INTERNATIONAL CONFERENCE ON



FUTURE ASPECTS OF SUSTAINABLE TECHNOLOGIES

11 - 12 November, 2019





Organized by: **CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR** (Deemed to be University under MHRD, Govt. of India) KOKRAJHAR, ASSAM, PIN- 783370, INDIA



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International Conference

on FUTURE ASPECTS OF SUSTAINABLE TECHNOLOGIES

11th – 12th March, 2019 Venue: Central Institute of Technology Kokrajhar

Organised by,



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केन्द्रीय प्रौद्योगिकी संस्थान कोकराझार CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

Deemed to be University, MHRD, Govt. of India Kokrajhar, BTAD, Assam 783370

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FROM THE DESK OF DIRECTOR



02.11.2019

It gives me immense pleasure to share with you that Central Institute of Technology Kokrajhar, Deemed University Status, is organising International Conference. The theme of the conference on "*Future Aspects of Sustainable Technologies*" is very enriching and encouraging which includes all possible viable science and technology. The institute is taking a step towards creating a healthy academic horizon much needed for all-round development of the national with international flavour. I welcome all esteemed delegates and participants to deliver their interesting & valuable talks in the conference FAST-2019.

I acknowledge efforts put by all organizing members. I wish a grand success.

Delifumer chetheharte:

Prof. Debkumar Chakrabarti Officiating Director CIT Kokrajhar Concurrently Professor at IIT Guwahati

Message

I am delighted that the Central Institute of Technology Kokrajhar (Deemed to be University) has taken the initiative to organise an International Conference with the thematic focus of 'Future Aspects of Sustainable Technologies' (FAST-2019) on 11-12 November 2019.

The humanity as a whole is now increasingly concerned about the ongoing extensive destruction of environment and ecological system, growing air, water and soil pollution, and the worsening impacts of climate change. Like never before, governments and their partners around the world are developing and implementing policies and practices as efforts towards achieving *sustainable development*, a term made popular in late 1980s by the Brundtland Report. The *Rio+20 Summit* of 2012 and the *2030 Agenda for Sustainable Development* adopted by the United Nations General Assembly in 2015 reconfirmed the global commitment in this direction.

Technologies of the future must address the multifarious challenges of sustainable development. Therefore, we need to contemplate, share and discuss all possible ideas for the development of future technologies that can help the humanity follow innovative pathways towards achieving the various dimensions of integrated sustainable development.

It is in this context that the International Conference on the 'Future Aspects of Sustainable Technologies' is an important step taken in the right direction by the Central Institute of Technology Kokrajhar.

I extend my congratulations to the Central Institute of Technology Kokrajhar on this innovative initiative and wish FAST-2019 a grand success!

Distinguished Prof. Bharat Dahiya

Director, Research Center for Integrated Sustainable Development, College of Interdisciplinary Studies, Thammasat University, Bangkok, Thailand

Distinguished Professor, Urban Youth Academy, Seoul, Republic of Korea

Series Editor, SCOPUS-indexed book series, Advances in 21st Century Human Settlements, Springer Nature, Singapore

OFFICE OF THE VICE-CHANCELLOR : BODOLAND UNIVERSITY

Debargaon, P.O. Rangalikhata Kokrajhar – 783370, BTC, Assam.



Tel. No. 03661-277127 (O) Fax No. 03661-277127 (O

Date: November 1, 2019

Message

There is no better platform than international conference for sharing and exchange of scientific knowledge on recent advances in areas pertaining to welfare of the present and future generations. I am glad that Central Institute of Technology (CIT), Kokrajhar has chosen a very pertinent broad theme "Future Aspect of Sustainable Technologies" (FAST-2019), for the international conference to be held during November 11-12, 2019.

I believe that a number of experts and academicians from various fields of S & T shall deliver talk and exhibit poster reflecting the results of intensive research which shall be impetus for sustainable growth and development of the region.

My best wishes to the Organizing Committee for a very successful conference.

(Prof. Laishram Ladusingh) Vice-Chancellor Bodoland University Vice-Chancellor Bodoland University Kokrajhar



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FROM THE DESK OF REGISTRAR



04.11.2019

Greetings from CITk......

It is with much pleasure that our institute is going to organize the International Conference on "Future Aspects of Sustainable Technologies" 11-12 November 2019. This conference will bring wave of knowledge from different fields and different parts of the world with national to our institute.

With this message, I am honoured and delighted to welcome you to attend this conference. I welcome each and every participants of the conference to feel the learning environment of CIT Kokrajhar and to make the event grant success.

As one of the active member, I believe that the success of the conference depends ultimately on all members who have worked extremely hard for the details of important aspects of the conference program FAST-2019.

Finally, I wish the conference great success.

Ms. Chaitali Brahma Registrar CIT Kokrajhar, Assam

 FUTURE ASPEC
 International Conference on 'Future Aspects of Sustainable Technologies'

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 Organised by,

 TECHNOLOGI
 Central Institute of Technology Kokrajhar



FROM THE DESK OF CONVENER





places. We believe that this conference will provide a wide and versatile platform to exchange the scientific as well as technological knowledge along with diverse applications towards the society.

We have received a very good number of participants for both oral and poster presentation from varied area of science and technology covering a wide spectrum of themes related sustainability. We are very much happy to publish all those as a conference abstract book along with inspiring messages. We hope, this book will be a valuable and memorable asset for the contributors, host institute as well as other Academic and Research bodies.

On behalf of organizing committee of FAST-2019, I would like to extend our gratefulness to the Director, Professor Debkumar Chakrabarti, for his approval with strong encouragement. We also very much obliged to Registrar Mrs. Chaitali Brahma for her continuous support and cooperation in all dimensions. We would like to appreciate the immense cooperation of Bodoland Territorial Council (BTC) and Indian Oil Corporation Limited (IOCL), Bongaigaon. The programme would not be up to the mark without the full contribution of members of organizing committee, staffs, chief guests, research scholars, speakers, delegates, participants, students, volunteers, and all who have joined their hands to make the event grand success. So, we are very much thankful to them from bottom of heart.

We would like to convey our best wishes to you all and appeal you to make our conference a great success.

With Best Regards



Dr. Pranjal Kalita Convener, FAST-2019 CIT Kokrajhar DR. PRANJAL KALITA CONVENER, FAST 2019 CIT KOKRAJHAR, ASSAM

FAST 2019 11th - 12th Nov, 2019 Central Institute of Technology Kokrajhar



FROM THE DESK OF CO-CONVENER, CIT KOKRAJHAR

It is my immense pleasure to welcome you all the great scientists, academicians, young researchers, Business delegates and students from all over the world to the International Conference on "Future Aspects of Sustainable Technology (FAST-2019)", 11 & 12 November-2019 at CIT Kokrajhar, organized by Central Institute of Technology Kokrajhar (Deemed to be University).

We believe that this conference will share an insight into the recent research and cutting edge technologies among a brilliant multi-disciplinary group of scientists, engineers, researchers, business delegates and talented student communities across the world with their exchange of break-through ideas. Consequently the conference will promote the recent outstanding achievements in the field of science and technology at international level to fulfil the future trends and demands.

Thus we are looking forward to an excellent conference with great scientists and engineers as well as researchers from different institutes around the world and would like to extend our heartiest thanks to you all for your positive effort making the conference a grand success.

I would like to convey my best wishes to you all.

With Best of regards

Dr. Manasi Buzar Baruah





ARIEL VIEW OF CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

MEMBERS OF ORGANIZING COMMITTEE (FAST - 2019)

Patron: Mr. Kampa Borgoyary, Deputy Chief, BTC Chairman: Prof. Debkumar Chakrabarti, Director CITK Convener: Dr. Pranjal Kalita Co-Conveners: Dr. Gautam Chandra Roy & Dr. Manasi Buzar Baruah



CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR (Deemed to be University under MHRD, Govt. of India) KOKRAJHAR, ASSAM, PIN- 783370, INDIA

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International Conference Future Aspects of Sustainable Technologies (FAST-2019) Central Institute of Technology, Kokrajhar, Assam, India November 11-12, 2019

Distinguished Prof. Bharat Dahiya

Director, Research Center for Integrated Sustainable Development, College of Interdisciplinary Studies, Thammasat University, Bangkok, Thailand Distinguished Professor, Urban Youth Academy, Seoul, Republic of Korea

Title of Keynote Address:

Sustainable Development and Technologies for the Future

Abstract: The world community at present is confronted multifarious challenges with regard to sustainable development. Whether they are the burning fires of Amazon rainforest in Latin America, the water-scarce cities and villages of Asia, or the persisting problems of poor sanitation in Sub-Saharan Africa, the much-celebrated idea of sustainable development provides a glimmer of hope to people around the world. Coined in 1987, the term sustainable development has come to connote the evolving social and environmental challenges as well as the hopes for the continuation of human and other living beings on our planet Earth in the future. In many countries, the disturbing juxtaposition of addressing social and environmental issues versus promoting economic development is all too familiar.

With this brief emergent and contextual background, the question that the humanity needs to pose to itself is: Whether our efforts to bring forth much needed innovations and develop future technologies contribute to promoting the global cause of sustainable development, and if so, in what ways; if not, then why not? This question is particularly pertinent for the FAST-2019 International Conference.

This keynote will discuss the linkages between *sustainable development and technologies for the future*. In doing so, first, it will explore the interface between sustainable development and future innovations in technology. Second, it will look into why innovation in technology is increasingly important now and in the future. Next, the keynote will concentrate our attention on understanding the idea of innovation and technology in its historical framework. In the final section, our effort will be on re-focussing the purpose of future technologies at multiple geographical scales vis-à-vis sustainable development.

Moving forward, what is needed is to make sure that the advances in technologies for the future—as scientific *and* creative human endeavours—aptly respond to the current and evolving challenges of sustainable development around the world in order to make our planet Earth a better place to live for all living beings.

Engineering Crystals of Coordination Solids: The Chemistry beyond Molecules

Manjit K. Bhattacharyya

Department of Chemistry, Cotton University, Guwahati, Assam, India E mail: manjit.bhattacharyya@cottonuniversity.ac.in

Abstract: Crystal engineering is the enthusiastic design and synthesis of new crystalline materials with prominence on finding strategies and logical ways to control or engineer properties [1]. The goal of crystal engineering is to recognize and design synthons [2] that are vigorous enough to be exchanged from one network structure to another that ensures generality and predictability. Some of the recently reported promising and unconventional new supramolecular synthons are pi- and sigma-hole interactions and can be considered as positive electrostatic potentials that are capable of interacting with electron dense regions in the crystal structures [3, 4].

The structural diversity and supramolecular association in coordination complexes depends on the appropriate choice of the ligands, the coordination geometry of the central metal, the character of solvent used and the ratio of metal salt to organic ligands [5, 6].

In order to explore rational design of supramolecular synthons, the cooperative interplay of non-covalent contacts as well as the solvent driven structural topology, we have synthesized and investigated structures of a few coordination solids of transition metals [7-9]. The energetically significant sigma-hole, pi-hole and anti-electrostatic hydrogen bonds unfold new synthons for engineering coordination solids of desired architectures and properties.

References

[1] Maity, T.; Mandal, H.; Bauza, A.; Samanta, B.C.; Frontera, A. Seth, S.K.; *NewJ.Chem.*, **2018**, *42*, 10202-10213

[2] Desiraju, G.R., Angew. Chem. Int. Ed. Engl. 1995, 34, 2311-2327.

[3] (a) Gogoi, A.; Islam, S.M.N.; Frontera, A. and Bhattacharyya, M.K. *Inorg.Chim. Acta*, 2019, 484, 133-141. (b) Dutta, D.; Nath, H.; Frontera, A. and Bhattacharyya, M.K. *Inorg.Chim. Acta*, 2019, 487, 354-361. [4] Bhattacharyya, M.K.; Saha, U.; Dutta, D.; Das, A.; Verma, A.K. and Frontera, A, *RSC Advances*, 2019, 9, 16339-16356. [5] Bhattacharyya, M.K.; Gogoi, A.; Chetry, S.; Dutta, D.; Verma, A.K.; Sarma, B.; Franconetti, A. and Frontera, A.; *J. Inorg. Biochem.*, 2019, 200, 110803. [6] Dutta, D.; Islam, S.M.N.; Saha, U.; Frontera, A. and Bhattacharyya, M.K. *J. Mol. Struct*, 2019, 1195, 733-743. [7] Islam, S.M.N.; Dutta, D.; Frontera, A., Bhattacharyya, M.K., *Inorg.Chim. Acta*, 2019, 487, 424–432. [8] (a) Gogoi, A.; Dutta, D.; Verma, A.K.; Nath, H.; Frontera, A.; Guha, A.K. and Bhattacharyya, M.K., *Polyhedron*, 2019, 168, 113-126. (b) Saha, U.; Dutta, D.; Nath, H.;Franconetti, A; Frontera, A. and Bhattacharyya, M.K., *Inorg.Chim. Acta*, 2019, 488, 159-169. (c) Saha, U.; Dutta, D.; Bauzá, A.; Frontera, A.; Sarma, B. and Bhattacharyya, M.K. *Polyhedron*, 2019,159, 387-399. [9] (a) Islam, S.M.N.; Dutta, D.; Guha, A.K. and Bhattacharyya, M.K., *Mol. Struct*, 2019, 1175, 130-138. (b) Gogoi, A.; Das, A.; Frontera, A.; Verma, A.K. and Bhattacharyya, M.K., *Inorg.Chim. Acta*, 2019, 493, 1-13.

Nematic/Modulated Nematic Phase in bent core mesogens

Manoj Kumar Paul Department of Chemistry, Assam University, Silchar-7880011 Email: paulmanojaus@gmail.com



Abstract: Nematic phase is the technologically most important mesophase and the backbone of the multibillion-dollar display industry. Modulation in this nematic phase viz., the formation of heliconical twist-bend (N_{TB}), splay-bend (N_{SB}), screw (N_S) structure, macroscopic biaxiality(N_B), etc. is the thrust area of current liquid crystal research due to their promising potentiality for use in ultrafast switching devices and in photonics. The bent curvature in molecular architecture lead to stabilize these modulations via formation of biaxial ordering or by inducing twist-bend helicity or splay bend in the nematic phase. So, significant number of bent-core molecules have been synthesized that exhibited nematic ordering having a rich variety of complexity of molecular structures regarding the bending unit (bent angle and polarity), linking moieties between two aromatic rings (direction and polarity), substitutions at the outer and/or core unit (position, size, and polarity), terminal chains (nature and length), and so forth. Unfortunately, till today, there is no unequivocal claim of biaxial nematogen¹ that can revolutionize the modern LC-based switching device technology. Interestingly, it is noted that only one piperazine based bent core mesogens² exhibiting twist bent nematic phase. Therefore, rational design of the bent core molecule is important for the elucidation of the structure-property relationship of the nematic and modulated nematic phase.

