Conference proceedings

SCHEMCON-2020

16th Annual session of Students Chemical Engineering Congress

October 9-10, 2020

Virtual mode

Organized by

Indian Institute of Chemical Engineers

Dr. H. L. Roy Building, Jadavpur University Campus,

Kolkata - 700032

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Contents

SCHEMCON-2020

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Prof. V S Sapkal **AICTE Nominee**	

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Ms. Piyali Chakraborty
Ms. Subha Samajdar

Organizing Secretary

Dr. Avijit Ghosh, Honorary Secretary, IIChE
Assistant Professor, Heritage Institute of Technology, Kolkata

SCHEMCON-2020

Program Schedule

Inaugural Program: SCHEMCON-2020	
Time	**Details**
9:00-9:05	Welcome address by The President: Prof. V. V. Basava Rao
9:05-9:10	Address by Guest of Honour: Prof. Basab Chaudhuri, Vice Chancellor, West Bengal State University
9:10-9:20	Address by Guest of Honour: Mr. Biswanath Chattopadhyay, CEO IVL Dhunseri Petrochem Industries Limited
9:20-9:25	Address by Guest of Honour: Prof. G. D. Yadav, Past President, IIChE & Former Vice Chancellor ICT Mumbai
9:25-9:30	Inauguration of IIChE App
9:30-9:35	Address by Vice President Prof. M. V. Rao
9:35-9:40	Address by Vice President Mr. P.K. Saxena
9:40-9:55	Address by Chief Guest: Shri C.P. Gurnani, Chief Executive Officer and Managing Director, Tech Mahindra
9:55-10:00	Vote of Thanks by Dr. Avijit Ghosh, Organizing Secretary, SCHEMCON-2020

SCHEMCON-2020

Day 1: OCTOBER 9, 2020 (Friday)

Time	Theme	Name of Chair Person & Coordinator	Name of coordinator	Meeting Link
9:00-10:00		**Inauguration Chief Guest:** Shri C.P. Gurnani, Chief Executive Officer and Managing Director, Tech Mahindra **Guest of Honours:** Prof. V. V. Basava Rao, President, IIChE Prof. Basab Chaudhuri, Vice Chancellor, West Bengal State University Mr. Biswanath Chattopadhyay, CEO IVL Dhunseri Petrochem Industries Limited Prof. G. D. Yadav, Past President, IIChE & Former Vice Chancellor ICT Mumbai Prof. M. V. Rao, Vice President, IIChE Mr. P.K. Saxena, Vice President, IIChE Organizing Secretary Dr. Avijit Ghosh **Inaugural Song:** Mrs. Sumana Mandal, Assistant Professor, Haldia Institute of Technology	Subha Samajdar, IIChE Headquarters	Time: Oct 9, 2020 09:00 AM India Join Zoom Meeting https://us02web.zoom.us/j/85228187246 Meeting ID: 852 2818 7246 YouTube Link: https://youtu.be/tBLegA14R3c
10.30-11.30	Special session I-Covid 19	**Session Chairpersons:** **Dr. T. L Prasad, BARC** Mobile: 9869879214 tlprasad63@gmail.com **Dr. C. Karthikeyan, Anamalai University** Mobile: 9171474175 drcktech@rediffmail.com **Dr. M. P. Jain, Retd. Scientist, BARC** Mobile: 9867262250 mpjain2000@yahoo.com	Anwesha Pandit anweshapandit12@gmail.com 9330795318 08610710	https://global.gotomeeting.com/join/148500029
11:30-13:30	NN- I	**Prof.(Dr) Alpana Mahapatra, D J Sanghvi College of Engineering, Mumbai** Mobile: 9920832421 alpana.mahapatra@djsce.ac.in	Aishika Mitra aishikamitra1008@gmail.com 7998453643	https://www.gotomeet.me/IIChE-HQ/schemcon-2020-nn-1 **Access Code:** 894-763-797
	NN- II	**Prof. Biswajit Mandal, HITH** Mobile: 9732961156 bmandal1977@rediffmail.com	Aniruddha Mondal 8013292565 aniruddha0266@gmail.com	https://global.gotomeeting.com/join/394490813

SCHEMCON-2020

	GSE- I	**Prof. Sunil Baran Kuila**, HITH Mobile: 8972960394 sunilbarankuila@gmail.com	Abhishek Ganguly abhishekganguly934@gmail.com 8017002896	https://global.gotomeeting.com/join/238357325
	GSE- II	**Prof. S. K Gupta, HBTU Kanpur** Mobile: 7081300512 skgupta@hbtu.ac.in	Jyotsana rani jyotsanaranichem@gmail.com 62054200477	https://global.gotomeeting.com/join/695624509
	GSE- III	**Prof. Monal Dutta,** CIT, Uluberia Mobile: 8334822119 soniairin@gmail.com **Prof. Sri Durga, OUCT** Mobile: 9949591929 sridurga.sri9@gmail.com	Powsali Sadak poushali.sadhak99@gmail.com 9875426084	https://global.gotomeeting.com/join/943167085
13:30-16:30	M. P Chary Award	**Prof. N. Balasubramanium,** Anna University **Mobile:** 9444954151 nbs.bala@gmail.com **Prof. Bishnupada Mandal,** IIT Guwahati bpmandal@iitg.ac.in	Trishita Bhattacharjee trishita99bhattacharyya@gmail.com 8777018320	https://global.gotomeeting.com/join/501838437
14:30–16:30	WM- I	**Prof. Amitava Bandopadhay,** Calcutta University Mobile: 9073507941 amitava.iiche@gmail.com **Prof. S. Ilaiah, OUCT** Mobile: 9603160577 ilaiah06014@gmail.com	Sushmit Ghosh sushmit.ghosh2001@gmail.com 9007975497	https://global.gotomeeting.com/join/581596565
	WM- II	**Prof. Madhu Agarwal,** MNIT Jaipur Mobile: 9413349429 madhunaresh@gmail.com	Ditsha Ganguly ditsha01@gmail.com 8697200473	https://global.gotomeeting.com/join/156442165
	WM- III	**Prof. R. Parthiban**, SSN College of Engineering Mobile: 9884488302 **parthibanr@ssn.edu.in**	Kartik Bansal kartik.bansalg@gmail.com 7003246035	https://global.gotomeeting.com/join/815337533
	BE - I	**Prof.(Dr). K. B. Radhakrishnan,** SCT College of Engineering, Trivandrum Mobile: 9447205767 drkbrnair20@gmail.com **Dr. Deepshikha Datta, GMRIT** Mobile: 9583829603 deepshikha.d@gmrit.edu.in	Raktim Ghosh rghansy@gmail.com 83358 69624	https://global.gotomeeting.com/join/877419869
16:30-17:30	**Keynote address**	Keynote Address by: Prof. Jayant Kr. Singh, IIT, Kanpur	Ms. Piyali Chakraborty, IIChE	Join Zoom Meeting https://us02web.zoom.us/j/4249611133 Meeting ID: 424 961 1133

SCHEMCON-2020

Day 2: OCTOBER 10, 2020 (Saturday)

8.15-8.35	**Invited Talk** –Dr. Sonal Majumdar, FDA, USA sonal.mazumder@gmail.com sonal.mazumder@fda.hhs.gov		Powsali Sadak 9875426084 poushali.sadhak99@gmail.com	Join Zoom Meeting https://us02web.zoom.us/j/4249611133 Meeting ID: 424 961 1133
8:35 – 10:00	PMS- I	**Dr. Somak Jyoti Sahu, HITH** Mobile:9932024865 somaksahu@gmail.com	Sreetama Pandit sreetamapandit@gmail.com 7596846260	https://global.gotomeeting.com/join/880607693
	PMS II	**Dr. Dwaipayan Sen, HITK** Mobile: 9748454268 dwaipayan.sen@heritageit.edu **Prof. Jyothi Thati, OUCT** Mobile: 9959167505 **jyothithati@ouct.ac.in** **kattajyothi@gmail.com**	Abhinaw Kumar rayankit149@gmail.com 9097520528	https://global.gotomeeting.com/join/690426901
	PMS- III	**Prof. Abbhuday Mallick, HIT Kolkata** Mobile: 9830589527 abhyuday.mallick@heritageit.edu **Mr. Dhawal Saxena, Blast Carboblocks Pvt. Ltd** Mobile: 9323363077 Dhawal_saxena@hotmail.com	Md Danish Faraz Hussain danish.faraz@live.com 8210935331	https://global.gotomeeting.com/join/167471141
	OCE- I	**Prof. Bimal Das, NIT, Durgapur** Mobile: 9434789023 bimal_30@yahoo.com	SK MD SHAHRIAR ALAM rubelmemari@gmail.com 7063089310	https://global.gotomeeting.com/join/528703821
	OCE- II	**Prof. Rajashimman, Annamalai University** Mobile: 9842565098 simms@rediffmail.com	Aniruddha Hore aniruddhahore02@gmail.com 9903271368 / 6290278304	https://global.gotomeeting.com/join/912300877
	OCE- III	**Prof. Tarun Kumar Naiya, IIT, Dhanbad** Mobile: 9471191367 trn2711@yahoo.com	Anwesha Pandit anweshapandit12@gmail.com 9330795318	https://global.gotomeeting.com/join/906522717

