated High-Sensitive Organic Field-Effect Transistors for Rapid Detection of a Chemical Warfare Agent

Samik Mallik, Shyam Chand Pal, Snehanjan Acharyya, Shiv Prakash Verma, Ajoy Mandal, Prasanta Kumar Guha, Madhab C. Das, and Dipak Kumar Goswami*

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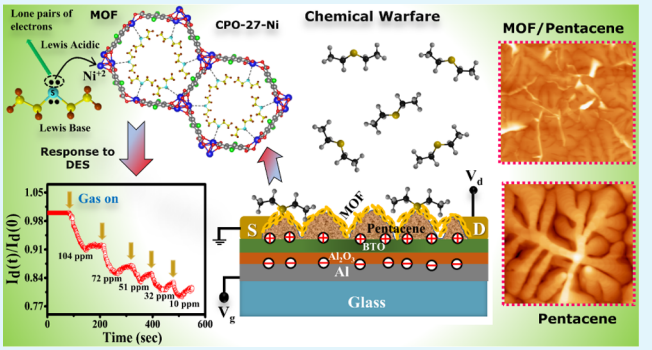
ABSTRACT: The selective and rapid detection of trace amounts of highly toxic chemical warfare agents has become imperative for efficiently using military and civilian defense. Metal−organic frameworks (MOFs) are a class of inorganic-organic hybrid porous material that could be potential next-generation toxic gas sensors. However, the growth of a MOF thin film for efficiently utilizing the material properties for fabricating electronic devices has been challenging. Herein, we report a new approach to efficiently integrate MOF as a receptor through diffusion-induced ingress into the grain boundaries of the pentacene semiconducting film in the place of the most adaptive chemical functionalization method for sensor fabrication. We used bilayer conducting channel-based organic field-effect transistors (OFETs) as a sensing platform comprising CPO-27-Ni as the sensing layer, coated on the pentacene layer, showed a strong response toward sensing of diethyl sulfide, which is one of the stimulants of bis (2-chloroethyl) sulfide, a highly toxic sulfur mustard (HD). Using OFET as a sensing platform, these sensors can be a potential candidate for trace amounts of sulfur mustard detection below 10 ppm in real time as wearable devices for onsite uses.



KEYWORDS: *organic field-effect transistors (OFETs), metal−organic frameworks (MOFs), chemical warfare agents (CWAs), recrystallization, sulfur mustard stimulants detection, Lewis acid−base interaction*

INTRODUCTION

Over the last few decades, industrial revolutions around the world have initiated a new threat to the environment by generating toxic gases. This leads to the urgency for the development of different types of gas sensors for careful and accurate monitoring.[1,2] During World War I (WWI), the chemical warfare agents (CWAs) used were highly toxic, and the exposure of a trace amount was enough to cause casualties of millions of people.[3,4] Therefore, quick detection of CWAs are crucial to deaden the persistent threat of terrorist activities to humankind. However, the issues like stability, sensitivity, and poor detection limit are hindering the realization of the sensors in real-time use. These limitations demanded some emerging materials, which lead to the discovery of crystalline hybrid materials with some structural diversity. Metal−organic frameworks (MOFs) have grown immensely over the last 20 years and are considered excellent sensing materials due to their high sensitivity in sensing various analytes, ultrahigh porosity, and large effective surface area.[5,6] During the past few years, researchers have used MOFs in the areas of catalysis,[7,8] gas storage,[9] gas separation,[10] supercapacitor,[11] gas sensors,[12−14] and optoelectronic-based sensors.[15] Besides these applications, MOFs also found applications in microelectronics industries for device fabrication as active channel materials or low-κ dielectric materials.[16,17] However, this ongoing interest in the fabrication of high-quality, homogeneous, and crystalline MOF thin film is still a challenge as there is no suitable solvent available to dissolve MOF materials properly.[18] Thus, a few methods have been used to fabricate MOF thin films such as layer-by-layer,[19] Langmuir−Blodgett (LB),[20] direct syntheses from mother solution,[21,22] seeded growth,[23] electrochemical methods,[24] spray coating,[25] and spin coating method.[26] However, the growing of uniform film under a device geometry is a challenge to exploit the material's unique properties. In this work, we have developed a new methodology to integrate MOF using a simple spin coating technique through diffusion-induced ingress into the grain boundaries of the underlying semiconducting layer and formed a well-ordered bilayer organic conducting channel for the fabrication of organic

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