In this presentation, we will present design and synthesis of the heterocyclic $(1,3,4-\text{oxadiazole}^{3a-3c}$ and 1,3,4-thiadiazole $^{4a-4b}$) and non-heterocyclic (substituted 1,3,phenylene) $^{5a-d}$ based new hockey stick shaped mesogens and their structure-property relationships.

References

[1] Francescangeli O, Samulski ET. Soft Matter. 2010;6:2413-2420.

[2] Chen D, Nakata M, Shao R, Tuchband MR, Shuai M, Baumeister U, Weissflog W, Walba DM, Glaser MA, Maclennan JE, Clark NA. Phys. Rev E. 2014;89:022506.

[3] (a) Saha SK, Bhattacharya B, Sarkar U, Rao DSS, Paul MK.. J. Mol. Liq. 2017; 241:881-896;
(b) Saha SK, Paul MK, Chandran A, Khanna PK, Biradar AM. Liq. Cryst. 2017; 44:1739-1750; (c) Saha SK, Paul MK. Liq. Cryst. 2018;46:386-396.

[4] (a) Saha SK, Deb J, Sarkar U, Paul MK. Liq. Cryst. 2017; 44: 2203-2221; (b) Saha SK, Mohiuddin G, Paul M K, Gupta SP, Khan RK, Ghosh S, Pal SK. ACS Omega.2019; 4:7711-7722.
[5] (a) Paul MK, Kalita G, Laskar AR, Debnath S, Gude V, Sarkar DD, Mohiuddin G, Varshney SK, Rao NVS. J.Mol.Struct.2013; 1049:78–89. (b) Nafees A, Kalita G, Paul MK, Sinha A, Rao NVS. RSC Adv. 2015; 5:7001-7006; (c) Nafees A, Sinha A, Rao NVS, Kalita G, Mohiuddin G, Paul MK. RSC Adv., 2016, 6, 43069-43079; (d) Paul MK, Saha SK, Kalita G, Bhattacharya B, Sarkar U. Dyes and Pigments., 2018; 10.1016/j.dyepig.2018.12.028.

Advances in bioenergy and solar energy research

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Abstract: Most of the commercial energy demand (~70 %) in India is largely met by imported and own fossil fuels such as Coal, Oil, and Gas, which will be exhausted within the next few decades. Increased use of fossil fuels causes environmental problems both locally and globally. Carbon dioxide emissions from burning fossil fuels are believed to be the main factor for alarming rise in global temperatures. Conference of Parties 21 held at Paris in the year 2015 strictly warned and asked the nations to reduce their greenhouse gas emission levels. Fortunately, India is endowed with vast potential of renewable energy viz. biomass, solar, wind, geothermal and small hydropower with current energy contribution at 24.5 % of total installed capacity of 360.456 GW. India has seen an annual growth rate of about 23% for renewable energy protuctions in India particularly in North Eastern region. This discussion aims to encompass the opportunities, challenges and technologies related to the implementation of bio-energy and solar energy devices. Fundamentals and advances in biochemical and thermochemical conversions of biomass and solar collectors like solar thermal, photovoltaic and PV/T's are discussed. Finally integration of those technologies for sustainable energy production is emphasized.

Opportunity and Initiatives of DST-Govt of India Towards Clean Energy

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Abstract: The initiative supports fresh ideas/ concepts, including feasibility assessment of various emerging and disruptive technologies, for their potential conversion into useful technology/ product. This is intended to be achieved through promoting oriented basic, applied and pre-competitive translational research for progressively achieving enhanced Technology Readiness Levels (TRLs).

The scheme directly caters to furthering the Sustainable Development Goal #7 (SDG 7) which aims to ensure access to affordable, reliable, sustainable and modern energy for all. The scheme also addresses some of the objectives of SDG#11 which aims to make cities and human settlements sustainable. As the scheme focuses on strengthening R&D capacity and collaboration framework in energy efficiency and Clean Energy, the scheme has potential to contribute to INDC targets of reducing the emission intensity of GDP and creating strong domestic and international framework. The scheme has to potential to be linked with several development programmes such as Saubhagya Yojana, National Solar Mission, Ujjwala Yojana, Make in India etc.

The Target Beneficiary of scheme include Academic Institution; Public funded R&D Organisation; SIRO Recognised Industrial units; Academic Institution; Local Bodies (Urban & Rural); Voluntary Organisation & Trusts; State S&T Council and Department; Autonomous Bodies at State & Central Level Dealing in subject area and Public Sector.

Biodiesel Production Using High FFA feedstocks

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Abstract: Worldwide biodiesel is being produced mainly from edible and non-edible oils. The choice of oil depends primarily on availability, price, and the policy adopted by the governing agencies. The economic aspects of biodiesel production are the barriers for its commercial success. The production of biodiesel from non-edible oils may offer solutions for various issues involved in the assessment of biomass-based industry for energy generation. Currently, non-edible rubber seed oil extracted from the seeds of rubber trees is getting more attention for production of biofuel, because in the latex manufacturing process, rubber seeds are not historically collected and commercialized. The useful properties of the rubber seed oil make it similar to well-known linseed and soybean oil. Hence considering this as a motivation the present work describe the synthesis of biodiesel from non-edible oil seeds and waste oil which are abundant in North East part of India and utilization of solid by- product to cover major aspects of biofuels production.

Keywords: Oil seeds, biodiesel, by products, waste oils.

Conceptualizing a National Sustainable Technology Roadmap: Glance through Socio Economic Framework

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Abstract: TIFAC (Technology Information, Forecasting and Assessment Council, the Autonomous Body under Department of Science & Technology, Government of India), in its vision document (Technology Vision 2035) suggested the future vision holistically, based on the current technological status of India, covering almost all areas of life (viz., Clean air and potable water, Food and nutritional security, Universal healthcare and public hygiene, Affordable energy during 24×7, Decent Habitat, Education, livelihood and creative opportunities, Safe and speedy mobility, Public safety and national security, Cultural diversity and vibrancy, Transparent and effective governance, Disaster and climate resilience and Ecofriendly conservation of natural resources). Useful technologies and their researches covering the above 12 sectors have been grouped to fall into four distinct phases (ready for deployable, require field trial only, further research remained and only at conceptual stage). Further, India is also committed to work to achieve the United Nation's 17 Sustainable Development Goals (No Poverty, Zero Hunger, Good Health and Wellbeing, Quality Education, Gender Equality, Clean Water and Sanitation, Affordable and Clean Energy, Decent Work and Economic Growth, Industry, Innovation and Infrastructure, Reduced Inequality, Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action, Life Below Water, Life on Land, Peace and Justice Strong Institutions and Partnerships to achieve the Goal). Combining the above ideas, concept of a Sustainable Technology Roadmap for India is discussed in this work with first hand experiences of some efforts of development and intervention of technologies. Socially relevant realistic research with interdisciplinary focus to address the nationally mandated issues is emphasized.

Study on morphological, mechanical and thermal behaviours epoxy composite reinforced with fibres and manomaterials

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Abstract: Due to the expanding area of applications, the demands of natural fibres composites have been increasing day by day. Composite materials have large potential to replace conventional metallic and synthetic materials. Unique properties like light weight, non-toxic, non-abrasivity, easy availability, low cost and biodegradable in nature of natural fibres makes the composite materials more potentiality for commercial applications. At present, the use of these composite materials is gradually increasing in many engineering applications like marine, defense, sports goods and many other automobile sectors.

Even though numbers of composite materials with synthetic fibres such as glass fibres, rayon, nylon etc. and metallic fibres have been used as reinforcing agent but natural fibres have uniqueness among them because of its extraordinary properties with significant strength and stiffness.

Epoxy based composite material reinforced with fibres and carbon nanomaterials derived from waste materials have been developed and investigated physical, mechanical and thermal properties of this material. It has been found that the physical and mechanical properties of the composites such as tensile strength, flexural strength, impact strength and hardness were marginally increased by the fibres content in it. Also nanomaterials have found to be unique reinforcing materials to improve the different properties of composite materials.

Keywords: Composites, fibres, nanomaterials, nanocomposites, epoxy

Bio Crude Co-refining: The Untapped Opportunity for India

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Abstract: Refinery integration of pyrolysis oil/bio–crude could provide higher degree of national energy security in environmental friendly and sustainable manner by supplementing conventional energy resources. It will reduce dependence on imported fossil fuels. The co-refining study of bio crude in Indian refinery set up is of critical importance for correct assessment of techno-economic feasibility for sizeable replacement of petro-crude in India.

Recently published IEA data shows that bio–crude co-processing upto 5 % is economically feasible in near term and upto 10% is feasible with progress in industry and technology. It also indicates that low biomass cost and pyrolysis R&D to further reduce bio crude production cost will accelerate large economical deployment of this technology. It estimates the global potential of over 40 billion litter biofuels with 10% pyrolysis oil/bio crude integration in refinery FCC units. However, the study also reveals that there would be an optimal hand off point between the bio refinery and the petroleum refinery. More data for co-processing of bio crude and partially upgraded bio crude are needed to further investigate this optimization.

The major questions for bio-crude refinery integration seems to be the correct assessment of the trade-offs for co-processing conventional petroleum feeds with biomass derived crude, degree of up-gradation required to co-process bio crude into refinery, the technical risks and finally how the future economy looks like based on the pilot scale techno-economic assessment studies.

The presentation will cover the key findings from some significant pilot scale studies on bio crude co-refining conducted globally. This will also cover the technology status of pyrolysis processes for bio crude production in India and its co-refining prospects including the technology developed in TERI. This will also throw light on the R&D need to drive commercial deployment of the pyrolysis technology in India.

Additionally TERI's other research initiatives on liquid biofuels i.e. UCO based Biodiesel, Algal biofuels and Biojet fuel will be briefly shared.

ORAL PRESENATIONS

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Hybrid Model to Predict Pore Pressure and Design of Safe & Economical Well from Seismic Velocity at the Top of Baramura Anticline, Tripura, India: A New Approach

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Abstract: The Baramura anticline falls in the state Tripura, North - East India. The anticline is extended upto neighbor county Bangladesh. The region is characterized by huge anticlines, normal faults and abnormally pressured formations which causes a wide margin of uncertainties in wildcat well planning and design. These geological complexities of Baramura anticline make the drilling engineers more challenging. Therefore a proper well design is essential in such a region to prevent blowout. Pore pressure plays an important role to design a safe and economical well in such a high pressure and temperature reservoir. A hybrid model is developed to predict pore pressure from seismic velocity data. The hybrid model is validated by a well-known method modified Eaton's method and RFT pressure data from offset wells. An excellent match with pore pressures estimated from RFT pressure data and predicted by hybrid model along with modified Eaton's method are observed in this research work. The efficiency and accuracy level of the hybrid model is more as compared to other methods as it does not required compaction velocity data, thus an error caused by manual compaction trend can be eliminated. Pore pressure predicted by hybrid model indicate result up to the 6000 m, which is up to the basement rock. The predicted pore pressures by hybrid model are used as an input to calculate the fracture pressure by Hubbert and Willis method, Mathews and Killy method and modified Eaton's method (Eaton, 1969). Equivalent mud weight selection is done using median line principle with an additional 0.3ppg, 0.3ppg and 0.2ppg Swab pressure, Surge pressure and safety factor respectively for calculation of all casing pipe. Casing setting depths are selected based on pore pressure gradient, fracture pressure gradient and mud weight using graphical method. Here four types of casing setting depths are selected: conductor, surface, intermediate and production casings at 100ft, 6050ft, 15500ft and 18500ft respectively. The casing policy is selected based on burst pressure, collapse pressure and tension load. For each casing kick tolerance in bbl is determined from kick tolerance graph to prevent the blowout. Finally a safe and economical well is designed on the top of Baramura anticline along with target depth selection, casing setting depth selection, casing policy selection and kick tolerance with consideration of collapse pressure, burst pressure, and tension load gives a clear picture of well planning on the top of anticline in pore pressure point of view.

References:

 Eaton, B. A., 1969. Fracture Gradient Prediction and Its Application in Oilfield Operations. Journal of Petroleum Technology, 21(10), pp. 1353-1360.

Analysis of the impact of climatic parameters on the rainfall, in Brahmaputra plain of Northeast region of India.

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Abstract: This study utilizes wavelet transformation (CWT, XWT, WTC), Hurst Exponent (H_w), Mann-Kendall (MK) test to explores multi-time scale feature, covariance, chaotic nature and significant trend of climatic parameters (i.e. rainfall, air temperature, relative humidity and pressure) in the Brahmaputra plain, adjacent to foot hill region of Arunachal Himalaya for period 1901-2018 and 1958-2018. Due to receiving heavy rainfall, especially in monsoon season, this region often causes flood. Result of MK test reveal a significant trend in monthly and seasonal scale. In most of the case, H_w shown persistence behaviour. CWT detected a statistically significant cycle of 2 and 6 year's period. Apart from 12-month period, another 2, 4, 6-month significant cycles were also detected. All these semi-annual and annual period were confirmed by the global wavelet spectra. Finally the modulation of 2-6 year and 8-16 month bands were examine by Scale-average wavelet power over 2-6 year and 8-16 month band. The results of XWT and WTC show that monthly rainfall variability correlates with climatic parameters fluctuations at 6 and 12-month. Other time-scale correlations at 2 and 6-year marks are also highlighted between the different time series. These correlation of climatic parameters constitute a dominating factor and explain the temporal variation of rainfall in the study region.

Keywords: Wavelet transformation, Hurst Exponent, Mann Kendall test, Brahmaputra plain.

Supramolecular Association involving unconventional Contacts in Pyridine based Transition Metal Coordination Solids: Antiproliferative Evaluation and Theoretical Studies

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Abstract: Crystal engineering of transition metal coordination solids has grown as an immense research topic in recent years due to their potential applications in biology, catalysis, adsorption, magnetism, molecular recognition, nonlinear optics, and sensors [1–2]. The construction of desired architectures with potential applications depends on various synthetic factors, such as the nature of the metal centers, counter ions and the reaction conditions [3-4]. In this respect, the suitable selection of organic moieties as ligands play a decisive role for the construction of architectures in coordination solids with desired dimensionalities [5]. The cooperative action of non-covalent supramolecular interactions play crucial role in the stability of such solids [6]. The proper fusion of experimental and theoretical studies explores new dimension to investigate the significance of such supramolecular contacts [7].