	OCE - IV	**Prof. Sutapa Roy,** HITH Mobile: 7319286492 sutaparoymasanta@gmail.com **Prof. M. Mukunda Vani, Anurag University** Mobile: 9866002491 hodchem@anurag.edu.in	Rajneeta Chaudhuri chaudhurirajneeta@gmail.com 9051987112	https://global.gotomeeting.com/join/513966589
	OCE - V	**Prof. Sanjib Barma, Calcutta University** Mobile: 7896889085 sanjib.burma@gmail.com **Dr. Sujoy Bose** sujoybose83@gmail.com 8011215386	Sai Samkari Chintalapati sschintalapati@gmail.com 9381945026, K.V.S.G Srivani Girijasrivani123@gmail.com 8008003091	https://global.gotomeeting.com/join/946745597
10.00-12.00	**Keynote address**	**Prof. J. B. Joshi** Emeritus Professor-J.C.Bose fellow jbjoshi@gmail.com	Subha Samajdar subha.samajdar@gmail.com 9836388112	Join Zoom Meeting https://us02web.zoom.us/j/424961 1133 Meeting ID: 424 961 1133
12.00-13.30	**Special Session II-Emerging trends on e-waste management**	**Chief Guest:** Prof. Saikat Maitra, Vice Chancellor, MAKAUT, WB **Guest of Honour:** Prof. T. K. Pariya, Director, School of Energy Science, MAKAUT **Session Chair:** **Prof. B. B. Paira, Academic Advisor, MAKAUT** Mobile: 7003266675 profbbpaira@gmail.com **Speakers:** **Prof. R Roychoudhuri** Mobile: 9831711342 Heritage Institute of Technology, Kolkata reshma.roychoudhuri@heritageit.ed **Mr. B. Debnath, Split Site Scholar, Aston university** biswajit.debnath.ju@gmail.com **Mr. A. Potluri** Managing Director, Green Waves Environmental Solutions, anil@greenwavesrecyclers.in	Aniruddha Mondal aniruddha0266@gmail.com 8013292565	https://global.gotomeeting.com/join/717214325

SCHEMCON-2020

14:00-15:00	**Panel Discussion on *Manufacturing up-gradation by Artificial Intelligence***	**Prof. V. K. Rattan, VC, GNA University** E-mail- vkrattanpu@yahoo.com Mob. 9815334198 **Dr. Sanjeev Katti, Director General** Energy Center ONC E-mail - sanjeev_katti@ongc.co.in Mob. 8451919270 **Sh. Sushil Kumar, Past President IIChE, Ex unit Head RIL Dahej** E-mail - sushilkumar.ril@gmail.com Mob. 8454840176 **Sh. R G Rajan, Ex CMD Rashtriya Chemical & fertilizer** E-mail - rgragan1957@gmai.com Mob. 9819991155 **Mr. Saurabh Srivastava, Google Research Center** saurabh.ixd@gmail.com Mob. 9945055966 **Dr. U Kamachi Mudali, Ex. CMD Heavy Water Board** ukmudali1@gmail.com Mob. 9969034515 **Moderator: Prof. Praveen Saxena,** Vice President, IIChE, Director & CEO Blast Carboblocks Pvt, Ltd praveensaxena1951@gmail.com	Trishita Bhattacharjee trishita99bhattacharyya@gmail.com 8777018320	https://global.gotomeeting.com/join/867985005
17:00-18:00		**Award Ceremony and Valedictory Session** **Chief Guest: Mr. Dileep Thatte, National Institute of Standards and Technology (NIST), USA** **Guest of Honours:** Prof. S.V. Satyanarayana, Immediate Past President, IIChE Prof. V. S. R. K. Prasad, Director, IIPE, Visakhapatnam Mr. Shyam Bang, Past President, IIChE **Chairpersons:** Prof. V.V. Basava Rao, President IIChE Prof. M. V. Rao, VP IIChE Mr. Praven Saxena, VP IIChE **Organizing Secretary** Dr. Avijit Ghosh	Piyali Chakrborty, IIChE Headquarters	Join Zoom Meeting https://us02web.zoom.us/j/89679924384 Meeting ID: 896 7992 4384 YouTube Link: https://youtu.be/HaVOhEZIN9Y

SCHEMCON-2020

MESSAGES

Prof. V.V. Basava Rao
President

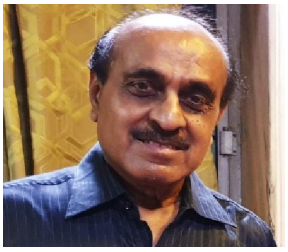
It is a matter of great pleasure to greet the IIChE fraternity on the occasion of the 16th SCHEMCON, being held at the IIChE Headquarters in Kolkata. The unprecedented crisis and distress, arising out the Covid-19 pandemic, forced us to cancel our original plan for this important event. Instead, for the first time in the annals of SCHEMCON, it is being digitally organised at the Institute Headquarters. One does not need much explanation to appreciate that it took considerable effort, energy and endeavour on the part of the organisers, particularly, the Organising Secretary, Dr. Avijit Ghosh, to plan the event with utmost care and coordination in the time of great difficulties.

Over the years, SCHEMCON has gained impressive popularity among the Chemical Engineering student communities and the faculty members across the country. It is a rewarding platform where the students can discover new ideas and learn new skills as well as share their out of the box thinking. It is their enthusiasm that has largely motivated us to go ahead with the event this year despite many hurdles.

The underlying theme for this year's SCHEMCON – 'Intensified Industrial Chemical Engineering – Operations, Practices and Techniques for Sustainable Development' is highly appropriate in the new normal world that is unfolding before us. The mankind has been grossly abusing and exploiting Planet Earth over the decades for trivial gains. The Covid-19 pandemic has forced the humanity to stall and reflect upon building a new world, where mankind would hopefully respect the Nature and not destroy it mercilessly. In this changed world, Sustainable Development will be the new *Mantra.*

I look forward to many engaging sessions in SCHEMCON this year, with renowned academics and industry experts offering stimulating ideas and sparking off engaging interactions among the participants. It will indeed be a rewarding experience for all of us.

SCHEMCON-2020



Praveen Saxena
Vice President

It is my pleasure to associate with virtual Student Chemical Engineers Congress 2020 and the specifically with the young Budding Chemical Engineers.

SCHEMCON is a global platform for the students to showcase their capabilities and capacities in the field of chemical engineering & technologies.

I wish grand success of virtual SCHEMCON 2020 held by HQ Kolkata. As previous years, I hope we continue our tradition of enthusiastic participation by students and knowledgeful sessions in this online edition this year.

SCHEMCON-2020

Prof. M.V Rao
Vice President

It is my great pleasure to greet the IIChE community, specially its collective of Student Members, on the occasion of the 16 th SCHEMCON, being hosted digitally by the IIChE Headquarters in Kolkata on 9 and 10 October 2020. This year, organising SCHEMCON was a challenging task with all of us still fighting a formidable battle against Covid-19 pandemic. But, as a matter of fact, all the hardships and obstacles in our path motivated the team IIChE to close ranks and plan the event in a manner,befitting the occasion.

Ever since its inception in 1947, IIChE has been committed to empowering students and practitioners of Chemical Engineering in its pursuits for knowledge and skill enhancement in Chemical Engineering and the allied fields. More particularly, in recent years, IIChE has been coming up with various ways and means to reach out to the students and to make them an integral partner in the Institute's endeavour for attaining excellence. Towards that direction, SCHEMCON has evolved as an ideal portal, enabling the students to imbue with knowledge from the fast evolving field of Chemical Engineering and helping them to translate the knowledge into innovative practices for sustainable growth of the society and the economy.

I am confident that with the presence and participation of esteemed academics and industry experts, SCHEMCON 2020 will offer impressive opportunities to the students to update themselves with the changing scenario in the arena of Chemical Engineering. Although unlike any previous year, this year's SCHEMCON is being held on virtual mode, nonetheless, I strongly believe that it will not dampen the high level of enthusiasm and energy among the students. I look forward to many engaging sessions ahead.