As a part of our efforts to explore supramolecular interactions, we have synthesized and investigated structures of a few coordination solids of transition metals. Unconventional antiparallel CO···CO and electrostatically enhanced π - π interaction stabilizes the architectures [8-9]. The *in-vitro* anticancer activities of the compounds have been investigated.

References:

1. Gogoi, A.; Islam, S.M.N.; Frontera, A.; Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 484, 133.

2. Saha, U.; Dutta, D.; Nath, H.; Franconetti, A; Frontera, A.; Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 488, 159.

3. Dutta, D.; Nath, H.; Frontera, A.; Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 487, 354

4. Dutta, D.; Chetry, S.; Gogoi, A.; Choudhury, B.; Guha, A.K. and Bhattacharyya, M.K. *Polyhedron*, 2018, 151, 381.

5. Bhattacharyya, M.K.; Gogoi, A.; Chetry, S.; Dutta, D.; Verma, A.K.; Sarma, B.; Franconetti, A.; Frontera, A.; *J. Inorg. Biochem.* 2019, 200, 110803.

6. Saha, U.; Dutta, D.; Bauzá, A.; Frontera, A.; Sarma, B. and Bhattacharyya, M. K. Polyhedron, 2019, 159, 387.

7. Islam, S.M.N.; Dutta, D.; Frontera, A., Bhattacharyya, M.K. *Inorg. Chim. Acta*, 2019, 487, 424. 8. Islam, S.M.N.; Dutta, D.; Sharma, P.; Verma, A.K.; Frontera, A.; Bhattacharyya, M.K.; *Inorg. Chim. Acta*, 2019, 498, 119108.

9. Islam, S.M.N.; Dutta, D.; Verma, A.K.; Nath, H.; Frontera, A.; Sharma, P.; Bhattacharyya, M.K.; *Inorg. Chim. Acta*, 2019, 498, 119161.

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Fuzzy solution of Traffic Jam Problem

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Abstract: Now-a-days almost every city is facing a big problem which is the traffic jam problem. One of the major hurdles of a city is to handle this traffic jam. Here I try to describe a method to avoid traffic jam through a mathematical approach (by fuzzy sets). This method can help to find a suitable route from one place to other place with lesser time than the other routes connecting the places.

Bibliography :

- 1. L.A. Zadeh, Fuzzy sets, Information control 8 (1965), pp. 338 353.
- 2. George. J Klir, Bo Yuan, Fuzzy sets and Fuzzy Logic, 1995, pp. 11-16.
- 3. C. R. Bector & Suresh Chandra, Fuzzy Mathematical Programming and Fuzzy Matrix Games, 2005, pp. 95-115.
- 4. John Clark & Derek Allan Holtan, Graph theory, 1991, pp.1-11.

Structural, Magnetic and Electrical Transport Properties of Multiferroic Spinel CdCr₂Se₃S

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Abstract: The Local structure around Cr^{3+} , magnetic properties and electrical transport behavior of single phase multiferroic spinel $CdCr_2Se_3S$ prepared by solid state reaction route have been presented here. The difference in Cr-Se and Cr-S bond length observed in EXAFS measurement shows the significant local lattice distortion of Cr-Se/S octahedral geometry. This local lattice distortion plays a vital role in determining the magnetic properties of this class of spinel. This compound exhibits soft ferromagnetism with paramagnetic-to-ferromagnetic phase transition at 110K. The low temperature resistivity measurement indicates the semiconductive nature of this compound. However, the conduction does not follow the Arrhenius model but the conduction is governed by hopping of electron. The nearest-neighbour small polaron hopping conduction is found to be dominant in the high temperature regime (200-300) K with energy gap ~76 meV while at intermediate temperature regime (100-200) K, Mott type variable range hopping is observed.

Bibliography

1. C. P. Sun, C. L. Huang, C. C. Lin, J. L. Her, C. J. Ho, S. Taran, H. Berger, B. K. Chaudhuri, H. D. Yang, Phys. Rev. B **79**, 214116 (2009).

2. C. P. Sun, C. L. Huang, C. C. Lin, J. L. Her, C. J. Ho, J.-Y. Lin, H. Berger, H. D. Yang, Appl. Phys. Lett. **96**, 122109 (2010)

3. P. Suchismita Behera, P. A. Bhobe, V. G. Sathe, A. K. Nigam, J. Appl. Phys. 120, 045107 (2016)

4. M. Viret, L. Ranno, and J. M. D. Coey, J. Appl. Phys. 81, 4964 (1997)

Design of Bimetallic Photocatalysts for Enhanced Solar Water Splitting to Generate Hydrogen

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Abstract: With the increase of global energy consumption, the conventional sources of energy would no longer be sufficient to meet the demand in a sustainable away. Therefore, to search an alternative and environmentally clean energy resource is an urgent need of the hour. Photocatalytic water splitting is a clean approach for solar energy conversion efficiently into hydrogen energy. The present study involves the synthesis of Au-Pd/C/TiO₂ and Au-Pd/rGO/TiO₂ nanocomposites using hydrothermal method. To obtain this, noble bimetallic NPs (Au-Pd) were dispersed on the high surface area carbon based support materials which subsequently integrated with Titania-P25. The synthesized catalysts were studied for photocatalytic water splitting under one sun condition both in powder and thin film form. The thin film of Au-Pd/rGO/TiO₂ exhibits 43 times higher hydrogen yield compared to its powder form. The thin film of Au-Pd/rGO/TiO₂ on the other hand shows 3.4 times higher activity than that of Au-Pd/C/TiO₂. This enhanced activity is due to improved absorption of visible light and an effective separation of photogenerated electron-hole pairs at the interface of the catalysts.

Keywords: Bimetal, Nanoparticles, Photocatalyst, Water Splitting, HER

Reference

- Tudu, B.; Nalajala, N.; Reddy, K. P.; Saikia, P.; Gopinath, C. S. Electronic Integration and Thin Film Aspects of Au-Pd/rGO/TiO₂ for Improved Solar Hydrogen Generation. ACS Appl. Mater. Interfaces 2019, 11(36), 32869-32878.
- (2) Bard, A. J.; Fox, M. A. Artificial Photosynthesis: Solar Splitting of Water to Hydrogen and Oxygen. Acc. Chem. Res. 1995, 28(3), 141-145. Biography:

Advance Energy Storage Devices For Interface With Renewable Energy Sources For Sustainable Energy System.

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Abstract: The use of renewable energy sources are increasing exponentially due to stringent power regulatory norms on use of conventional sources and increased incentives from various agencies for use of renewable energy sources. In spite of this, the exploration of renewable energy sources are not up to their potential due to constraints in its intermittent nature, technology advancement and service. In order to explore these sources, renewable energy sources should be augmented with energy storage devices. Short-term distributed energy storage (DES) systems based on advanced technologies, such as superconducting magnetic energy storage (SMES), super capacitor (or ultracapacitor) energy storage (SCES or UCES) and flywheel energy storage (FES) etc are in use.

This paper presents state of art configuration and control of Super conducting Magnetic Energy Storage device for obtaining sustainable energy from renewable energy sources.

Keywords: Renewable Energy Sources (RES), Distributed Energy Storage (DES), Super Conducting Magnetic Energy Storage Device (SMES).

REFERENCES:

Fig.1. Schematic of Energy storage

- 1. Prashant.S. Kadam and Dr.K.Vadirajacharya, "Superconducting magnetic energy storage unit for power conditioning", UACEE international journal of advancements in electronics and electrical engineering, Vol-1, Issue-1, 2012, pp138-142.
- 2. M. H. Ali, B. Wu, R. A. Dougal, "An Overview of SMES applications in power and energy systems," IEEE Trans. Sustainable Energy, vol. 1, no. 1, pp. 38-47, 2010.
- 3. M. G. Molina, P. E. Mercado, E. H. Watanabe, "Improved Superconducting Magnetic Energy Storage (SMES) controller for high power utility applications," IEEE Trans. Energy Conversion, vol. 26, no. 2, pp. 444-456, 2011.
- 4. M. G. Molina, P. E. Mercado, "Power flow stabilization and control of microgrid with wind generation by superconducting magnetic energy storage," IEEE Trans. Power Electronics, vol. 26, no. 3, pp. 910-922, 2011.

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Fig.2. Super Conducting Magnetic

Energy Storage System.



A novel co-association of microalga, *Scenedesmus* with cyanobacterium, *Oscillatoria* for cost-effective harvesting of biomass

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Abstract: Microalgae are the most promising biomass for biodiesel production. However, the existing cultivation system and the harvesting technology hinder the commercialization of microalgal derived biofuel. Thus, in the present study, a novel co-cultivation is developed for microalgae and cyanobacteria. High lipid-containing microalgal strain, *Scenedesmus* was chosen as a source of biomass. While, a filamentous cyanobacterium, *Oscillatoria* was selected because of its cell-cell aggregation and flocculating properties. *Scenedesmus* cells are very minute and get dispersed in suspension. Log phase culture of *Oscillatoria* was mixed with 4, 8, 12 and 16 days old culture of *Scenedesmus* in different ratios of 1:1,1:2, 1:4, and 2:1, respectively. All of the samples incubated for 30 days of microalgal growth. The results showed the attachment of microalgal cells to filamentous cyanobacterium with the formation of dense aggregations of filaments that float at the surface, thus harvested easily by decanting the water. The ratio which exhibits the best harvesting efficiency, biomass recovery, and oil content was selected. The system also showed a significant increase in nutrient removal indicating an advanced way of wastewater treatment. Hence, the co-cultivation strategy is an innovative technology for the commercialization of microalgal biomass.

Keywords: Oscillatoria, Scenedesmus, co-cultivation, suspension

A Novel Heterogeneous Catalyst Derived from Kesseru Plant for Green Production of Biodiesel

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Abstract: To encounter the future energy demand as well as sustainable alternative of conventional fossil fuel, biodiesel from the last few decades is gaining attention as an environmentally friendly, clean and green source of energy. In this regard, ash based heterogeneous catalyst for green synthesis of biodiesel is prevailing in biodiesel research. Accordingly, in the present study, heterogeneous catalyst derived from Kesseru plant is investigated for effective synthesis of biodiesel from Jatropha oil. The uncalcined ash catalyst and catalyst calcined at 550 °C and 850 °C are being utilized in the transesterification of iatropha oil to biodiesel. The catalyst is characterised by using sophisticated techniques like Powder XRD, FTIR, BET, SEM-EDX, XPS and TEM. The characterization of the catalyst reveals the presence of mixed metal oxides and carbonates with a surface area of 96.569, 27.500, 78.448 m²/g for uncalcined catalyst, and catalyst calcined at 550 °C and 850 °C, respectively. The catalyst calcined at 550 °C comparatively showed good catalytic activity than others at 65°C with a biodiesel yield of 97.75% under the optimized conditions of 12:1 methanol to oil molar ratio and 7 wt.% of catalyst in a short reaction time of 65 min. The produced biodiesel was characterized by FT-IR and NMR techniques. The derived catalyst is biodegradable, reusable, and can be a potential candidate as green, environmentally friendly, and cost effective catalyst for industrial scale production of biodiesel.

Keywords: Transesterification, biodiesel, heterogeneous catalyst, Jatropha curcas.

References:

- Balajii M, Niju S. A novel biobased heterogeneous catalyst derived from Musa acuminata peduncle for biodiesel production–Process optimization using central composite design. Energy Conversion and Management. 2019;189:118-31.
- [2] Tulashie SK, Kalita P, Kotoka F, Segbefia OK, Quarshie L. Biodiesel production from shea butter: A suitable alternative fuel to premix fuel. Materialia. 2018;3:288-94.
- [3] Balajii M, Niju S. Banana peduncle–A green and renewable heterogeneous base catalyst for biodiesel production from Ceiba pentandra oil. Renewable Energy. 2020;146:2255-69.
- [4] Betiku E, Etim AO, Pereao O, Ojumu TV. Two-step conversion of neem (Azadirachta indica) seed oil into fatty methyl esters using a heterogeneous biomass-based catalyst: An example of cocoa pod husk. Energy & Fuels. 2017;31(6):6182-93.
- [5] Bardhan P, Gohain M, Daimary N, Kishor S, Chattopadhyay P, Gupta K, Chaliha C, Kalita E, Deka D, Mandal M. Microbial lipids from cellulolytic oleaginous fungus Penicillium citrinum PKB20 as a potential feedstock for biodiesel production. Annals of Microbiology. 2019:1-2.
- [6] Betiku E, Okeleye AA, Ishola NB, Osunleke AS, Ojumu TV. Development of a Novel Mesoporous Biocatalyst Derived from Kola Nut Pod Husk for Conversion of Kariya Seed Oil to Methyl Esters: A Case of Synthesis, Modeling and Optimization Studies. Catalysis Letters. 2019;149(7):1772-87.
Managing E-waste in India: Current Situation and Challenges

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Abstract: Electronic waste or e-waste refers to unwanted, obsolete or unusable electronic and electrical products. It is also known as WEEE (Waste Electrical or Electronic Equipment). Ever increasing usage of electronics and electrical equipments has resulted in piling up of e-waste in developed countries as well as developing nations like India. The problem of e-waste has become an immediate and long term concern as its unregulated and improper accumulation and recycling can lead to major environmental problems endangering not only humans but also animals & other species due to toxic and other dangerous materials available in them. This paper attempts to provide a brief insight into the concept of e-waste, its generation in India and the environmental hazard and health concerns attached to it. More specifically, it highlights the e-waste management mechanism system in India citing various issues related it and suggest strategies for effective e-waste management including immediate need for clear and sustainable technologies to tackle this problem.

Keywords: E-waste, WEEE, recycling, Environment, informal sector, EPR,

Reference

1. Kumar, R., Karishma, *Current Scenario of e-waste management in India :Issues and strategies*, International Journal of Scientific and Research Publications, ISSN 2250-3153, Volume 6, Issue 1, January 2016, pp 424.

2. Ganguly, R., *E-Waste Management in India – An Overview*, International Journal of Earth Sciences and Engineering, ISSN 0974-5904, Volume 09, No. 02, April 2016, P.P.575

3. Baldé, C. P., Forti, V., Gray, V., Kuehr, R., Stegmann, P, The Global E-waste Monitor 2017: Quantities, Flows, and Resources, pp.38

4.https://swachhindia.ndtv.com/india-world-top-5-e-waste-producer-assocham-nec-report-21415/

5. Vetrivel, Petheeswari., Kalpana Devi, P., A Focus on E-Waste: Effects on Environment and Human Health, International Journal of Novel Trends in Pharmaceutical Sciences, ISSN: 2277 – 2782, Volume 2 | Number 1 | Feb | 2012, pp.47.