SCHEMCON-2020

Dr. Avijit Ghosh
Honorary Secretary

With the countdown beginning for SCHEMCON 2020, it gives me great pleasure as the Organising Secretary for this year's Students Chemical Engineering Congress to look forward to a memorable and rewarding event ahead, notwithstanding the surrounding gloom arising out of the Covid-19 pandemic situation. This year's SCHEMCON is going to be unique for more than one reasons. Firstly, this is the maiden time that the IIChE Headquarters in Kolkata is organising the event. Moreover, for the first time, the event is being hosted entirely on the virtual platform amidst the Covid-19 crisis.

The idea behind initiating SCHEMCON back in 2005 was to create a platform for the young minds to initiate them to the latest developments and discoveries in the fast evolving field of Chemical Engineering. Another objective was to enable the students spell out their innovative ideas and perceptions while enabling them absorb valuable inputs from acclaimed academics and seasoned professionals. It is a matter of great satisfaction for IIChE that over the years the Institute has been able to steadily establish popularity of the event among the academic fraternity in the Chemical Engineering field all across the country.

For the present year, it was a great challenge for the Institute Headquarters to organize the event with a short notice following the change in the original plans due to the unabated pandemic crisis. I am, indeed, very thankful to the IIChE President, Prof. V.V. Basava Rao, and several of my other colleagues in the IIChE Council and in other academic institutions whose strong support and suggestions smoothened out many difficulties and eased many logistic bottlenecks. I also appreciate the cooperation of the IIChE Headquarters team, providing me all the necessary assistance.

The central theme for this year's SCHEMCON – 'Intensified Industrial Chemical Engineering – Operations, Practices and Techniques for Sustainable Development (IIChE-OPTSD)'– is very apt for the present situation. As the world struggles to get back to a normal life that we all knew before the onset of the pandemic, the need of the hour is to search for ways and means to ensure Sustainable Development for the future of the humanity.

I keep my fingers crossed wishing that SCHEMCON 2020 turns out to be highly successful in every aspect. I also look forward to many invigorating sessions of academic empowerment and insightful interactions under the umbrella of SCHEMCON 2020.

SCHEMCON-2020

Dr. Madhu Agarwal
Joint Secretary

I am very grateful to the organizing team of ONLINE SCHEMCON-2020 extending the horizons in Intensified Industrial Chemical Engineering-Operations, Practices and Techniques for Sustainable Development. It is particularly meaningful for me not only as a Joint Secretary to be here, in the organization like Indian Institute of Chemical Engineers but being a teacher the importance of shared values and common policies, as a basis for sustainable development and sustaining peace. I would like to take this opportunity to thank IIChE for providing the excellent platform for students in the Conference to adapt advances, specially in the field of Chemical Engineering and the interdisciplinary areas. For the recent scenarios, it has become imperative to explore the new horizons developing hybrid systems. Such platform is the plethora for exchange of ideas, knowledge, and creativity. Therefore, considering the participation of accomplished individuals from industries, research institutes, laboratories, academia, and students, I am once again obliged to be a part of event.

SCHEMCON-2020

Prof. Gaurav Rattan
Honorary Registrar

Technology has changed many folds in last decades. To keep a pace with the changing times, teaching learning ecosystem has to work on solving real time problems. We believe that with every technological breakthrough, new avenues for doing active research open up.

On behalf of the IIChE 2020 organizing committee, I am honored and delighted to welcome you to the Online SCHEMCON 2020, October 9-10, Theme: Intensified Industrial Chemical Engineering Operations, Practices and Techniques for Sustainable development a virtual mode from IIChE Headquarters. I believe we have chosen an online virtual conference platform that guarantees a successful technical conference to offer best way to allow researchers to share their scientific work and interact with collaborators.

This conference is conceptualized keeping in view the needs of current times. Having said so, I believe this conference would serve as an excellent springboard for various stakeholders to set and achieve higher goals in making the world a better place to live.

I cordially welcome all the academicians, researchers, industrialists and engineers who are taking part in this noble endeavor. Your presence at this conference and valuable scientific contribution will no doubt set the standard for future conferences of this nature.

I am sure that this conference will add more laurels in the years to come.

Invited Talks

SCHEMCON-2020

Continuous Manufacturing -- A Key to Sustainable Manufacturing

Dr. Sonal Mazumder
*Corresponding Author Email: sonal.mazumder@gmail.com
Regulatory Reviewer (Chemical Engineering), US Food & Drug Administration, USA

Abstract

Continuous Manufacturing is achieving extensive consideration as a way of producing fine chemicals, active pharmaceutical ingredients, and finished dosage forms. Although potential benefits over traditional batch-wise production have been discussed at many occasions and appear evident, continuous processes are only slowly being implemented. The American Chemical Society Green Chemistry Institute Pharmaceutical Roundtable has defined "continuous processing" as one of its research priorities. Innovative continuous manufacturing (CM) technologies have a great potential to improve control over quality, reduce costs, enhance process safety, and significantly reduce the timelines currently involved across the medicines' supply chain. When compared to traditional batch manufacturing, continuous manufacturing also has enhanced ability to control the process and product quality through knowledge of residence times and the implementation of process analytical technology (PAT) tools. The design and implementation of continuous processes for the manufacture of pharmaceutical intermediates, APIs, or even drug products are a truly multidisciplinary effort. It starts with defining a route which is most favorable among several possible routes to reach a target molecule. It requires a thorough understanding of each single-chemical transformation on molecular level, covers the knowledge of the kinetics of the desired and competing reaction pathways including factors such as activation enthalpy and entropy, and reaction enthalpy. This leads to performance requirements for the reactor in which the desired reaction is intended to run. This finally leads to required reactor features such as mixing speed, heat removal, residence time distribution, and others. It also leads to requirements regarding the control accuracy and speed of feedback loops. Consequently, stakeholders of very different disciplines are engaged in implementing a continuous process. The speaker will give an overview of the continuous manufacturing process related to development of pharmaceutical products along with Quality-by-design (QbD) paradigm for pharmaceutical development and the advancement of process analytical technology (PAT) for designing, analyzing, and controlling manufacturing using science and risk-based approaches.

Special Session II

Emerging Trends on E-Waste Management

Reshma Roychoudhuri (Mitra)
*Corresponding Author E-mail: reshma.roychoudhuri@heritageit.edu
Heritage Institute of Technology

Abstract

End of life electronic equipment, known as e-waste, is a threat to the whole world. The problem of e-waste disposal is a very well-known fact, and its generation is increasing exponentially every year. There are many factors that are associated with the end of life disposal of e-waste management. The complexity of the materials used, occurrence of hazardous substances, lack of awareness, legislative requirements, availability of technologies, supply chain uncertainty are some of the major issues pertaining with e-waste management. Aim of the talk would be to touch upon the various factors, issues and challenges of e-waste management.

SCHEMCON-2020

Solar Panel Recycling: Resource Recovery and Circular Economy Aspects

Biswajit Debnath
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The Aston Institute of Urban Technologies and Environment (ASTUTE), Aston University, Birmingham, B47ET, UK

Abstract

Global energy demand is increasing exponentially, and the renewable energy sources are becoming promising and sustainable solutions. Solar power, which is the most abundant source of energy, is a big area of research as well as market analysis. Hence, there has been a sharp increase in global solar power investments leading to a high demand of solar panels. The solar panels, otherwise known as Photo-Voltaic (PV) panels, not only help in energy harvesting but also comes with the danger of end-of-life (EoL) disposal. It is expected that by 2030, there will be 1.7 – 8 million tonnes of solar panel waste which will reach 60-78 million tonnes by 2050. End of life solar panel is categorised as electronic waste (e-waste) which is hazardous in nature as it contains heavy metals e.g.lead(Pb),tin (Sn), cadmium (Cd) etc.It can be considered as an emerging e-waste. Since the lifespan of solar panels are quite high compared to other electronic devices, the volume of solar panel waste generation is low. This is one of the key issues for the commercial recycling plants. There are only a few dedicated solar panel recycling units around the world and the cost of recycling is quite high.There are existing technologies that includes physical disintegration, dry and wet mechanical process, thermal treatment, chemical etching, leaching, pyrolysis etc. However, the recycling line changes based on the type of the solar panels. Hence segregation of solar panels plays a role in this case. Additionally, the supply chain issues are also very important and needs to be addressed. In this article, the current status of solar panel recycling has been discussed in detail with a focus on the existing and upcoming technologies for resource recovery. The importance and the role of supply chain network has been discussed. Additionally, a generalised idea on circular economy aspects of solar panel recycling has been briefly stated. It is expected that the article will be helpful to the researchers and policymakers.