6. http://www.changealliance.in/managing-e-waste-in-india-current-situation-and-challenges

7. Garg N. Adhana, D. K., *E-Waste Management in India: A Study of Current Scenario* International Journal of Management, Technology And Engineering Volume IX, Issue I, JANUARY/2019 ISSN NO : 2249-745.

8. Lakshmi, S., Raj, A., Jarin T. *A Review Study of E-Waste Management in India*, Asian Journal of Applied Science and Technology (AJAST), Volume 1, Issue 9, Pages 33-36, October 2017.

9. Borthakur, A., Govind, M., *How well are we managing E-waste in India: evidences from the city of Bangalore*, Energ. Ecol. Environ. (2017) 2(4):225–235, DOI 10.1007/s40974-017-0060-0

10. Singh, V. P., *Law Relating To E-Waste Management In India: A Critical Study*, International Journal of Management, Law & Science Studies, IJMLSS, ISSN:2456-4303, ,VOL 02, ISSUE 5, JANUARY 2018.

Development of a Process for Tenderization of Meat Using Banana Peel Waste

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Abstract: Banana peel is considered to be a cheaper and useful waste material obtained after banana processing for the purpose of meat tenderization in comparison to conventional tenderizing agents like papain, bromelain etc. In this study three different varieties of banana e.g. *Musa balbisiana, Musa acuminate, Musa paradisiaca* are considered for the treatment of banana peel waste with beef meat to examine the effect of pH, texture, water holding capacity and cooking loss. The pH of treated beef meat showed increase values of 7.78, 7.36, and 7.4 respectively after 72 h of marination as compared with the value of raw meat of 5.76. However the meat treated with bromelain and papain showed decrease in pH viz.5.06 and 5.31 respectively after 72 h. The alkaline extract marinates showed improved water holding capacity and tenderization effect as compared to acidic marinates. Beef meat treated with peel waste of *Musa balbisiana* variety showed significant decrease in shear stress from 0.42 kg/cm² to 0.29 kg/cm². However no such significant change was observed during treatment with papain and bromelain. Meat treated with peel waste of *Musa balbisiana*, papain and bromelain showed the maximum cooking loss when compared to *Musa acuminate* and *Musa paradisiaca*.

Keywords: Meat, banana peel waste, tenderization, water holding capacity, cooking loss

Renewable and eco-friendly heterogeneous base catalyst for biodiesel production

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Abstract: In this study, *Brassica nigra* ash is investigated as an effective green catalyst for the production of biodiesel. The catalyst was prepared by calcination of ash obtained from waste Brassica nigra plant at 550°C for 2 h. The catalyst was characterized by XRD, FT-IR, BET, XRF, AAS, XPS, SEM-EDX and TEM. The characterization revealed the presence of high potassium content (56.13%) followed by calcium (26.04%) and found to be highly basic with pH value of 11.76. The catalyst is found to be excellent in the transesterification of soybean oil to biodiesel resulting in 98.79% yield with 7 wt.% of catalyst and 12:1 methanol to oil molar ratio at 65°C in a reaction time of 25 min. The study exhibited similar catalytic activity for biodiesel synthesis from both edible and non-edible oils (Jatropha oil and Thevetia peruviana oil) under the identical reaction conditions. The activation energy of the reaction was found to be 27.87 kJ/mol. The catalyst reusability showed up to 96% yield in the 3rd cycle of reaction without significant loss in catalytic activity. The produced biodiesel was characterized using FT-IR, ¹H NMR, ¹³C NMR and GC-MS. The fuel properties are well comparable with the international standard as well as with other reported literatures. The synthesized heterogeneous catalyst is easy to handle, non-toxic, biodegradable, environmentally benign, and reusable. The raw material for the catalyst is easily available as waste with free of cost and this study is a value addition to the generated wastes along with a viable capability in reduction of the overall biodiesel production cost.

Keywords: Transesterification, Brassica nigra, heterogeneous catalyst, biodiesel, triglyceride.

Development of rapid detection biosensor for non prescribed colistin drug in animal food products

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Abstract: Colistin is a last resort antibiotic used to treat gram negative infections like pneumonia and bacteremia. However, there is widespread malpractice of using colistin as "growth promoters" in animal farming through which humans are getting non-prescribed exposure to it. Overuse or non-prescribed exposure to any antibiotic leads to threat of infectious microbes developing resistance. In addition, prolonged use of colistin can cause toxic damage to human organs. The significance of colistin in human medication and its extensive abuse is so high that the Indian government in 2019 had to ban the use of colistin in animal farming. In order to prevent such malpractice of colistin abuse biosensors can be developed to detect the presence of colistin in animal food products like meat and milk. The basic architecture of a biosensor involves three components: (1) the bioreceptor which interacts with analyte; it can be an enzyme, antibody, protein or nucleic acid (2) the transducer, which receives and converts the signal processing system, which amplifies and displays the output of the interaction. Biosensors are much more cost effective and rapid detection alternatives to traditional analytical methods.

Keywords: Colistin, antibiotics, animal food products, biosensor

Sustainability of Agro-Wastes Towards Organic Synthesis

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Abstract: Agro wastes are the agricultural residues or wastes produced after harvesting the agricultural products of various agricultural activities. Because of its environmental benign nature and cost effective process, its reutilization in various reactions as heterogeneous catalyst is the most emerging topic for researchers now a days. Recently, various agricultural wastes derived ashes are reported as effective heterogeneous base catalyst for biodiesel production through transesterification reaction from different oil feedstocks. In this study, we have used the agro-wastes of Musa balbisiana plant derived ashes as heterogeneous base catalyst for aldol condensation reactions because of its highly basic in nature and is found to be effective for the reactions between different aldehydes and ketones, showing the highest activity towards the compounds having electron withdrawing groups. The catalyst was prepared by burning the dried Musa balbisiana plant trunk wastes and activated at 500°C. The detail will be discussed during presentation.

Keywords: Agro-waste, Heterogeneous catalyst, Aldol reactions

References:

- 1. Basumatary, S. (2014). Transesterification of citrus maxima seed oil to biodiesel using heterogeneous catalyst derived from peel and rhizome of Musa balbisiana Colla. International *Journal of ChemTech Research*, 7. 2265-2271.
- 2. Nath, B., Das, B., Kalita, P., & Basumatary, S. (2019). Waste to value addition: Utilization of waste Brassica nigra plant derived novel green heterogeneous base catalyst for effective synthesis of biodiesel. *Journal of Cleaner Production*, 239, 0959-6526.

Heterogeneous catalyst derived from Musa paradisiaca for effective synthesis of Biodiesel

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Abstract: In recent times, biodiesel has emerged as a potential fuel to replace conventional sources of energy as it is a renewable, biodegradable and non-toxic fuel. In this study, heterogeneous catalyst derived from waste *Musa paradisiaca* is utilized for biodiesel synthesis from *Jatropha curcas* oil. The catalyst is calcined at 550 °C and characterized by FT-IR, BET, SEM-EDX, and TEM. A biodiesel yield of 97.65% was achieved from Jatropha oil under the optimal reaction conditions of 9:1 methanol to oil molar ratio, and 5 wt.% of catalyst amount at the reaction temperature of 65 °C within a very short time period. The produced biodiesel was characterized by FT-IR and NMR.

Keywords: Banana plant, biodiesel, transesterification, heterogeneous catalyst, Jatropha curcas.

Bibliography

- 1. G. Pathak, D. Das, K. Rajkumari, L. Rokhum, Exploiting waste: Towards a sustainable production of biodiesel using *Musa acuminata* peel ash as a heterogeneous catalyst, Green Chem. 20(10) (2018) 2365–73.
- E. Betiku, S.O. Ajala, Modeling and optimization of *Thevetia peruviana* (yellow oleander) oil biodiesel synthesis via *Musa paradisiacal* (plantain) peels as heterogeneous base catalyst: A case of artificial neural network vs. response surface methodology, Ind. Crops Prod. 53 (2014) 314–22.

Valorization of Sugarcane Bagasse for Energy Production

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Abstract: Combustion of sugarcane bagasse is a very common technology for cogeneration in most developing countries. However, this method may not be appropriate in organic waste management due: wet bagasse is undesirable for the combustion process, low heating value, low efficiency of approximately 26% can be achieved by direct combustion of bagasse, ash build up after combustion, existence of alkali earth metals (Na and K) in the syngas is unfavourable to the gas turbines blades, emissions of smoke and airborne fly ash from the combustion process poses an environmental concern. Due to these drawbacks, more efficient methods of reusing bagasse are worth investigating like pyrolysis. The objective of the present work is to investigate the viability of producing multiple products from the readily available sugarcane bagasse in a fixed batch Pyrolyzer. Maximum yield of bio oil (35.6%) was obtained at 550°C at 10°C min⁻¹ and a higher yield (37%) of biochar was achieved at 350°C. The higher heating value of the biochar was 32 MJ/kg. This show the viable applications of sugar cane bagasse for the production of energy.

Spectral anlysis of Neutron Star SXT V 1333 Aql

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Abstract: The interstellar medium (ISM) is one of the most important component of galaxies because it influences their evolution. We use high quality grating spectra of NS SXT V 1333 Aql taken with XMM-Newton to measure column densities of different elements. The column densities of the neutral gas species are in aggrement with those found in literature. We have reduced the 1st order spectra of RGS detectors on board of XMM Newton with Science analysis system (SAS) and performed the spectral analysis with SPEX. The spectra shows the neutral absorption edges. This work shows that X-ray spectroscopy is a very powerful method to probe ISM.

Subject headings: X-ray, Neutron Star, SXT, Aquila 1

Robust multivariate metal–porphyrin frameworks for efficient fixation of CO₂ to cyclic carbonates

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Abstract: A family of multivariate metal–organic frameworks (MOFs) with three-kinds of orderly distributed metals were designed and successfully synthesized by combining metalloporphyrin sheets and pentafluoride (NbOF₅)²⁻ pillars. Benefiting from the cooperative nature of open-metal-sites (OMSs) within porphyrins, specific pore-sizes, coupled with fluorine-rich electrostatic environments, the fabricated materials demonstrated high affinity toward CO₂, and good catalytic performance, structural robustness, and good recyclability for the conversion of epoxides and CO₂ to cyclic carbonates at room temperature and 1 atm pressure.



Fig.(a) Local coordination environments A (from $\{M(Pyridine)_4F_2\}$), B (from $\{MOxF6x\}$) and C (from metalloporphyrin) (b) Network topology of the FTPFs.(c) Crystal structure of the FTPFs.

References:

 A. Chen, Y. Zhang, J. Chen, L. Chen and Y. Yu, J. Mater. Chem. A, 2015, 3, 9807–9816
 C. A. Trickett, A. Helal, B. A. Al-Maythalony, Z. H. Yamani, K. E. Cordova and O. M. Yaghi, Nat. Rev. Mater., 2017, 2, 17045.
 L. He, J. K. Nath and O. Lin, Chem. Commun., 2019, 55, 412

Green synthesis of Copper (II) Oxide nanoparticles using citrus maxima peel extract

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Abstract: Green technologies are the cutting age of modern technologies and so, the researchers are paying keen attention to develop eco-friendly nanoparticles. The utilization of green technology suppresses the use of harmful chemicals and generates less toxic products. This article reports on an investigation on citrus maxima (pomelo) peels extract as a capping or reducing agent as well as the plant leaves extracts for the same purpose. The multifunctional properties of Copper (II) oxide in the areas of catalyst, gas sensor, magnetic storage media, solar cell etc have been fascinating the researchers to develop copper oxide nanoparticles since long back. In this work copper oxide biosynthesized nanoparticles were characterized by X-ray diffractometer (XRD), FTIR and UV-visible spectroscopy. The XRD pattern confirms the monoclinic crystalline phase of copper oxide and optical analysis by UV-Visible DRS spectroscopy showed that the reflectance is about 504 nm. Sharp peak observed at 532.36 cm⁻¹ in FTIR is due to the vibration of Cu-O bond. The prepared materials are expected to be promising candidate in the area of photocatalyst, electrochemical sensor and antibacterial activities which is a cost effective and eco-friendly option.

Keywords: Green synthesis, Citrus maxima (pomelo), Copper (II) oxide nanoparticles

Reference:

- Y.Yulizar, I. Latifah, R.Bakri and D.O.B Apriandanu, Plant Extract Mediated Synthesis of Copper (II) Oxide Nanoparticles Using Oldenlandia corymbosa L. Leaf. AIP Conference Proceeding 2023,020097 (2018).
- Mohammod Aminuzzaman, Leong Mei Kei, and Wong Hong Liang, Green synthesis of copper oxide (CuO) nanoparticles using banana peel extract and their photocatalytic activities. AIP Conference proceedings 1828, 020016(2017).

Recent Advances in Silk Based Material for Sustainable Technological Applications

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Abstract: The recent progress made in preparation and application of silk-based material are reviewed. In a conventional synthesis process, silk biomaterials are produced mainly by using aqueous or organic solvent-processing methods to meet a range of application via eco-friendly approaches. Silk materials are widely used and studied for protein biomaterial due to large-scale production from natural sources, excellent biocompatibility, remarkable mechanical properties and controllable degradation. Potential applications of silk materials are outlined; such as application in textile, tissue engineering, drug delivery, antimicrobial materials, degradable devices and controlled release systems. This review also summarizes advances in fabrication of silk fibroin with other nanomaterials for the possible sustainable application of silk materials in sensors, optics, photonics and optoelectronic devices.

Keywords: Silk Protein, Biomaterials, Antibacterial material, Biosensors, Bio application

References:

- 1. Zhao, L.; Wang, H.; Luo, J.; Liu, Y.; Song, G.; Tang, G. Sol Energy. 2016, 127, 28.
- 2. Panda, D.; Konar, S.; Bajpai, S. K.; Arockiarajan, A. J. Mech. Behav. Biomed. 2017, 71, 362.
- **3.** Lee, O. J.; Kim, J.; Moon, B. M.; Chao, J. R.; Yoon, J.; Ju, H. W.; Lee, J. M.; Park, H. J.; Kim, D. W.; Kim, S. J.; Park, H. S.; Park, C. H. Tissue Eng Regen Med. 2016, 13, 218
- 4. Matsumoto, A.; Chen, J.; Collette, A. L.; Kim, U.; Altman, G. H.; Ceb
- 5. e, P.; Kaplan, D. L. J. Phys. Chem. B. 2006, 110, 21630.
- 6. Wang, S.; Xu, T.; Yang, Y.; Shao, Z. ACS Appl. Mater. Inter. 2015, 7, 21254.
- 7. Sarı, A.; Alkan, C.; Dö güs cü, D. K.; Kızıl, Ç. Sol Energy. 2015, 115, 195.
- 8. Qiu, X.; Li, W.; Song, G.; Chu, X.; Tang, G. Sol. Energy Mater. Sol C. 2012, 98, 283.
- 9. Cao, Z.; Chen, X.; Yao, J.; Huang, L.; Shao, Z. Soft Matter. 2007, 3, 910.