Keywords: Solar Panel Recycling, Circular Economy, Resource Recovery, E-waste, Supply Chain.

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Emerging trends on E-waste management

P. Anil Chowdary
*Corresponding Author Email: anil@greenwavesrecyclers.in
Managing Director,Green Waves Environmental Solutions, Visakhapatnam

Emerging trends on E-waste management E-waste is the Toxic Legacy of our Digital Age. Setting new benchmarks in maintaining the confidentiality of the business data and offering highly efficient e-Waste management services is GreenWaves Environmental Solutions - the first authorized (by Pollution Control Board, Andhra Pradesh) e-Waste collection and handling unit of Andhra Pradesh. Interestingly, besides a data destruction certificate, GreenWaves sends a video of storage device disposal to its customers. We consider e-Waste not as a waste but as a multiple-resource. It's a tool for social transformation giving paramount importance to the trust factor;

Focused on collecting all types of recyclable e-Waste, GreenWaves has built an app called ReByte. The app within mere touches ensures safe & environment-friendly disposal of recyclable wastes collected from the user's door-step, and also provides reverse-logistics. Additionally, clients are given a chart indexing the types of e-Waste and provided with assistance in custom clearance and filling of e-Waste's annual returns.

Through continuous innovations and implementing cutting-edge recycling technologies, GreenWaves has created a niche for itself. It engages in end-to-end operations – right from collecting electronic waste from various functional areas to storing, and dismantling. The company collects e-Waste from Corporate, Government, SMEs, Educational Institutions, Retailers, and Individuals among other sources. The dismantling process (including manual semi-manual & automatic) involves physical segregation of particles such as plastics, glass, steel, non-ferrous materials, wires, gases & printed circuit boards, and hazardous e-Waste like tube lights, sodium vapors lamps, and cartridges. All along the process, safe handling of elements and safety of its employees are given the first priority. On the other hand, by passing-on the knowledge to its clients and the general public, GreenWaves is tirelessly creating public awareness. It regularly conducts workshops & several programs (E-Drives), in addition to framing creative portraits poised to inspiring people to utilize e-Waste in innovative ways. Furthermore, to impart the knowledge on the importance of proper e-Waste disposal and its ill-effects of mismanagement to every individual, the company has installed e-Bins in selected areas of Visakhapatnam for disposal & recycling of small electrical & electronic items.

Owing to such exquisite range of service offerings and delicate methodologies followed, GreenWaves has also won the National Awards for its excellence in e-Waste Recycling at Indian Industry Session (at 8th Regional 3R Forum in Asia and the Pacific). And yet another golden feather on its crown is the invitation it received from National Green Tribunal Conference to deliver a talk on e-Waste Management at Guwahati. On world environmental day we had been given Seva Puraskar award by Andhra Pradesh Pollution Control board for our great contribution towards sensitizing the people on Ewaste management and for

effective recycling of e-waste. We aim to be the first company to provide an indigenous solution for e-Waste management to every individual. GreenWaves is well on its way to make this part of the world a better place to live in.

E - Waste Mukt Bharat - Swachh Bharat

Nanomaterial & Nanotechnology (NN)

Restrained Synthesis of 1D, 2D & 3D α-Fe2O3, Cu-O and their conglomerates for assessment of Photo-Induced & magnetic properties

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ID: OP-01-001

Abstract

Hematite was one of the extensively engineered materials premediated to study far-flung applications in material science. We paraphrase the template-based synthesis ofcontrolled self-assembly α-Fe 2 O 3 structures such as 1D (nanorods), 2D (hexagonalplatelets), and 3-D (spheres) succored by hydrothermal technique. 3-D Cuprous Oxidestructures were also synthesized. The combo of these oxides was mimicked ascomposites. All the synthesized materials including composites were characterized forphase purity and crystallographic properties through X-Ray Diffraction. Morphologicalstudies of structured materials were performed with the aid of Scanning ElectronMicroscope. Pair Distribution Function (PDF) was performed to understand vacancyordering in the materials. Comprehensive studies of bandgap properties were evaluatedby Diffuse Reflectance Spectroscopy (DRS). Elemental analysis of the synthesizedmaterials were conferred using Energy Dispersive X-Ray spectroscopy (EDAX).Systematic photo-catalytic of methylene blue dye with composites as catalysts usinglow power visible light were conferred which provided degradation upto 85%. UV-visible spectrophotometer was used to trace the degradation of organic dyes. Further,they were subjected to magnetic properties and photocurrent testing. The roomtemperature MH curve for 0-D Iron Oxide nanoparticles inheritedsoft magnetic behaviour with low coercive field and 3-D Iron Oxide sphere was ahard magnet with larger coercive field.Photocurrent testing; Photocatalytic degradation; Coercive field.

Key Words: Template synthesis; hydrothermal technique; Pair Distribution Function;

Nano-biosensors for Advanced Packaging Systems and Food Safety

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ID: OP-01-003

Abstract

Nano-biosensors have emerged as a next-generation technology, opening new horizons in thefield of food technology and food safety. These advanced sensing systems help to facilitatethe monitoring of food quality by detecting the foodborne pathogens, foreign particles inprocessed food, controlling food additives concentration and analyzing the freshness bydetermining shelf life of the product. The devices can be easily integrated with the packagingmaterial, giving rise to a novel Intelligent Packaging System. The working principle dealswith the conversion of biological or chemical signals into electrical signals via transducer.Depending upon the type of information obtained from these nano-sensors, they are broadlycategorized into Mechanical (based on changes in resonant frequency), electrochemical(involve chemical changes) and optical (output signal received is a light signal) sensor. Thisarticle mainly discusses the application of Iron based magnetic nanoparticles which proves tobe a promising material for fabricating these biosensing devices. Also, a future perspective onthe usage of biopolymer-based nanocomposite for enhancing the performance of sensingdevices have been discussed.

Keywords: Nano-biosensors; Intelligent packaging system; Magnetic nanoparticles

SCHEMCON-2020

Nanomedicine

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ID: OP-01-005

Abstract

What if we could screen of thousand of diseases all at once...with just a singledrop of blood. What if we could search out and destroy cancer cells withoutsurgery or chemotherapy? What if we could restore eyesight by injecting tinyparticles that help the body repair injured nerves. These scenarios may seemfar-fetched that they are among the long term goals of researchers working inthe field of medicine, but what is Nanomedicine? Nanomedicine is theapplication of nanotechnology to medicine. Its kind of like giant game of lego,only it is very small and the building blocks are molecules and atoms. So whatdoctors needs our tiny tools that can work with fantastic precision at thenanoscale the size of the smallest working parts of our bodies. Nanomedicinerefers to highly specific medical intervention at the molecular scale for curingdisease or repairing damaged tissues, such as bone, muscle, or nerve.

Applications of nanotechnology for treatment, diagnosis, monitoring and controlof biological systems is referred to as nanomedicine. It is a relatively newertechnology based on the uses of engineered nanomaterials like liposomes,carbon nanotubes, fullerences, polymeric micelles, quantum dots.Nanomedicine gives great hope for better and faster treatment of manydiseases and hope for better tomorrow. However, the creation of new“nanodrugs” requires a special understanding of the properties of nanoparticles.This review present the work which determines and describes the way ofcreating new nanodrugs and molecular dynamic applications up to newmedicinal products, as a proposal for the personalized nanomedicine in theearly future.

Keywords : Nanomedicine, Fullerences, Nanoparticles, Nanodrugs,Personalized nanomedicine.

SCHEMCON-2020

Ruthenium-bound Silica Nanoparticles coated onto Contact Lenses for Oxygen Sensing in the Tear Film

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ID: OP- 01-006

Abstract

Oxygen tension (pO2) in the tears is invariably affected by contact lens wear, especially in thepost-lens tear film (PLTF). This negatively influences oxygen metabolism of cellular layers ofthe cornea and measuring pO_2 dynamics (in ns) underneath PLTF is an important tool toevaluate health of the cornea. Measurement of pO_2 dynamics in nano timescale in the PLTF is amajor unmet clinical need. Hence, we propose to employ O_2-sensitive Ruthenium (Ru)phenanthroline bound to hollow silica nanoparticles (NPs) coated on contact lens for measuringpO 2 dynamics.Ru-SiO 2 NPs were prepared by microemulsion method and water etched to improve porosity. Theaverage size of Ru-SiO 2 NPs was 150 ± 20 nm. XRD showed that Ru-SiO 2 NPs were amorphousin nature. FTIR results confirmed that Ru was bound to Si. Fluorescence emission at 590 nmconfirmed the presence of Ru. To enhance binding of the NPs to the contact lens, they werefunctionalized with binders. The life time of Ru measured using spot-fluorometer was found tobe 4-6 µs and fluorescence decay was seen, confirming oxygen selectivity of the NPs. Futurework includes in vivo measurement of pO 2 dynamics in PLTF in a rabbit model using custom-built spot fluorometer.