Camellia Sinensis (Tea) modulated biosynthesis of Nickel Oxide nanoparticles for antimicrobial study and photocatalytic applications

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Abstract: Recently, the biosynthesis of nanoparticle attracted the attention of scientific community due to its simplicity, ease and eco-friendly nature. In the present study, we report the green synthesis of Nickel oxide nanoparticles (NiONPs) using Camellia Sinensis (Tea) leaves extract. The bio fabricated NiONPs were characterized by scanning electron microscopy (SEM), Energy-dispersive X-ray (EDX), FTIR, Photo Luminescence and X-ray diffraction techniques. The formation of sheet like nanoparticles was shown by HR-SEM. The particle size as revealed by HR-SEM was in the range of 60-80 nm and it matches with the average crystallite size calculated from the XRD pattern. It is then evaluated for antibacterial activity against gram-positive bacterial strains and photocatalytic degradation of Methyl orange (MO) under solar light irradiation. At optimized conditions, up to 99.5% MO dye degradation was achieved.

References

1. A.A. Ezhilarasi, J.J. Vijaya, K. Kaviyarasu, L.J. Kennedy, R.J. Ramalingam, H.A. Al-Lohedan, J Photochem Photobiol *B.*, *180* (2018) 39-50.

2. V. Helan, J.J. Prince, N.A. Al-Dhabi, M.V. Arasu, A. Ayeshamariam, G. Madhumitha, S.M. Roopan, M. Jayachandran, Results Phys., 6 (2016) 712-718.

Antioxidant activity and abundant phenolics in *Jou*: An ethnic alcoholic beverage of *Bodo* tribal community, NE-India

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Abstract: Metabolic activity in a living system leads to formation of free radicals and are responsible for oxidative stress. Food stuffs which contain anti-oxidant molecules play pivotal role in scavenging or detoxification of oxidation stress. The ethnic alcoholic beverage of *Bodo* tribal community *Jou* viz. fresh *Joubidwi* (directly fermented beverage), *Joufinai* (stored beverage) and *Jougwran* (distilled beverage) are brewed from malt rice through *Bodos*' traditional fermentation method and observed with good antioxidant behaviors. DPPH-RSE (radical scavenging effect) of samples from fresh to the stored beverages varies from 39.959% to 75.797% with total antioxidant activity (TAA) from 0.86 ± 0.04 mg/mL to 2.22 ± 0.02 mg/mL in ascorbic acid equivalents. TAA for the distilled variety was not observed. Similarly with storage total polyphenol (2.63 ± 0.00 to 4.16 ± 0.00 mg/mL in gallic acid equivalents) and flavonoid contents (10.04 ± 0.29 to 28.95 ± 1.71 mg/mL in quarcetin equivalents) of beverage samples increases. Again, polyphenols *viz.*, gallic acid, catechin, caffic acid, syringic acid, ferulic acids were identified in all *Jou* samples through reverse phase HPLC. Presence of maximum number of polyphenols indicates the more TAA in *Jou*. The presence of polyphenols catechin, caffic acid, salicylic acid, syringic acids etc. indicates alcoholic beverage *Jou* as nutritional feed stock for anti-oxidants.

Key words: Ethnic alcoholic beverage, nutritional, Joubidwi, Joufinai, Jougwran

Experimental evaluation of a rectangular spiral tube only PV/T collector

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Abstract: Inherent efficiency drops due to increase in PV module operating temperature creates a huge difference between the projected and actual electricity generated in large power plants. As a solution to this problem a hybrid collector called Photovoltaic-Thermal or simply PV/T, with PV at top and thermal collector at bottom has been developed. PV/T can cool the PV as well generate low temperature thermal energy. In this study experimental evaluation of newly developed PV/T collector having transparent solar panel with copper tubes arranged in horizontal oscillating and rectangular spiral configurations. The PV/T collectors are experimentally evaluated under outdoor conditions at Indian Institute of Technology Guwahati. The developed PV/T's are compared in terms of electrical and thermal efficiencies.

Keywords: PV/T; spiral absorber; electrical efficiency; thermal efficiency.

Role of Secondary Building Units to construct robust Metal-Organic Frameworks

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Abstract: Metal–Organic Frameworks (MOF) have emerged the area of scientific interest for many researchers on account of wide applications in different fields due to porosity and their wide applications.¹ In MOF, metal containing units also called secondary building units (SBUs) are coordinated with organic linkers through coordinate bonds forming robust 1D, 2D, 3D framework. Yaghi et al has developed a fruitful strategy, which he termed as reticular chemistry^{2,3} to use different SBUs to form different 1D, 2D and 3D network structures and termed these coordination polymers as metal-organic frameworks (MOF). The interesting features of MOF are (a) many of them maintain their underlying structure and crystallinity on changing the organic linkers or SBUs and also functionality of organic ligands (b) many of them also maintain porosity and crystallinity at reasonably higher temperature even after removal of adsorbed guest molecules. These excellent tuneable properties are not present in zeolites, where cavities are usually confined by rigid tetrahedral oxide skeletons that are difficult to alter. Both square and triangular SBUs to construct different MOF and our effort to isolate both square and triangular SBUs by using simple monocarboxylic acid linkers and different metal salts. Detail will be discussed in the presentation.

Keywords: MOF; Secondary Building Unit (SBU), functional material

References

- 1. S. Kitagawa et.al Angew. Chem. Int. Ed. 2004, 43, 2334-2375
- Introduction to Reticular Chemistry: Metal-Organic Frameworks and Covalent Organic Frameworks; O. M. Yaghi, M. J. Kalmutzki, C. S. Diercks, Wiley-VCH, Weinheim, 2019. 509
- 3. Reticular Chemistry: Molecular Precision in Infinite 2D and 3D; O.M. Yaghi, *Mol. Front. J.*, **2019**, *3*, 1-18

Traditional Wisdom and Sustainable Technology; Bamboo and Green Products of North-East India

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Abstract: Eco- friendly products denote the activities of human beings in way which is friendly to the environment. They are generally known as "Green products" which are generally made from non- toxic locally obtained sustainable materials. Today these eco-friendly products are readily available from articles like handmade paper, jute bags and recycle papers to eco-friendly fuels. To be precise, one such eco-friendly products can be included in the list, that is cane and bamboo the 'Green Gold' which is grown in abundance in this region of North East India and which can provide local solution to several global challenges. This paper showcases on promotion of traditional craftsmanship employment and innovation applications through the sustainability process technique or design. Unique ways of using the traditional method of Bamboo basket as dustbins which is eco-friendly in application and is put into use as a fertilizer after it is decomposed. However, there are lot of challenges to make it very effective, usable and appropriate in quality and use for market. An attempt has been made to facilitate rural talent, preserving identity.

Keywords: Green product, sustainability, eco-friendly, Green Gold.

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Structural, morphological and optical properties of pure ZnO and Ag doped ZnO nanoparticles synthesized via sol-gel technique for photocatalytic application

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Abstract: Pure ZnO and Ag (2%, 4% and 6%) doped ZnO nanoparticles were synthesized via solgel techniques, a simple cost effective and most commonly used technique from zinc sulphate (ZnSO4.H₂O), silver nitrate (AgNO₃) and sodium hydroxide (NaOH). The obtained white precipitates were calcined at 500^oC for about 3 hours to obtain Ag-doped ZnO nanoparticles. The detail characterization of the ZnO nanoparticle obtained was carried out using X-ray diffraction (XRD), scanning electron microscope (SEM) and Ultraviolet-Visible-Near IR (UV–Vis-NIR) spectroscopy. The XRD patterns of samples were in agreement with that of the crystalline wurtzite hexagonal phase of ZnO and the multiple diffraction peaks indicated the polycrystalline nature of the ZnO nanoparticles. Crystallite size and strain of the ZnO nanoparticles were determined by using Scherrer's formula and Williamson–Hall analysis. It is observed that the crystallite size as well as strain increases with increase of Ag concentration. SEM images revealed the morphology and grain size of prepared ZnO nanoparticles are not uniform. The optical study by using UV-Vis-NIR spectroscopy has shown that absorption shifts towards higher wavelength and band gap decreases with the increase of Ag concentration.

Keywords: Nanoparticles, Zinc Oxide, Sol-gel, XRD, SEM, UV-Vis-NIR spectroscopy.

Solvent Driven Structural Topology in Cu(II) Phenanthroline Complexes involving Energetically Significant Intra and Intermolecular Chelate Ring Contacts: Anticancer Evaluation and Theoretical studies

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Abstract: The construction of supramolecular assemblies is an appealing research topic now-adays, because of their importance in biology, catalysis, material chemistry and nano-science [1-2]. The proper choice of metal centre, organic moieties as ligands and reaction conditions are important parameters for the formation of interesting supramolecular networks [3]. The suitable selection of solvents can also be an important factor for construction of desired architectures of varied dimensionalities [4]. The same ligands and the same metal salt in different solvents with the same exterior conditions can produce different self assembly processes in coordination network solids [5-6]. Non-covalent interactions form the backbone of supramolecular structures, which include hydrogen bonding, stacking, electrostatic and charge-transfer interactions, as well as metal ion coordination [7-8]. These interactions have been receiving more attention in recent years for experimental and theoretical chemists to explore new directions in crystal engineering [9].

In order to understand the effect of solvent on supramolecular coordination networks, we have reported two new Cu(II) complexes. It is interesting that switching the solvent from methanol to DMF results in coordination architectures of different stoichiometries. Furthermore, the unconventional contacts involving chelate rings in the compounds have been theoretically investigated by using molecular DFT calculations and NCI index analyses. The anticancer potential of complexes has been validated *in vitro* in malignant DL cell line.

References:

 Islam, S.M.N.; Dutta, D.; Guha, A.K. and Bhattacharyya, M.K. J. Mol. Struc., 2019, 1175, 130.
 Gogoi, A.; Dutta, D.; Verma, A.K.; Nath, H.; Frontera, A.; Guha, A.K.; Bhattacharyya, M.K.; Polyhedron 168 (2019) 113.

3. Dutta, D.; Islam, S.M.N.; Saha, U.; Frontera, A. Bhattacharyya, M.K. J. Mol. Struc., 2019, 1195, 733.

4. Bhattacharyya, M.K.; Saha, U.; Dutta, D.; Das, A.; Verma; A.K.; Frontera, A.; *RSC Adv.*, 2019, 9, 16339.

5. Gogoi, A.; Saha, U.; Dutta, D.; Bhattacharyya, M.K. J. Struct. Chem., 2019, 60, 324.

6. Saha, U.; Dutta, D.; Nath, H.; Franconetti, A; Frontera, A. and Bhattacharyya, M.K. *Inorg. Chim. Acta*, 2019, 488, 159.

7. Bhattacharyya, M.K.; Gogoi, A.; Chetry, S.; Dutta, D.; Verma, A.K.; Sarma, B.; Franconetti, A.; Frontera, A.; *J. Inorg. Biochem.* 2019, 200, 110803.

8. Saha, U.; Dutta, D.; Bauzá, A.; Frontera, A.; Sarma, B. and Bhattacharyya, M. K. Polyhedron, 2019, 159, 387.

9. Islam, S.M.N.; Dutta, D.; Frontera, A., Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 487, 424.

Fault Detection, Diagnosis and Troubleshooting Technique in Solar PV Smart Grid

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Abstract: Fault detection and diagnosis in solar photovoltaic (PV) arrays is a challenging task in order to increase reliability and safety in PV systems. Because of PV's nonlinear characteristics, a variegation of faults may be difficult to detect by conventional protection devices, leading to safety issues and fire hazards in PV fields. In order to overcome this protection gap, researcher has introduced several technique such as Machine learning, Graph-Based Semi-supervised Learning, Support vector machine (SVM), Spread Spectrum Time-Domain Reflectometry (SSTDR), Multi-Resolution Signal Decomposition and Fuzzy Inference Systems have been proposed earlier for fault detection based on measurements, such as PV array voltage, current, irradiance, and temperature. However, existing solutions or troubleshooting technique usually use supervised learning models, which are trained by numerous labeled data and therefore, have downside i.e. a healthy photovoltaic (PV) array has specific impedance between node pairs, and any ground fault changes the impedance values which could results into error while assessment.

An all new simulation based deep learning tool could be introduce with all the above fault detection proficiency fabricated into it. The system will be capable to eliminate all the real-time drawback of the existing fault detection technique and will be enhance with multi dimensional features. This system could also be intensify with cloud computing for exchange of resources, especially data storage and computing power, without direct active management by the user throughout the globe.

References

- [1] IvánGarcía, William E. McMahon, Myles A. Steiner, John F. Geisz, Aron Habte, Daniel J. Friedman "Optimization of Multifunction Solar Cells Through Indoor Energy Yield Measurements", IEEE Journal of Photovoltaic, Volume: 5, Issue: 1, Page(s): 438-445, 2014.
- [2] T. K. Das, A. Banik, S. Chattopadhyay, A. Das, "Sub-harmonics based String Fault Assessm ent in Solar PV Arrays", Modelling and Simulation in Science, Technology and Engineering Mathematics – Proceedings of International conference on Modeling and Simulation(MS-17) , ISBN-9783319748078, computer science, ISSN-21945357, paper ID-132, Kolkata, India, 4 th -5th November, 2017.
- [3] T. K. Das, S. Chattopadhyay, A. Das, *"Load Bus Symmetrical Fault Analysis in Microgrid S ystem"*, Lectures on Modelling and Simulation (AMSE), ISSN-**1961-5086**, pp **151-162**, **Fra nce**, November, **2017**.
- [4] Rosalinda H. van Leest, Peter Mulder, Natasha Gruginskie, Simone C. W. van Laar, Gerard J. Bauhuis, HyenseokCheun, Heonmin Lee, Wonki Yoon, Remco van der Heijden, Ed Bongers, Elias Vlieg, John J. Schermer.: "*Temperature-Induced Degradation of Thin-Film III–V Solar Cells for Space Applications*", IEEE Journal of Photovoltaic, Volume: 7, Issue: 2, Page(s): 702 708, 2017.