Keywords: Post-lens tear film, oxygen dynamics, fluorescence quenching, ruthenium

SCHEMCON-2020

Microwave assisted Nano-catalysis in water

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ID: OP:-01-007

Abstract

Nowadays, Everyone is tending towards sustainable development by using renewableresources, implementing new techniques, efficient raw materials recoveries and byimproving the reusability of products. A lot of pressure is present on all the chemistry-related industries to improve the overall efficiency and sustainability of industrialprocesses due to the rise in demand for chemical products and the quest for sustainablesolutions. Among the greener approaches for sustainable development, a combination ofNano-catalyst in presence of benign water medium with non-conventional Microwaveheating is one of them. Nanomaterials acts as both catalyst and susceptors andMicrowaves with aqueous medium leads to homogeneous in-core heating, enhancedyields and selectivity. Microwave-assisted Nano-catalysis in water approach for a wide
variety of organic reactions have shorter residence time, safeguard the catalyst fromdeactivation and decomposition and other benefits. It appears that this approach ofintegrating the Microwave heating with nano-catalysis and benign water (as a reactionmedium) can provide an excellent synergistic effect with greater impact than these threeindividual components separately. Glutathione-based Nano-organocatalyst for aqueousmicrowave-assisted synthesis of heterocycles is one of the examples of this approach.

Keywords: Nano-Organocatalyst, microwave heating, polar aqueous medium.

SCHEMCON-2020

Review on carbon materials, metal oxide, conducting polymers as electrode material for supercapacitors

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ID:OP -01-008

Abstract

There is a rising curiosity in the application of supercapacitors in energy storage systems because of theirhigh specific power, fast charge/discharge rates and long cycle stability. Researchers have concentratedrecently on building nanomaterials to boost their capacitive performance of supercapacitors. Predominantly, theutilisation of fibres as templates has led to theoretical and practical benefits owing to their increasedspecific surface area, which permits fast electrolyte-ion diffusion. Carbon and carbon derivatives are themost popular selection for the composite electrodes. Also, the inclusion of redox-active components, liketransition metal oxides (TMOs) and conducting polymers (CPs), into the fibres is meant to play a significantrole in enhancing the electrochemical behaviour of the fibre-based materials. On the other hand,
supercapacitors comprising TMO- and CP-based fibres generally suffer from poorer ion-transport kineticsand poor electronic conductivity, which can impact the rate capability and cycling stability of the electrodes.Therefore, the development of TMO/CP based fibres has achieved widespread consideration because theysynergistically unite the benefits of both materials, enabling revolutionary applications in theelectrochemical field. In this article different carbon materials, metal oxides and conducting polymers usedas working electrode materials are presented.

Keywords: Supercapacitor, Nanomaterials, Carbon, Conducting polymers, Metal oxides, Composites

SCHEMCON-2020

Artificial Intelligence Driven Safe and Profitable Agriculture

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ID: OP- 01-011

Abstract

Agriculture in India ranks second largest in the world with total arable land area ofapproximately 159.7 million hectares employing more than 50% of the Indian workforce and contributing about 17-18% to country's GDP. Therefore, adopting moreefficient agricultural practices using advance technologies to address the currentbottlenecks is a must. The agriculture sector is always in search and increasingly look atways to leverage technology for better yield and targeted agri-based solutions to benefitthe farmers. With advancements in technology coupled with conducive policies, penetration of technologies like artificial intelligence (AI) is a great starting point forthe agricultural sector. AI could act as the epitome of shift in conventional practices, enabling farmers to produce quality crops in the appropriate time and ensuring efficientmarket supply chains. The current paper highlights important applications of AI inIndian agriculture with utmost emphasis on three important applications, viz.monitoring of crop and soil, predictive agricultural analytics and supply chainefficiencies. AI comes as a great boon to the agricultural sector which is heavilydependent on climatic conditions which are often unpredictable. The future of farminglargely depends on adapting cognitive solutions. AI solutions if become viable andoffered in an open source platform to make it affordable, would result in faster adoptionof the technology and greater insight among the agricultural producers and consumers.

Keywords: Artificial intelligence; agriculture; crop; technology

SCHEMCON-2020

The role of nanotechnology in the treatment of viral infections

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ID: OP-01-012

Abstract

Infectious diseases are the leading cause of mortality worldwide, with viruses in particular makingglobal impact on healthcare and socioeconomic development. In addition, the rapid development of drugresistance to currently available therapies and adverse side effects due to prolonged use is a seriouspublic health concern. The development of novel treatment strategies is therefore required. Theinteraction of nanostructures with microorganisms is fast-revolutionizing the biomedical field byoffering advantages in both diagnostic and therapeutic applications. Nanoparticles offer unique physicalproperties that have associated benefits for drug delivery. These are predominantly due to the particlesize, large surface area to volume ratio, tunable surface charge of the particle with the possibility ofencapsulation, and large drug payloads that can be accommodated. These properties, which are unlikebulk materials of the same compositions, make nanoparticulate drug delivery systems ideal candidates toexplore in order to achieve and/or improve therapeutic effects. This review presents a broad overview ofthe application of nanosized materials for the treatment of common viral infections.

Keywords: advances, hepatitis, HIV, influenza, nanotechnology, vaccine, virus.

SCHEMCON-2020

One Step Facile Synthesis of Tunable Core-shell Type Magnetic Ni/NiO Nanoparticles for Waste Water Applications

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ID: OP-01-014

Abstract

Here, we propose a facile synthesis of magnetic nickel-nickel oxide nanoparticles throughpolymer assisted route where the surface area of the nanoparticles can be tuned bymanipulating the reaction parameters. To make the nanoparticles, oxalic acid and nickelprecursor were thoroughly mixed into a PEG solution which was prepared in ethanol. Furtheraddition of water led to the formation of nickel oxalate which was then calcined to get theNi/NiO nanoparticles. Upon calcination, nickel oxalate converts into nickel oxide and polymerinto carbon which acts as a reducing agent facilitating conversion of non-magnetic nickeloxide to magnetic nickel while oxidizing itself into carbon dioxide. Further oxidation of Ni tocreate a magnetic core-shell type nanoparticle having Nio on inner-core and Ni on outer-coreis to be expected when the calcination time is for long duration. Effect of parameters such asprecursor concentration, calcination temperature and time of calcination was studied on themorphology of particles. The synthesized nanoparticles were characterized throughmicroscopic (FESEM and TEM), spectroscopic (XRD) and BET surface area analysis.Potential of the nanoparticles was evaluated through a series adsorption experiments whichresults a quick removal of Pd(II) from water having a capacity of ~300 mg/g.

Keywords: Magnetic nanoparticles, Heavy metals removal, Morphology Characteristics

SCHEMCON-2020

Biogenic synthesis of Silver nanoparticles for their biomedical Applications

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ID: OP-01-015

Abstract

Among several noble metal nanoparticles, silver nanoparticles have attained a specialfocus in biomedical applications recently. Conventionally silver nanoparticles, whichhave excellent antimicrobial properties, are synthesized by chemical method usingchemicals as reducing agents, which later on become accountable for various biologicalrisks due to their general toxicity; engendering the serious concern to developenvironment friendly processes. Biological approaches for instance green synthesisexhibits superiority over chemical and/or biological methods. Although among thevarious biological methods, microbe mediated synthesis is not of industrial feasibilitydue to the requirements of highly aseptic conditions and its maintenance. Therefore, theuse of plant extracts for this purpose is advantageous over microorganisms due to theease of improvement. Moreover, different plant extracts have proven to have wide rangeSand strong antibacterial properties for both Gram positive and Gram Negative bacteria.In this research, we have discussed the potential of these NPs in biomedical applications. Increased risk of viral contamination has also prevailed in the human race, stronginhibiting character of silver can be used to make a disinfectant solution spray madewith biogenic synthesis. Also several synthesis methods and plant extracts have beendiscussed and a comparison is drawn at the end for better understanding.

SCHEMCON-2020

Synthesis and characterization of glass/copper and glass/silver core/shell particles

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ID: OP-01-016

Abstract

Core/shell structures consisting of silica or glass cores and metallic shells have attracted a lotof attention in the last two decades due to their unique properties and numerous potentialapplications. The present work deals with the synthesis and characterization of micron sizedcore/shell particles. The method that has been discussed here deals with the bottom-up (self-assembly) approach of synthesizing core/shell particles and hence can be easily scaled up tonano-scale and so the bulk synthesis of such particles can take place at the industrial scale. Itis its application in the fabrication of micro and nano sized Janus beads that have driven themotivation to work on this project. In this work, the focus has been done on synthesizingglass/copper core/shell structures and glass/silver core/shell structures using electrolessdeposition. The core/shell composites were characterized using X-Ray Diffraction Pattern,UV-Visible Absorbance Spectra, FT-IR Analysis, SEM and EDS analysis techniques.

Keywords: core/shell structures; Janus beads; glass/copper core/shell particles; glass/silvercore/shell particles; electroless deposition

SCHEMCON-2020

Synthesis of NiO@CO3O4 core shell nanoparticles for photoelectrocatalytic applications

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ID: OP-01-017

Abstract

NiO@Co 3 O 4 core shell nanoparticles were synthesised by a facile one pot co-precipitation method,wherein, Ni(OH) 2 was precipitated out first, followed by the precipitation the hydroxides of Co (II or III)on the surface of nucleated Ni(OH) 2 . These nanoparticles were consequently calcined at 450℃, to ensurea porous Co 3 O 4 shell structure with high surface area. Subsequent characterisation included SEManalysis to infer the morphology of the material, and XPS spectroscopy to determine the surfacecharacterisation, as well as to qualitatively highlight the core electron spectra of Ni 2+ and Co +2/+3 .Sincethe core and shell both consist of p-type semiconductors, these were tested as photo-cathodes forphotoelectrocatalytic water splitting, and suitable inferences were drawn to shed light on the synergyexhibited by the material.

Keywords: - Core shell nanoparticles; photoelectrocatalysis; water splitting; co-precipitation.

SCHEMCON-2020

Review on Nano Enhanced Phase Change Materials for Storage Applications

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ID: OP-01-018

Abstract

Thermal energy storage systems have received growing attention in recent years for variousapplications, such as thermal management, energy efficient operation and maintaining uniformsupply of energy. The researchers worldwide are investigating the methods to utilize phase changematerials (PCMs) based latent heat storage systems for various applications. PCMs offer promisingthermal storage characteristics where they can absorb and release large amounts of latent heat andundergo phase transition. The major limiting factor of most PCMs is their poor thermal conductivity.One of the most common methods to increase the thermal conductivity is by adding nanoparticles tothe PCM matrix and are referred to as nano-enhanced phase change materials (NEPCMs). This studyprovides a comprehensive review on the application of these nano-enhanced PCMs. It discusses theuse of NEPCM for building application, heat exchanger, heat sink, heat pipe, solar water system,solar still, air conditioning, etc. The review of NEPCMs for various temperature ranges forms thepart of this study. The main advantage of these NEPCMs is the reduced cooling load in buildings, passive cooling, heat recovery as well as improving the efficiency of solar thermal systems.

Keywords: Latent heat storage; nano enhanced phase change materials; thermal conductivity; thermalcharacterization.

A review on stability of nano-enhanced Phase Change Materials

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ID: OP-01-019

Abstract

Phase Change Material (PCM) utilization for various applications is limited due to their low thermalconductivity. Thus, researches has been carried out to enhance the thermal conductivity of thesematerials. The addition of high thermal conductivity nanoparticles is one such solution. Studiessuggest that thermal conductivity of Nano-enhanced PCMs (NEPCMs) can be increased evenmultiple times of the base PCM, thereby increasing the dispatch ability of these NEPCMs. Theincrease in nanoparticle concentration results in their separation, which is a major concern and oftennot discussed in details. Another issue is the cyclic stability of these NEPCMs. This addition alsoaffects the other thermophysical properties such as the storage capacity of the PCMs. To overcomethis, we add certain additives that stabilize the nanoparticles within the PCM, enhancing theirthermal conductivity and stability. These materials (surfactants) decrease the surface tension throughcreation of ionic environment and improve the dispersion of nanoparticles effectively. The stabilityof nanoparticles in PCMs is studied using thermal cycling analyses. The present study provides acomprehensive review on studies carried out to improve the stability of nanoparticles in the PCMusing surfactants and their impact on thermal conductivity and stability characteristics.

Keywords: Phase Change Materials (PCMs); Thermal Energy Storage; Thermophysical properties;Surfactants.

Synthesis of nitrogen doped TIO2 nanosheet photocatalyst

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ID: OP-01-021

Abstract

TiO 2 nanosheets have recently gained interest due to their enhanced photocatalytic activity owing totheir defect-free surfaces and high specific surface area. Three modifications of TiO 2 nanosheets withsilver, copper and with Graphene oxide for performance enhancement have been reported. Themodification with metal will result in loss of photoactivity due to ion leaching and the composite withGraphene oxide results in large particle size of the resulting composite photocatalyst. Nitrogen dopinghas successfully been reported in nanoparticles and is advantageous as it doesn't involve ion leechingand size increase issues. In the present work, TiO 2 nanosheets were synthesized using the hydrothermalmethod. The obtained TiO 2 nanosheets were treated with a nitrogen precursor ammonia and heat-treatedto facilitate nitrogen doping. The prepared nanosheets were characterized using X-ray diffraction andField emission scanning electron microscopy. The photocatalytic activity was accessed using dyedegradation studies. The N-doped nanosheets synthesized using ammonia showed enhancedphotocatalytic activity.

Keywords: TiO 2 nanosheets; Nitrogen doping; photocatalyst

TiO2 nanosheet/cellulose acetate nanocomposite floating photocatalyst for solar degradation of pollutants

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ID: OP-01-022

Abstract

Floating photocatalyst are viable options for degradation of pollutants using solar radiation. The
presence of photocatalyst floating on top of water body can enable better exposure to Sunlight and alsobetter air contact for photodegradation. Direct use of powder photocatalyst in water bodies isimpracticable. In the present work TiO2 nanosheets were immobilized in cellulose acetate matrix andprovided supports using Ethylene Vinyl Acetate to develop a floating photocatalyst. The performance ofthe floating photocatalyst for degrading pollutants under solar radiation was evaluated using Congo reddye as a model pollutant. The TiO2 nanosheet based floating photocatalyst showed good performance indegradation Congo red dye. X-ray diffraction and Field emission scanning electron microscopy wereused to characterize the photocatalyst.

Keywords- TiO2 nanosheets; Cellulose acetate; nanocomposite; floating photocatalyst

Synthesis of Cu/Co3O4 nanomaterials and its application for CO oxidation

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ID: OP-01-023

Abstract

In this study, Cu substituted cobalt oxide (Co 3 O 4) nanoparticles were synthesized usingsonochemical method. Cobalt oxide nanoparticles were chosen as catalysts due to its excellentabsorption properties towards gases such as CH 4 and CO, and also because of its abundantlattice oxygen. Cobalt's half-filled d-orbitals also contribute to good catalytic activity. Further,Cu was doped in the lattice of cobalt oxide and Cu was chosen due to its low work functionand high chemisorption ability. The synthesized Cu/Co 3 O 4 via sonochemical protocol offerednarrow particle size distribution indicating the homogenous particle size. All these factors ledto the hypothesis that Cu/Co 3 O 4 would be an excellent catalyst for reactions such as COoxidation. Cu/Co 3 O 4 nanoparticles were characterized with XRF, XPS, SEM analysis, TGAand tested its activity for CO oxidation reaction using a packed bed reactor with GHSV of47760 h -1 . Cu/Co 3 O 4 offered excellent catalytic activity for CO oxidation and showed 100%conversion of CO below 275°C. This study shows that Cu/Co 3 O 4 can be a promising catalystto mitigate harmful CO emissions.

Keywords: Cu/Co 3 O 4 ;Sonochemical Synthesis; CO Oxidation.

Advancements in Antiviral and Antimicrobial Nano-fibers Technology: For a Pandemic-Free World

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ID: OP-01-026

Abstract

With the rapid outbreak of the COVID-19 pandemic, there is an urgent requirement of atechnology which can aid humans to prevent getting in contact with the virus pathogen. Forthis, the personal protective clothing (PPC) has to be engineered in a way that the viruspathogen neither enters human system nor gets transmitted to the environment on disposal.Silver, copper, and zinc nanoparticles demonstrate significant antimicrobial and antiviralactivity with a wide therapeutic index. Moreover, recently it has been discovered that thezeolite formulations could be combined with various materials used in manufacturing medicaldevices, surfaces, textiles, or household items where antimicrobial properties are required. Thesynthetic zeolites facilitate the ion exchange mechanism to exhibit antiviral and antimicrobialproperties. With recent developments in electrospinning, both synthetic and natural polymers,impregnated with nanoparticles, can be produced as nanofibers with diameters ranging fromtens to hundreds of nanometers with controlled morphology and function. In this work, wediscuss the feasibility of the existing technology to be scaled-up and commercialized for publicuse which can lead to increased preparedness for averting future pandemics.