Case Study on Embodied CO₂ Emission in Building Construction

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Abstract: The present reality has encountered with global warming and climate change. Besides other contributors, extraction of natural resources as building materials itself consume energy, cause environmental degradation and contribute to an unnatural weather change i.e. global warming. Buildings are the biggest energy consumers and greenhouse gases emitters, both in the developed and developing countries. Earnest changes are therefore required relating to energy saving, emissions control, production and application of materials. Prompt recommendation related to use of renewable resources, and to recycling and reuse of building materials is necessary. As current research moves towards zero energy buildings or 'Green Building', it is important to minimize the total energy consumption and environmental impact of a building during its lifecycle. This project portrays how much a typical building is contributing to global warming by releasing the carbon dioxide emission. And how the architects and building designers can diminish the measure of carbon footprint emitted from the building materials. As a case study a 3-storied Type-II teachers' quarter of Central Institute Of Technology, Kokrajhar made of normally utilized materials; concrete, brick, steel and ceramic tiles has been chosen. Due to lack of a comprehensive database, data from an international database are utilized. The results offer sensible baseline indicators for the contribution of every material in terms of mass and ECO2. Total amount of carbon emission is calculable and eventually suggestions area unit given to scale back greenhouse gas emission.

Keywords: Global warming, Green House Gases, Carbon footprint, Construction and Building materials, Green building.

Supramolecular Association in Isostructural Coordination Solids of Mn(II), Co(II) and Zn(II) chlorobenzoates: Antiproliferative evaluation and Theoretical studies

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Abstract: The ability of the N- and O-donor ligands to bind with metal ions in different ways makes them suitable for the design and controllable synthesis of coordination solids [1-2]. Supramolecular assemblies involving the pyridine based ligands play an important role in stabilizing interesting networks and are therefore of particular interest from the viewpoint of crystal engineering [3]. The carboxylate based coordination solids have also received considerable interest in the field of metal organic chemistry since they exhibit numerous biological activities that include antitumor, anti-Candida and antimicrobial [4-6]. Weak non covalent contacts viz., hydrogen bonding, π – π stacking interactions etc. have a prominent role in sustaining supramolecular assemblies [7]. Experimental and theoretical studies provide fruitful evidences for unusual non-covalent interactions in metal organic coordination solids [8-9].

Herein, we have reported the synthesis and structure of three monomeric isostructural Co(II), Mn(II) and Zn(II) complexes involving chlorobenzoates. We have also studied the weak non-covalent interactions that may govern the stability of the structures. The electrostatically enhanced π - π interactions observed in the complexes were theoretically studied by using the molecular DFT calculations. The cytotoxicity and apoptosis inducing potential of the complexes have been investigated and found active against DL cancer cell lines.

1. Islam, S.M.N.; Dutta, D.; Guha, A.K. and Bhattacharyya, M.K. J. Mol. Struc., 2019, 1175, 130.

2. Dutta, D.; Islam, S.M.N.; Saha, U.; Chetry, S., Guha, A.K. and Bhattacharyya, M.K. J. Chem. Crystallogr. 2018, 48, 156.

3. Dutta, D.; Nath, H.; Frontera, A. and Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 487, 354

4. Dutta, D.; Chetry, S.; Gogoi, A.; Choudhury, B.; Guha, A.K. and Bhattacharyya, M.K. Polyhedron, 2018, 151, 381;

5. Gogoi, A.; Islam, S.M.N.; Frontera, A. and Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 484, 133.

6. Saha, U.; Dutta, D.; Nath, H.; Franconetti, A; Frontera, A.; Bhattacharyya, M.K. *Inorg. Chim. Acta*, 2019, 488, 159.

7. Bhattacharyya, M.K.; Gogoi, A.; Chetry, S.; Dutta, D.; Verma, A.K.; Sarma, B.; Franconetti, A.; Frontera, A.; J. Inorg. Biochem. 2019, 200, 110803.

8. Saha, U.; Dutta, D.; Bauzá, A.; Frontera, A.; Sarma, B.; Bhattacharyya, M. K. Polyhedron, 2019, 159, 387;

9. Islam, S.M.N.; Dutta, D.; Frontera, A., Bhattacharyya, M.K. Inorg. Chim. Acta, 2019, 487, 424.

A preliminary survey on the status of drinking water quality in the lower primary schools in Bongaigaon block of Bongaigaon District of Assam

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Abstract: The present study conducted during the months of January to July, 2019 had been aimed at assessing and comparing the drinking water quality with WHO (World Health Organisation) standards in the lower primary schools of different clusters of Bongaigaon block in Bongaigaon district of Assam. Out of 271 Lower Primary (LP) schools of this block; 50% of the schools were selected randomly for collection of water samples to assess eleven parameters – pH, Turbidity, Iron Content, Nitrate, Chloride, Hardness, Fluoride, Arsenic, Manganese, Residual Chlorine and Bacterial content. Out of the 136 schools selected at random; the primary water source for 33, 46, 47 and 10 number of schools is deep tube well, hand tube well, Tara hand pump and ring well respectively. In all these water samples pH, Chloride, Hardness, Fluoride and residual Chlorine were found within the permissible limit but the other parameters- Turbidity, Iron, Nitrate, Arsenic, Manganese and Bacterial content were found beyond the permissible limit in some water sample. The paper indulges in deep findings and analysis of these water samples and has attempted to display the results as appropriately as possible.

Bibliography:

[1] APHA Standard Methods for Examination of Water and Waste Water. 19th Ed., American Public Health Association, American Water Works Association and Water Pollution Control Federation, Washington, DC, 1995.

[2] C.P. Sawant, G.C. Saxena and V.S. Shrivastav, "Trace metals in and around the industrial belt," Ecology Environment and Conservation, 6(6): 135-137, 2000.

[3] G. F. Nordberg, "Health Hazards of Environmental Cadmium Pollution," Royal Swedish Academy of Sciences, Vol. 3, No. 2, pp. 55-56, Ambio © 1974.

[4] H.W. Moon, R.E. Issaeson and J. Pohlenz, "Mechanism of association of enteropathogenic *E. coli* with intestinal epithelium," Am. J. Clin. Nutn., 22: 119-127, 1979.

[5] IS 10500 : 1991; Water quality standards, Indian Standard for drinking water - specification IS 10500 : 1991.

[6] Jackson R.B. et. al., (2001). Water in Changing World. Issues in Ecology, 9, Washington, DC: Ecological Society of America, 1-16.

[7] Kahlown, M. A., Tahir, M.A., Rasheed, H., & Bhatti, K. P. (2006). Water Quality Status, National Water Quality Monitoring Programme. 4th Technical Report. Pakistan Council of Research in water Resources (PCRWR), 5.

[8] K. Veera Bhadram, M. Ravindra and M. Pradhanthi, "Evaluation of water quality index at Visakhapatnam city, Andhra Pradesh," Nature Environment and Pollution Technology, 3(1): 65-68, 2004.

[9] Mohsin M., Safdar F., Asghar F., & Jamal F., (2013). Assessment of Drinking Water Quality and its Impact on Residents Health in Bahawalpur City. International Journal of Humanities and Social Science, Vol. 3 No. 15.

[10] M. Kumar and A. Puri, "A Review of permissible limits of drinking water," Indian Journal of Occupational and Environmental Medicine, 16 (1):40-44, 2012.

[11] NEERI, 1986, 1988. Manual of Water and Waste Water Analysis, National Environmental Engineering Research Institute, Neheru Marg, Nagpur.

[12] R. Roy and M. Thakuria, "Status of the drinking water quality in schools of Bongaigaon area of Bongaigaon district of Assam," Nature Environment and Pollution Technology, 6(3): 485-489, 2007.

[13] S. Murugesan, D.S. Kumar, S. Rajan and D. Chandrica, "Comparative study of the ground water resources of east and west region of Chennai, Tamilnadu," Nature Environment and Pollution Technology, 3(4): 495-499, 2004.

[14] WHO Regional Publication, South East Asia Series No. 14, WHO, New Delhi, 1997.

[15] WHO. (2002), Global Strategy for Food Safety; Safer food for better Health, Geneva: World Health Organization (WHO).

[16] WHO, (2004), Guidelines for Drinking-Water Quality (3rd Ed., Vol.1). Geneva: World Health Organization (WHO).

[17] Y.S. Patil and D.H. Tambekar, "Exploration of biodiversity of *E. coli* in water sample of saline belt of Akola and Buldhana district," 44th Annual conference of Association of Microbiologists of India, Dharwad, 2003.

Functionalized carbon nanotube based anticancer drug delivery system

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Abstract: Carbon nanotubes (CNTs) have attracted considerable attention in almost all branches of sciences due to its unique structure and amazing mechanical, electronic and optical properties. Inspite of the numerous potential applications, the incorporation of CNTs in biomedical research is one of the most challenging areas. In recent times, improved drug delivery methods were developed which incorporates CNTs for enhancing cancer therapy. However, at present the development of selectively target oriented CNT based drug delivery system still face challenges due to the weak interaction in between the drug molecule and surface of the pristine CNTs. Therefore, it fails to saves the drug from degradation during its transportation to the targeted cancer cells. Here, we used functionalized carbon nanotube to increase the adsorption energy in between the carbon surface of the nanotube and drug molecule. Cisplatin drug molecule is used as an anticancer drug and Mg doped CNT is used as a functionalized nanotube. Density functional theory is used to design and optimized all the structures. Results obtain from the theoretical calculation revels that the adsorption energy of cisplatin on Mg doped nanotube is almost ten times higher than compared to pristine nanotube. It clearly indicates that cisplatin-Mg doped nanotube system can be used as an innovative and emerging drug delivery system which save the drug from degradation.

Keywords: Carbon nanotube, Density Functional Theory, functionalization, Drug delivery system

Biography:

Sunlight induced photocatalytic activity of magnetically retrievable Fe₃O₄@SiO₂@g-C₃N₄/TiO₂nanocomposite photocatalyst

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Abstract: The magnetically retrievable visible light induced $Fe_3O_4@SiO_2@g-C_3N_4/TiO_2$ microsphere nanocomposite photocatalyst of different weight percentage of g-C₃N₄ have been synthesized successfully. The microsphere comprised $Fe_3O_4@SiO_2$ as a magnetic component as an core and a nanocomposite of g-C₃N₄/TiO₂ as an outer shell, and a core-shell structure compounded by an effective and appropriate method and can be used in photocatalytic application. The physiochemical properties of the photocatalyst were characterized by various spectroscopy and microscopy techniques. The photocatalytic performance of the photocatalyst was examined using model organic pollutant such as Rh.B and MO dye (10ppm) concentration. Photodegradation studies exhibits 91% degradation in both cationic and anionic dye over 10wt% g-C₃N₄/TiO₂, where the rate constant is 3.2 and 27.7 fold higher for Rh B and MO as compared to composite TiO₂. The Scavengers test was performed to analyze dominant reactive species, it confirms superoxide and hydroxyl radical species are playing major role in degradation of Rh.B and MO. It is reveal that prepared nanocomposite photocatalyst is working for both cationic as well as anionic dye. This study reveal that the prepared Fe₃O₄@SiO₂@g-C₃N₄/TiO₂ nanocomposite as potential candidate for application in the purification of organic pollutants for waste water treatment.

Keywords: Fe₃O₄@SiO₂@g-C₃N₄/TiO₂ Nanocomposite, Core-Shell Structure, Photocatalysis, Methyl Orange, Rhodamine B.

References

- 1.Kumar, A. et al. (2018), Chemical Engineering Journal, 353, pp 645–656. doi: 10.1016/j.cej.2018.07.153.
- 2.Raizada, P. et al. (2017), Process Safety and Environmental Protection. Institution of Chemical Engineers, 106, pp. 104–116. doi: 10.1016/j.psep.2016.12.012.
- 3.Lu, D. et al. (2018), ACS Sustainable Chemistry and Engineering, 6(8), pp. 9903–9911. doi: 10.1021/acssuschemeng.8b01118.
- 4. Majumder, S. *et al.* (2015), *Dalton Transactions*. Royal Society of Chemistry, 44(16), pp. 7190–7202. doi: 10.1039/c4dt02551b.
- 5.K., A. and B.M., J. A. (2018), *Journal of Environmental Chemical Engineering*, 6(5), pp. 5720–5731. doi: 10.1016/j.jece.2018.08.042.
- 6.Babu, K. V. et al. (2016), doi: 10.1016/j.jascer.2016.05.001.
- 7.Shiamala, L. *et al.* (2018), *Journal of Environmental Chemical Engineering*, 6(2), pp. 3306–3321. doi: 10.1016/j.jece.2018.04.065.
- 8.Khaki, M. R. D. et al. (2017), Journal of Environmental Management, 198, pp. 78–94. doi: 10.1016/j.jenvman.2017.04.099.

Utilization of spent Micro Algal biomass for the production of bio-oil employing slow pyrolysis process

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Abstract: The utilization of microalgal biomass (MB) for biofuel production has been extensively studied and recognized as an established process. The MB after extracting primary fuels termed as spent MB reported to contain nutrients consisting of proteins, lipids, and carbohydrates. These can be further exploited to produce bio-oil using thermochemical processes. The application of MB are well reported, but very limited reports are available on the utilization of spent MB. Therefore, the present study gives an insight into the application of spent MB for the production of bio-oil and bio-char by slow pyrolysis process. The maximum bio-oil yield of 16.67% was obtained at 450°C, and the corresponding bio-char and gas yield were 40 and 43.3 wt%. The bio-oil obtained was found to have a calorific value of 16.4 MJ/kg and water content of 48 wt%. Further, its chemical composition was estimated using FT-IR and GC-MS.

Keywords: Microalgae, biofuels, pyrolysis, bio-oil

Effects Of Fly Ash, Stone Dust And Glass Fiber On Compressive Strength Of Engineered Cementitious Composite

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Abstract: ECC also called as bendable concrete. It is mortar base rather than concrete. Fiber is used instead of coarse aggregate. It acts as a reinforcing agent and makes the structure flexible also helps in minimizing cracks. It is helpful for earthquake prone areas since it shows ductile behavior.

In the present study different ECC mixtures were evaluated, sand replaced with stone dust, cement with fly ash having cement: sand ratio of 1:3, water/cement as 0.56 along glass fiber. For the analysis, three types of ECC mixes were used having different percentage of cementitious materials replaced with fly ash, having varying proportion of stone dust and glass fiber. Concrete cubes of different combinations of materials as discussed above were tested for compressive strength for 7 and 28 days. As the purpose of the research was to determine the effects of combination of different components (fly ash, stone dust and glass fiber) on to the compressive strength of the ECC; it was finally observed that the optimum compressive strength of ECC was found out with fly ash 30%, stone dust 35% and glass fiber 1.25%.

Application of castor oil based Eco-friendly polymeric additives for lubricating oil

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Abstract: Performance of polymers prepared from castor oil and dodecyl acrylate as biodegradable multifunctional additive in the formulation of eco-friendly lubricant was investigated in this article. Homopolymer of castor oil and its copolymers with dodecyl acrylate (DDA) at different percentage compositions (w/w) were synthesized using Azo-bis-isobutyronitrile (AIBN) as initiator. The polymers were characterized by spectral techniques (FT-IR and NMR spectroscopy). Gel Permeation Chromatography (GPC) method was used to determine the molecular weight of the prepared polymers. Performance evaluation of all the prepared polymers was evaluated in SN150 mineral oil as viscosity index improver (VII), pour point depressant (PPD) and antiwear according to standard ASTM methods. Percentage of biodegradability of the polymers was tested through disc diffusion method.

Keywords: Castor oil, Viscosity Index Improver, Pour point depressant, Antiwear, 1. Mutlu, H.; Meier, M. A. R. Castor oil as a renewable resource for the chemical industry. *Eur. J. Lipid Sci. Technol.* 2010, *112* (1), 10–30.

2. Kunduru, K. R.; Basu, A.; Zada, M. H.; Domb, A. J. Castor oil - based biodegradable polyesters. *Biomacromolecules* 2015, *16* (9), 2572–2587.

3. Azambujaa, M. A.; Diasb, A. A. Use of castor oil-based polyurethane adhesive in the production of glued laminated timber beams. *Mater. Res.* 2006, 9 (3), 287–291.

Synthesis, characterization and antimicrobial studies of manganese(IV) complexes derived from dihydrazone

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Abstract: Schiff base with manganese(IV) chemistry is of great interest since such units have the potential for application as biomimics for enzymes. Ligand moieties are derived as schiff base and monometallic manganese(IV) complexes bis(2-hvdroxv-1of ligand. naphthaldehyde)glutaryldihydrazone (nghH4) were synthesized by reacting manganese acetate tetrahydrate with dihydrazone in appropriate conditions in absence and presence of various pyridine bases in methanol medium. The ligand contains two identical azomethine, amide and phenol functions. The composition of the complexes has been established by elemental analysis, mass spectra and thermal studies. The structural assessment of the complexes were done on the basis of study from magnetic susceptibility measurements, molar conductances, electronic, electron paramagnetic resonance and infrared spectroscopy. In complexes (1), (2) and (3), pyridine and its derivative 2-picoline and 3-picoline, were respectively added to the reaction mixture of metal salt and dihydrazone. Study of molar conductances for the complexes suggests their nonelectrolytic nature. In these complexes, magnetic moment and electron paramagnetic resonance studies correspond to Mn(IV) oxidation state. The physico-chemical study supports for the presence of octahedral geometry around manganese(IV) center. The dihydrazone behaves as tetradentate ligand coordinating the metal with anti-cis configuration as is correlated by infrared spectral data. Antimicrobial studies have also been done.

References:

- R. A. Lal, D. Basumatary, O. B. Chanu, A. Lemtur, M. Asthana, A. Kumar, A. K., "Synthesis, characterization, reactivity, and electrochemical studies of manganese(IV) complexes of bis(2-hydroxy-1-naphthaldehyde)adipoyldihydrazone," J. Coord. Chem., vol. 64, pp. 300 - 313, 2011.
- [2] M. Sharma, K. Chauhan, R. K. Srivastava, S. V. Singh, K. Srivastava, J. K. Saxena, S. K. Puri, P. M. S. Chauhan, "Design and synthesis of a new class of 4-aminoquinolinyl- and 9anilinoacridinyl schiff base hydrazones as potent antimalarial agents," Chem. Biol. Drug. Des., vol. 84, pp. 175-181, 2014.
- [3] S. Manna, S. Mistri, A. Bhunia, A. Paul, E. Zangrando, S. C. Manna, "Manganese(IV) complex with a polydentate Schiff base ligand: synthesis, crystal structure, TDDFT calculation, electronic absorption and EPR spectral study," J. Coord. Chem, vol. 70, pp. 296– 313, 2017.

Financial Inclusion: Role Of Technology In Sustainable Development In North East India.

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Abstract: India is home of 1.2 billion people, with 29 states and 7 union territories and having 600,000 villages and 640 districts.India has the second highest number – about 190 million – of financially excluded households in the world. The Northeast India is a geographically unique place and it is also one of the most economically backward regions of India. Hence the Inclusive development of India is only possible when this part of India is equally developed. This development will only be sustainable with the help of technology like opening of ATMs/Kiosks, Banking on mobile, use of smart phones, better technology for corresponding banking in rural and remote area etc.

The financial condition and living standard of the poor and the deprived section can be improved with help of financial access and technology for sustainable development of the northeast part of India.

Therefore, this paper makes an attempt to focus on studying the role of technology in sustainable development in Northeast India in achieving financial inclusions.

Keywords: Financial inclusion, Sustainable development, Technology

Synthesis and structural investigation of manganese(IV) complexes of schiff base hydrazone with antimicrobial potential

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Abstract: New series of manganese(IV) complexes from the ligand Bis(2-hydroxy-1naphthaldehvde)fumarvldihvdrazone (nafhH₄) with composition of $[Mn^{IV}(nafh)](A)_2]$ (where A= H₂O, (1); pyridine, (2); 2-picoline, (3) were synthesized. The composition of isolated complexes have been characterized by elemental analysis, thermal studies, mass spectral data, molar conductance, magnetic moment along with electronic, EPR and IR spectral studies. Molar conductances of the complexes in DMSO indicated their nonelectrolytic nature. Magnetic moment and EPR studies revealed +4 oxidation state of manganese in these complexes. The polyfunctional ligand has stabilized the +4 oxidation state of manganese which are not known to be widely reported. Data from electronic and EPR spectral studies was correlated with six-coordinate octahedral geometry around the manganese center. IR spectral studies have revealed that nafhH₄ coordinates to the manganese center in a tetradentate fashion. With rapidly rising global antimicrobial resistance and death of antibiotics in the clinical pipeline, there is an urgent need and growing interest in the exploration and use of new antimicrobial agents. Herein, we have investigated antimicrobial efficacies of these complexes against Enterobacter aerogenes, Salmonella enterica Typhimurium, Bacillus cereus, Escherichia coli, Klebsiella pneumoniae and Proteus vulgaris. The complexes are promising as these are found to be active against a variety of pathogens.

References:

- [5] R. A. Lal, D. Basumatary, O. B. Chanu, A. Lemtur, M. Asthana, A. Kumar, A. K., "Synthesis, characterization, reactivity, and electrochemical studies of manganese(IV) complexes of bis(2-hydroxy-1-naphthaldehyde)adipoyldihydrazone," J. Coord. Chem., vol. 64, pp. 300 - 313, 2011.
- [6] M. Sharma, K. Chauhan, R. K. Srivastava, S. V. Singh, K. Srivastava, J. K. Saxena, S. K. Puri, P. M. S. Chauhan, "Design and synthesis of a new class of 4-aminoquinolinyl- and 9anilinoacridinyl schiff base hydrazones as potent antimalarial agents," Chem. Biol. Drug. Des., vol. 84, pp. 175-181, 2014.
- [7] S. Manna, S. Mistri, A. Bhunia, A. Paul, E. Zangrando, S. C. Manna, "Manganese(IV) complex with a polydentate Schiff base ligand: synthesis, crystal structure, TDDFT calculation, electronic absorption and EPR spectral study," J. Coord. Chem, vol. 70, pp. 296–313, 2017.
- [8] S. Carvalho, E. da Silva, R. Santa-Rita, S. de Castro, C. Fraga, "Synthesis and antitrypanosomal profile of new functionalized 1,3,4-thiadiazole-2-arylhydrazone derivatives, designed as non-mutagenic megazol analogues," Bioorg. Med. Chem. Lett., vol. 14, pp. 5967-5970, 2004.
- [9] E. T. Knittl, A. A. Abou-Hussein, W. Liner, "Syntheses, characterization, and biological activity of novel mono- and binuclear transition metal complexes with a hydrazone Schiff base derived from a coumarin derivative and oxalyldihydrazine," Monatshefte für Chemie, vol. 149, pp 431–443, February 2018.

A green approach to improve the oxidation stability of biodiesel using natural antioxidant

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Abstract: The present study deals with the estimation of oxidation stability in the presence of alcoholic extracts of yellow passion fruit seed (YPFS) and its comparison with the synthetic antioxidants such as butylated hydroxyanisole (BHA) and butylated hydroxytoluene (BHT). The oxidation stability of the sample was measured using the PetroOXY method at 100, 110, 120, 130, 140, and 150 °C at varying YPFS extract concentrations ranging from 0 to 3000 ppm. The results of the study revealed that the stability of biodiesel increased with the increase of extract concentration while decreased with increasing temperature. The first-order rate law explained the oxidation of biodiesel with a correlation coefficient (R^2) higher than 0.95. The reaction rate constant for the consumption of YPFS extract in biodiesel fitted well with the Arrhenius equation giving the activation energy of 79.68 kJ/mol. The shelf life of biodiesel at room temperature was estimated by extrapolating the natural logarithm of oxidative stability versus temperature for different extract concentrations. This study demonstrated that YPFS extract is effective in enhancing the oxidative stability of biodiesel.

Keywords: Biodiesel, Oxidation stability, Kinetic study, Antioxidant, PetroOXY

Superconducting Magnetic Energy Storage With Reneable Energy Sources

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Abstract: The use of electric vehicles has been increasing significantly on announcement of non registration of fuel vehicles. This needs huge infrastucture development for EV charging. Many gaint players are interested to plant charging stations. In order to bring stabilisation in power flow from the grid for this EV charging station SMES energy storage device will play a vital role. This paper discusses on the control of SMES under the load fluctuation and faulty condition. The results obtained from the analysis indicates the effectiveness of compensating the instantaneous voltage dip and improving the power system quality.

Fig. Schematic representation of SMES incorporated to an EV charging system

References:

[1] K. T. Chau and C. C. Chan,

"Emerging energy-efficient technologies for hybrid electric vehicles," Proc. IEEE, vol. 95, no. 4, pp. 821–835, Apr. 2007.

[2] S. P. Richardson, D. Flynn, and A. Keane, "Optimal charging of electric vehicles in low-voltage distribution systems," IEEE Trans. Power. Syst., vol. 27, no. 1, pp. 268–279, Feb. 2012.

[3] K. Qian, C. Zhou, M. Allan, and Y. Yuan, "Modeling of load demand due to EV battery charging in distribution systems," IEEE Trans. Power. Syst., vol. 26, no. 2, pp. 802–810, May 2011.

[4] P. Zhang, K. Qian, C. Zhou, B. G. Stewart, and D. M. Hepburn, "A methodology for optimization of power systems demand due to electric vehicle charging load," IEEE Trans. Power. Syst., vol. 27, no. 3, pp. 1628–1636, Aug. 2012.

[5] K. Clement-Nyns, E. Haesen, and J. Driesen, "The impact of charging plug-in hybrid electric vehicles on a residential distribution grid," IEEE Trans. Power Syst., vol. 25, no. 1, pp. 371–380,



Synthesis of PVA capped ZnS nanoparticles and it's Optical Characterization

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Abstract: Semiconducting nanomaterials such as CdS and ZnS are receiving a lot of attentions from the research community all over the world due to the unique properties which they exhibit. Such semiconducting materials find applications in areas like photochemical analysis, gas sensing, optoelectronic devices, biomedical science etc.

In the present work, Zinc Sulfide (ZnS) nanoparticles have been synthesized by adopting a wet chemical synthesis technique. ZnS is a II-VI semiconductor with a direct band gapof 3.68eV. Here, Zinc Chloride (ZnCl₂) and Sodium Sulfide (Na₂S) have been taken as the precursors and Polyvinyl Alcohol (PVA) has been used as the matrix. Five samples have been synthesized by varying the reaction time. The synthesized nanoparticles have been characterized by UV-visible Spectroscopy (UV-vis) and Photoluminescence Spectroscopy (PL). From the UV-visible spectra the absorption edges have been observed in the range 291-296 nm. All the absorption edgesare blue shifted compared to the bulk which confirms formation of nanoparticles of ZnS. The corresponding band gaps have been estimated using Tauc's plot. Band gaps have been found in the range 3.31-3.58 eV which further confirms the formation of ZnS nanoparticles. The PL spectra shows formation of well defined emission peaks. The excitonic peaks have been observed in the range 323-339 nm. Few peaks corresponding to defect level emissions have also been observed. The effect of change in reaction time has been studied from the results obtained.

References:

[1] J.P. Borah and K.C. Sarma, Acta Physica Polonica A, 114 (2008).

[2] K. Vishwakarma, Asian Journalof Chemistry, 25 (2013).

[3] B. Bodo, R. Singha and S. C. Das, International Journal of Applied Physics and Mathematics, 2, (2012).

Study of effect of variation in reaction time upon CdS nanoparticles

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Abstract: In recent times a huge amount of research work is been carried out in the field of semi conducting nanoparticles all over the world. Semi-conducting nanoparticles belonging to group II-VI such as Cadmium Sulphide (CdS) and Zinc Sulphide (ZnS) have attracted much interest due to their applications in electronics, opto-electronics and non-linear optics. In this work, we report synthesis of CdS nanoparticles by varying reaction time (t= 1hr, 2 hrs, 3hrs, & 4 hrs) using chemical precipitation method. CdS is a wide bandgap semi conductor having bandgap = 2.42 eV. Here synthesis of CdS nanoparticles have been carried out by taking Cadmium Chloride(CdCl2) and Sodium Sulphide (Na₂S) as the precursors and Polyvinyl alcohol (PVA) as the capping agent. The synthesised nanoparticles have been characterized by UV visible spectroscopy (UV-vis), Photoluminescence spectroscopy (PL), X-ray diffraction (XRD) and Scanning Electron Microscopy (SEM). From the UV-Vis spectra, blue shift of the absorption edges of CdS nanoparticles compared to bulk CdS have been observed which confirms formation of nanoparticles of CdS. The corresponding band gaps have been calculated using Tauc's method. The PL spectra shows formation of well defined emission peaks. From the XRD pattern, the average crystallite size have been found to be = 3.51 nm. From SEM micrograph, formation of more or less spherical nanoparticles could be observed. Four different samples of ZnS nanoparticles have been synthesized by changing the reaction time from 1hr to 4hrs and the corresponding changes in the result have been studied.