Keywords: Anti-viral mask, COVID-19; PPEs; electrospun nanofiber.

SCHEMCON-2020

A Review on synthesis of TiO2 nanoparticles

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ID: OP-01-028

Abstract

TiO 2 nanoparticles widely studied for its photocatalytic and oxidative applications.Nanoparticles are particles between 1 to 100 nm scales. Nanoparticles possess a uniquephysical, chemical and biological properties at nanoscale than bulk materials. Titaniumdioxide can be prepared in the different forms such as powders, crystals, thin films.Titanium dioxide (TiO 2) nanoparticles are one kind of important and promisingphotocatalysts because of their oxidizing power. TiO 2 belongs to the family of transitionmetals. There are three polymorphs of TiO 2 found in nature anatase, rutile, brooklite. Thesize and geometry of semiconductor materials depends on the motion of electrons andholes. Titanium dioxide has been widely used in photovoltaic environmental applicationssuch as renewable energy sources CO 2 conversion, water treatment, air pollution controland many applications in a vast range of industrial and consumer goods including paints,coatings, adhesives, paper and paperboard, plastics and rubber, printing inks, watertreatment agents.

The anatase phase has a band gap of 3.2 eV and is able to absorb light only of wavelengthsshorter than 388 nm. There are many methods of the synthesis of TiO 2 nanoparticles,sol–gel technique, solvothermal, hydrothermal, electrochemical process, precipitationmethod etc. The sol-gel method is a versatile process used for synthesizing various oxidematerials. In this review paper, different preparation methods that can be used to synthesizeTiO 2 nanoparticles and the photocatalytic environmental applications are proposed verywell.

Keywords- Titanium dioxide nanoparticles, band gap, photocatalyst.

SCHEMCON-2020

Applications and properties of graphene and its composites

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ID: OP-01-032

Abstract

Graphene is the thinnest material known to mankind of about one atom thick (around 0.34 nm), and isalso incredibly strong – about 200 times stronger than steel. Graphene consists of a sheet of singlecarbon atoms arranged in a honeycomb structure. Graphene and its composites can be synthesizedthrough various methods such as exfoliation, chemical vapor decomposition, nano tube slicing, carbondioxide reduction, spin coating, supersonic spray, microwave assisted oxidation, ion implantation.However, it is found that the production of graphene for commercial application is still under researchfor improvement of its quality, size and amount. Alongside being incredible strong, graphene alsoconducts heat and electricity remarkably well, resists rust and has excellent optical and mechanicalproperties. Graphene is an extremely diverse material, and can be alloyed with other elements toproduce materials with superior properties. The extraordinary properties of graphene show somepromising applications such as optical electronic, photovoltaic systems, bio fields, hydrogen storage,sensors, catalysis, super capacitors, DNA sequencing, water filters, solar cells and others.In this paper, we have concentrated on some applications and properties of graphene and itscomposites. Applications of graphene as bullet proof vests, membrane for fuel, hydrogen ion filters.

Keywords: Graphene; nano tube slicing; applications; properties

Green & Sustainable Energy (GSE)

SCHEMCON-2020

Investigation of Nanoparticles-polysaccharides based porous membrane for Hydrogen separation

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ID: OP-02-001

Abstract

A growing interest in the hydrogen-based economy as an energy carrier has placed a high demand for hydrogen separation and purification techniques. The palladiummaterial has a high affinity to adsorb hydrogen. Therefore it is a relevant material used in the membrane for improving selectivity and permeability of hydrogen gas. In thiswork, MWCNTs and polysaccharide-based guar gum material has been using to thedeveloped membrane and Pd-nanoparticles dispersed in the polymeric matrix. Forincreasing the performance of the membrane, functionalized MWCNTs with Pdnanoparticles were dispersed in it. The MWCNTs with Pd nanoparticles found highselective towards the hydrogen gas as compare to other gases due to the adsorption ofhydrogen molecules in Pd nanoparticles. These composite membranes werecharacterized by Fourier transform infrared spectroscopy (FTIR), Scanning ElectronMicroscope (SEM) for confirming the distribution and functionalization of MWCNTsin guar gum membrane.

Keywords: Hydrogen separation; Guar gum membrane; Pd-nanoparticles

SCHEMCON-2020

An alternative source of electricity using microbes

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ID: OP-02-002

Abstract

Microbial fuel cells (MFC) represents a very promising technology for generating electrical energy from organic and inorganic matter in wastewater using microorganisms as biocatalysts. MFCs provide a suitable, eco-friendly alternative to produce energy and to treat wastewater simultaneously. Various types of wastewater can be used as feedstock for the microbial fuel cells in which the exoelectrogenic bacteria produce electrons under anaerobic conditions. Compared with conventional aeration technologies for wastewater treatment, MFCs produce less sludge with net energy production. Now a days electricity play a major role in daily life. It is one of the method of electricity production.

SCHEMCON-2020

Hydrogen Storage using Carbon based Nanomaterials

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ID: OP-02-003

Abstract

With an increase in the global population, the depletion of fossil fuels is much anticipated.This will eventually lead to global energy crisis. Hydrogen is seen as a potential candidateto meet the future demands of the energy carrier. But, the only difficulty arises is in itsstorage. Hydrogen has the highest gravimetric density and lightest volumetric densityamong all gases. This makes it difficult to store hydrogen at ambient conditions. Hence,storage has become a major topic of discussion since the past few years. Hydrogen can bestored either by adsorption (carbon material) or by absorption (complex metal hydrides).When compared, the adsorption principle displayed high storage capacities at favorableoperating conditions. Following the same, the present article discusses the differentallotropes of carbon i.e. graphite, C-nanofibers and C-Nanotubes for their hydrogen storagecapacities. These materials have been critically discussed on the basis of kinetic,thermodynamic, and operating conditions. Also, the methods to improve the storagecapacity of carbon-based materials have been intensively reviewed.

Keywords: Hydrogen storage, Carbon Nanotubes, Physisorption, Adsorption, Absorption

SCHEMCON-2020

Microalgal Biofuel: A Potent Green Energy Source

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ID: OP-02-005

Abstract

The alarming depletion of fossil fuels and the pollution caused by their usage has led tothe discovery of alt. sources- biofuels being one of them. Biofuels can be obtained fromdifferent sources by using different processes. Microalgae has emerged as a sustainablefd., upon which various researches are being done. The production of biofuels frommicroalgae involves a vital enhancement of accumulated lipids in microalgal cells. TAGis the primary form of energy storage in microalgal cells, comprising of 60-70% of drycell weight. Each TAG molecule consists of a glycerol backbone to which three fattyacids moieties are connected which can be enhanced to increase the lipid content incells, leading to increased production of oil/fuel.

Biofuel is not only a cleaner, greener and safer alt., but also it will curb the energycrisis. Using microalgae as the primary fd., replacing the food crops that are being usedwill help reduce the food and water shortage as well as get the saline water and barrenlands in use. Unlike fossil fuels, it only emits CO 2 rather than emitting gases likeCO,SO 2, etc.. Thus, production of biofuels from microalgae will lead to a betterenvironment in the future.

Keywords: Triacylglycerol-TAG ; Feedstock-fd. ; Alternative- alt.

SCHEMCON-2020

Syngas Fermentation: Current Studies and Future Outlook

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ID: OP-02-006

Abstract

The increase in population and energy demand has led to unsustainable utilisation of fossilfuels. With depleting fossil fuel resources and increasing concern about climate change,the demand for cleaner fuels is rising. Many countries are making policy interventions topromote cleaner fuels like bioethanol and biodiesel. First-generation biofuels are alreadycommercially available, but these are being criticised due to "food vs energy" debates.Second-generation biofuels are thus getting much more attention by researchers. Syngasfermentation is the conversion of syngas to bioethanol and other products like acetic acid,2,3-butanediol etc. using biocatalysts. It is the second step in the production of biofuelafter biomass gasification. Biomass gasification integrated with syngas fermentation canbe a sustainable source for biofuel production. Although many studies are beingconducted on the syngas fermentation, the process is still far from commercialisation dueto low yield and mass transfer limitations. In this study, the various benefits, limitationsof syngas fermentation and recent developments for improving the process have beenreviewed. The paper discusses the process from a bioethanol production point of view.
The review also discusses the opportunities for commercialisation of the process from anIndian outlook. The study also provides some recommendations for future studies.