BIBLIOGRAPHY :

[1] Rajendra Kumar Duchaniya, "Optical studies of chemically synthesised CdS nanoparticles", International Journal of mining, Metallurgy and Mechanical Engineering(IJMMME)vOL.2, iSSUE 2(2014) issn 23020-4060(Online)

[2] Jumi Kakati and Pranayee Datta, 'Photochemical enhancement of CdS nanocrystals by Cu doping' Advanced science engineering and medicine, Vol.5, pp-1-5, 2012

[3] J. Barman, J.P. Borah, K.C Sharma, "Effect of pH variation on size and structure of CdS nanocrystalline thin film", chalogenide letters Vol.5, No. 11 November, 2008, p-265-271

Synthesis of bisindolylmethanes and N-benzyl-tetrahydro-isoquinoline *via* the C-C bond cleavage followed by reduction of iminium ion

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Abstract: The C-C bond cleavage through the reaction of tetrahydroisoquinolines (THIQs) or indoles with activated olefins. THIQ reacts with olefins under catalyst- and solvent-free condition resulting the formation of N-benzyltetrahydroisoquinoline *via* the C-C bond cleavage followed by reduction of iminium ion. Here, THIQ behaves as a reducing agent. On the other hand, when indole is used in place of THIQ in presence of ceric ammonium nitrate as catalyst under solvent-free condition, symmetrical bisindolylmethanes (BIMs) are obtained. The methodology could be further extended to synthesize unsymmetrical BIMs.



Reference;

1. I. Rahman, B. Deka, M. L. Deb, P. K. Baruah, Chemistry Select 2019, 4, 10425-10429.

Bibliography,

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FAST 2019 11-12 NOV, 2019 CENTRAL INSITUTE OF TCHNOLOGY KOKRAJHAR | 55
Isolation and evaluation of antimicrobial property of a probiotic strain from Bas-Tenga, an indigenous fermented food of Nagaland

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Abstract: Probiotics are of immense importance because of their beneficial properties such as immune modulatory properties and normalization of gut microbiota. The present study was focused on isolation of potent probiotic strains from traditional fermented foods and beverages of ethnic tribes of North-East India and application of probiotic traits in food. Various ethnic foods and beverage samples such as Anishi, Akhone, Hentak, Hamei, Soidon, Tuairoi, Hawaijar, Jumai, Tungrymbai, Khoricha and Bas-Tenga were collected from the seven sister states of North east region. The food samples were collected aseptically and isolation was carried on in Lactobacillus selection Agar Base and MRS medium under both aerobic and anaerobic condition. The isolates were screened based on anti-microbial activity against indicator strains *E. coli* and *B. subtilis*. One rod shaped isolate BT1 was obtained from fermented food, Bas-Tenga of Nagaland. The isolate was Gram positive, catalase negative, oxidase negative and aerobic in nature. It showed antimicrobial activity against *E. coli* and *B. subtilis*. It seems isolate BT1 is producing bacteriocin-like compound which can be applied in food biopreservation.

Keywords: Probiotic, ethnic fermented food, Antimicrobial activity, food biopreservation

Technology Intervention on Solar Dryer Through Latent Heat Storage

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Abstract: Solar energy has been considered as one of the viable and sustainable forms of energy where electricity (photovoltaic) and heat (solar thermal) are two commonly harnessed options. The prospect of utilization of solar energy using a variety of dryers has been investigated earlier with mixed degree of successes. The intermittent and varying nature of solar radiation has been identified as a barrier for its extensive applications despite its needs for primary processing of many products including agricultural produces so as to mitigate post-harvest losses. This paper attempts to study the feasibility of enhancing the performance of solar air heater/dryer through latent heat storage of available solar energy using Phase change material (PCM). Use of PCMs in solar dryer as thermal energy storage is expected to reduce the fluctuating temperature due to non-uniform solar insolation diurnally. Better uniformity outlet temperature and increasing the overall efficiency of the system are expected. The detail selection procedure and thermophysical properties of the PCMs are analysed through Differential Scanning Calorimetry, Thermogravimetric analysis, thermal charging-discharging rate and corrosion test. Acetamide and paraffin wax/graphite/high-density polyethylene are considered as suitable PCMs for heat storage in solar dryer having favourable melting temperature (60°C - 107°C) for the application.

Exploration of novel probiotic microbial species from North-East region and their application as anti-phytopathogen, biopesticide, phytostimulant & biofertilizer in agriculture: A Review

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Abstract: Probiotics are living microorganisms belonging to mainly lactic acid bacteria. They have many beneficial properties in human health as well as in agriculture also. Proposed work idea is focused on isolation and identification of novel probiotic microbes from ethnic fermented foods of indigenous tribes of north eastern region (NER) of India. A variety of region specific fermented foods and beverages such as Kharoli, Gundruk, Goimoza, Jim tenga, Lumg-seij, Miya mecheng, Ekung, Muya awandru, and Nichaow traditionally produced and consumed, and even locally marketed in NER India. These fermented foods are consortia of beneficial lactic acid bacteria and their antimicrobial activity and other properties have application as anti-phytopathogen. biopesticide, biofertilizer, phytostimulant etc. Probiotic microorganisms confer direct benefits to the plant acting as biocontrol agents for their antagonistic activity against phytopathogens Xanthomonas campestris, Erwinia carotovora, and Pseudomonas syringae. Probiotic bacteria can act as phytostimulant by can enhancing phyto hormones like auxin, cytokine, gibberelic acid and ethylene. These bacteria has potential in seed germination. Lactobacillus has potential impact in seed germination of Bengal gram (Cicer arietinum), Peas (Pisum sativum), Mustard seeds (Bassica hirta), Rice (Oryza sativa L). Present work idea will explore novel probiotic strains for potent applications in agriculture.

Keywords: Probiotics, fermented foods, agriculture, biocontrol agent, phytostimulant.

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GC-MS analysis of phytochemicals for *Clerodendrum viscosum vent*.in ethyl acetate extract found in Kokrajhar district: NE-India

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Abstract: *Clerodendrum Viscosum vent* is widely distributed tropical plant is North-Eastern states of India. NE-India is the land of 130 tribal community, out of which *Bodo* is the largest plain tribe, highly concentrated in Kokrajhar district. Ethnobotanical uses of *Clerodendrum viscosum* vent among *Bodos* is quite attention-grabbing. They use the plant to cure stomach problems and in some skin allergies. The phytochemical screening of ethyl acetate extract along with GC-MS analysis for bioactive compounds of the plant is reported here. The screened phytochemicals were phenols, flavonoids, quinines, saponines, steroids, terpenoids and tannins. 14 phyto-components with prominent biological activity were identified in phyto-chemical investigation of the plant. L(+)-Ascorbicacid-2,6-dihexadecanoate (RT= 38.906 minutes), hentriacontane (RT= 43.803 minutes), vitamin-A aldehyde (RT= 50.716 minutes), stigmasterol (RT= 51.406 minutes) were some major detected phyto-compounds acquiring peak area 14.11%, 13.44%, 3.324% and 2.979% respectively with bioactivities like cytotoxicity, antitumor activity, ant arthritic activity etc. Isolation of bioactive compounds in future will enhance the study in the field of pharmacognosy.

Key words: Ethnobotanical uses, cytotoxicity, Bodo, phyto-components

Bibliography of presenting author: Research Scholar (M.Sc), Bodoland University

Utilization of Waste *Heteropanax fragrans* as Heterogeneous Catalyst for Biodiesel Production

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Abstract: Non-renewable energy sources are finite in the form of natural gas, coal and oil. Non renewable energy sources once used, it requires million more years to replenish. So, now a days, biodiesel is targeted as alternate fuel to decrease the Greenhouse Gas Emission by replacing the non-renewable source mainly fossil fuel.In this report, we have prepared heterogeneous catalyst from waste plant derived *Heteropanax fragrans* to avoid hazardous chemicals. Since, agro-waste are found to be basic in nature thus we are highly motivated base-catalyzed transesterification reaction. The prepared catalyst is characterised by BET, FT-IR & HRTEM. The catalytic activity has been investigated for production of biodiesel transesterification reaction using agro-waste of *Heteropanax fragrans plant* derived heterogeneous catalyst. The yield of the biodiesel was found to be 93.5% under the optimal reaction condition of 1:15 methanol to oil ratio and 7wt % of uncalcined catalyst at 67 °C.The produced biodiesel was characterised by FT-IR and ¹H-NMR.

Keywords: Agro-waste, *Heteropanax Fragrans Plant*, heterogeneous catalyst, transesterification and biodiesel.

Evaluation of Freeze drying effect on bioactive compounds, antioxidant and color of *Camellia assamecia* from four different tea estates in Assam

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Abstract: Tea is among the most consumed drink worldwide, and its strong antioxidant activity is considered as the main contributor to several health benefits, such as cardiovascular protection andanticancer effect. Drying of tea is the major steps which mostly change the concentration of bioactive compounds present, as studies say. The main objective of the work was to evaluate the freeze drying method on tea leave samples. After drying the moisture content analysis, Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Antioxidant Activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay was done and IC50 value has been calculated. The Total Phenolic Content was determined by using Folin-Ciocalteu assay. Among the four samples, the sample from Golaghat Shyamal Tea Estate was found to be the best with TPC in the range of 458 ± 2.02 to 493 ± 4.74 mg Gallic acid equivalent (GAE)/gm tea extract. The DPPH scavenging activity was turned out to be in the range of 87 ± 1.02 to 94 ± 3.90 percentage. The color, measured by Haunter lab colorimeter, lies in the region greenish/bluish with color difference having L* value of 38.53, a* value of -5.98 and b* value of 19.30 to L* value of 35.61, a* value of -1.05 and b* value of 14.36 which represents to be bluish.

Keywords: Freeze drying, antioxidant activity, Total polyphenol, Flavanoid content, Color

Oven drying effects on polyphenols and color of tea leaves from four tea estate of Assam

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Abstract: Tea is among the most consumed drink worldwide, and its strong antioxidant activity is considered as the main contributor to several health benefits, such as cardiovascular protection andanticancer effect. The main objective of the work was study the effect of oven drying, which is one of the vital steps in maintain the quality with respect to polyphenols compounds and color, on tea leave samples. The Total Phenolic Content (TPC) by using Folin-Ciocalteu assay, Total Flavonoid Content (TFC) by AgCl method, Antioxidant Activity using 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, color by haunter lab colorimetrewas done and IC50 value has been calculated. The Total Phenolic Content was determined and was in the range of 147 ± 2.02 to 193 ± 4.74 mg Gallic acid equivalent (GAE)/gm tea extract. The DPPH scavenging activity was turned out to be in the range of 85 ± 1.02 to 94 ± 3.90 percentage. The color of the sample had color difference of 1931 CIE units with chroma 14.04 and hue-85.71. The study showed that drying method had significant effect on TPC, TFC and %RSA in DPPH Assay and color of the tea leaves.

Keywords: Oven Drying, antioxidant activity, Total polyphenol, Flavonoid content, Color

FAST/2019/PP-27

Anaerobic digestion of vegetable waste at different blending ratio: A comparative study



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Abstract: Anaerobic digestion (AD) is one of the most reliable and cost-effective technology for waste management. In a country like India, where the population is high, there is a significant source of vegetable waste available from both residential and non-residential sources. Hence, the effective utilization of these wastes through AD can play a vital role in reducing their adverse environmental impacts as well as for the production of biogas. The present study analyses the experimental results obtained from a laboratory-scale anaerobic digestion process using uncooked vegetable waste (VW). Digesters are prepared with four different total solid (TS) contents viz. 1.5 ± 0.03 , 3.2 ± 0.3 , 4.5 ± 0.08 and 6.3 ± 0.05 %. A total of four digesters of capacity 1000 litres glass bottles are used, and the tests are carried out for a retention time of 55 days. It is observed that the highest biogas production is found for the digester with TS of 4.5 ± 0.08 %. The study also evaluates the daily variation of temperature and pH value in the digester and their effects on biogas production rates are analysed. The primary objective of this study is to develop an understanding of most influencing factors affecting biogas production rate for flexibility of utilising various feedstocks in pilot-scale biogas plants.

Keywords: Anaerobic digestion, Vegetable wastage, Total solid, Biogas production rate.

Response surface methodology based optimization of a biodiesel run variable compression ratio diesel engine

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Abstract: The consciousness on application of biofuel in diesel engine is progressing reliably among the population across the world for its advantages over fossil fuels. The study presents a mathematical model of a 3.5 kW diesel engine operated with three different biodiesels (Jatropha, Karanja and Mahua) based on response surface methodology (RSM). Design of experiments (DoE) statistical tool is used to develop the experimental matrix. The response variable considered are brake thermal efficiency (BTE), exhaust gas temperature (EGT), oxides of nitrogen (NOx), unburned hydrocarbons (HC) and carbon monoxide (CO). Optimization of engine input parameters such as load and compression ratio (CR) is performed using desirability approach to maximize and minimize the engine performance and emission levels respectively. The results indicated a high overall desirability of 96% for Jatropha biodiesel at an optimum condition of 51.7% load and CR of 18. However, Karanja and Mahua biodiesel showed a desirability of 94.2 and 94% for load 53.7% and CR of 18 respectively.

Keywords: Diesel engine; biodiesel; compression ratio; response surface methodology

Use of solar flat plate collector to assist vapour absorption refrigeration system

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Abstract: VARS (vapour absorption refrigeration system) uses low grade energy to operate which is given to generator of VARS to obtain cooling effect. For heating the generator, solar heat obtained from flat plate collector using water as medium is used by generator of VARS where water is heated to 98°C in flat plate collector from ambient temperature. For study month May(summer) and January(winter) are taken in which COP(coefficient of performance) are 0.2 and 0.4 respectively which is less than carnot COP for May(0.25) and January(0.481) based on temperature of VARS' components like generator(90°C), evaporator(10°C), and absorber, condenser temperature(average ambient temperatures) are 34°C, 25°C in the month of May and January respectively. Cooling load is taken as 2.8 kW and generator heat load of VARS from collector in May and January is 0.0521 kg/s and 0.0228 kg/s respectively. The flat plate collector's specifications of glass cover, absorber plate (mild steel) and collector are taken from ref[1].The system will work only during day time using solar radiation.

Keywords: COP(coefficient of performance), Carnot, Cooling load, VARS.

[1] M.M.Baig, M.A.Khan, M.K.M.Udin, M.R.Malik, M.W.W.Haque, "Calculation and fabrication of a solar flat plate collector efficiency using mild steel as absorber plate", International Journal of Science Technology and Engineering, vol.3, issue 08, pp.36-41, 2017.

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