Keywords: Syngas fermentation; Second-generation biofuels; Bioethanol

SCHEMCON-2020

Review of the Solar Photocatalytic Process and its Applications in Integrated Energy Generation and Wastewater Treatment

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ID: OP-02-008

Abstract

Energy and Water are indispensable elements of our lives. Harnessing energy in anefficient and environmentally sustainable manner is almost as troublesome as purifyingcontaminated water to its completely potable form. Solar Photocatalysis, a relativelynascent field of research, shows great potential in addressing these inherent problems.An analysis of this novel process and the technologies employed therein forms the basisof this review paper. The fundament of Solar Photocatalysis rests upon the simultaneousoxidation-reduction reactions occurring due to the photon-induced electron-hole pairsformed in a semi-conducting nano-catalyst. The catalyst in use needs to have acharacteristic energy profile that complements the process for the given reactant. TiO2 ,one such semiconducting oxide, has been extensively researched for the heterogeneoussplitting of water due to its suitably positioned energy bands with respect to the
oxidation and reduction potentials of water. Major advancements in the development ofcatalysts, critical engineering strategies to overcome various shortcomings and avigorous comparative performance assessment of the prominent catalysts (CdS, ZnO,ZnS, Fe 2 O 3) form the crux of this review paper. It also intends to emphasise on theextent of untapped potential associated with this groundbreaking process.

Keywords: Integrated Energy Generation; Wastewater Treatment; Solar Photocatalysis;Semiconductingnano-catalyst

SCHEMCON-2020

Organic Photovoltaics - An Enhancement in Green Technology

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ID: OP-02-009

Abstract

Dye-Sensitized Solar Cells (DSSCs) represent a relatively new photovoltaic technology(PVT) with great potential and is a low-cost solar cell belonging to the group of organicphotovoltaics. It also offers the possibility of various colours and attractive designs,such as semi-transparent modules. Dye-sensitized solar cells have been investigatedintensely during the last three decades. It works using electrochemical principles inwhich sensitive dyes are absorbed in the TiO2 photo-electrode layer.Organic Photovoltaics (OPV) is a rapidly emerging PVT. We have developed andapplied new high-performance absorber materials with improved performance andlifetime, focusing on the growth of photovoltage and provide stability to photo-oxidation.The building-integrated PVT market may find OPV especially attractive because of theavailability of absorbers in different colors and their ability to make efficient transparentdevices.

Keywords: Dye-Sensitized Solar Cell; Photovoltaic Technology; OrganicPhotovoltaics; Photo voltage.

SCHEMCON-2020

Integrated System of Biodiesel and Power Cogeneration Using a Solar Thermal Energy System

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ID:OP-02-010

Abstract

Biodiesel plays an important role to diminish the consumption of fossil fuels and their subsequent pollution in the transportation sector and can be used in diesel engines without significant changes. But biodiesel needs energy to be produced. A renewable energy source such as solar energy is a promising source for this aim, reducing the carbon dioxide production and cost. Biodiesel production processes can be coupled with solar energy sources to achieve higher efficiency and renewability. Employing a subsystem to produce power simultaneously increases the process performance. An integrated process including Parabolic Trough Solar Collector (PTSC), Biodiesel Production Unit (BPU) and Organic Rankine Cycle (ORC) is proposed for this purpose. Methanol, fresh oil and sodium hydroxide enter the BPU as a feed.

Biodiesel is produced in BPU by transesterification reaction in which plant and animalfeed stock is converted to a mixture of monoalkyl esters of long chain fatty acids. PTSCs are employed to supply required thermal energy for BPU and ORC subsystems.The ORC provides the needed power of the system. Not only does the ORC provide the internal required power of the plant but also the integration of ORC with BPU and PTSC subsystems form a biodiesel-power cogeneration process.

KEYWORDS: biodiesel; cogeneration; organic rankine cycle; parabolic trough solar collector; tranesterification

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Organic photovoltaics - an enhancement in green Technology

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ID: OP-02-012

Abstract

Dye-Sensitized Solar Cells (DSSCs) represent a relatively new photovoltaic technology(PVT) with great potential and is a low-cost solar cell belonging to the group of organicphotovoltaics. It also offers the possibility of various colours and attractive designs,such as semi-transparent modules. Dye-sensitized solar cells have been investigatedintensely during the last three decades. It works using electrochemical principles inwhich sensitive dyes are absorbed in the TiO2 photo-electrode layer. Organic Photovoltaics (OPV) is a rapidly emerging PVT. We have developed and applied new high-performance absorber materials with improved performance and lifetime, focusing on the growth of photovoltage and provide stability to photo-oxidation.The building-integrated PVT market may find OPV especially attractive because of theavailability of absorbers in different colors and their ability to make efficient transparentdevices.

Keywords: Dye-Sensitized Solar Cell; Photovoltaic Technology; OrganicPhotovoltaics; Photo voltage.

SCHEMCON-2020

Study of Upgrading Biogas by Biological Hydrogen Methanation

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Abstract

ID:OP-02-015

Biogas production is an established sustainable process for simultaneous generation ofrenewable energy and treatment of organic wastes. The increasing interest of utilizing biogasas substitute to natural gas or its exploitation as vehicles fuel opened new avenues in thedevelopment of biogas upgrading techniques.This study on biological biogas upgrading by utilizing hydrogen to obtain biomethane, theaim of all upgrading biogas technologies is to achieve high methane purity and low methanelosses with low energy consumption,Based on a review of the literature on the technologies for biogas upgrading and enhancementwith attention to the emerging biological methanation processes, the review includescomprehensive description of the main principles of various biogas upgrading methodologies,scientific and technical outcomes related to their bio-methanation efficiency, challenges thathave to be addressed for further development and incentives and feasibility of the upgradingconcepts.

The experiment demonstrated that biological methanation in continuous stirred tank reactor is well feasible for biogas upgrading under the prerequisite that an adequate H 2 source isavailable, and observed that (the production of bio-methane was 90% of the produced gases,
reduction of greenhouse gases and reduction 10% of ammonia losses as well as 50% nitrogen oxide emission).

Key Words: Green Energy; Renewable Energy; Upgrading Biogas; Anaerobic Digestion;Hydrogen Solubility.

SCHEMCON-2020

Recent Developments in All Solid State Lithium Ion Batteries: A Review

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Abstract

Battery development is imperative to shift the focus of energy consumption towardsrenewable energy sources and promote green technology. Today, lithium ion batteries(LIBs) are considered as a promising candidate for its application in electrochemicalstorage devices mainly because of the high energy density offered, due to the lowestredox potential of lithium metal. However, they suffer from several drawbacks andsafety issues because of the flammable behaviour of liquid electrolytes. Thus,researchers around the globe are paving their research focus towards solid state batterytechnology due to its better safety, high energy density and better mechanical andthermal stability. This review exhaustively studies and compares development andchallenges faced by three main solid lithium electrolytes which are sulfides, oxides andpolymers. The review also brings out the major issues such as interfacial as well as themechanical and electrochemical stabilities associated with these solid electrolytes, alongwith the projected strategies. Unique characteristics of solid state batteries and theircapacity to occupy a niche in the alternative energy sector are discussed.

Keywords: Solid State Batteries; energy density; lithium ion conductivity; sulfides;oxides; polymers.

SCHEMCON-2020

Perovskite Solar Cell for Energy Harvesting: A Review

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ID: OP-02-019

Abstract

Keywords: Organometallic Halides ; Thin Film PV Cell ; Ecological FootprintPerovskite solar cell is based on ABX3 type organometallic halides (also known asperovskite) is one of the most promising photovoltaic thin-film solar cell technologies. Thedesign of the perovskite solar cell is inspired by the 3rd generation DSSC - Dye SensitisedSolar Cell. DSSC is a thin-film type solar cell that converts the visible light into aphotocurrent using methylammonium lead halide (naturally occurring dye in barriers)absorbed on nanocrystalline TiO2 surface. Even the easy construction of DSSC usingrecycled e-waste did not get much attention because of its too low chemical stability whenexposed to harsh environments. But (naturally occurring or engineered in a lab) Perovskitesolar cells in comparison to conventional silicon cells have higher potential to give betterefficiencies in different working conditions. Perovskite has low bandgap, hence requires 20times less materials to manufacture thin film, reducing 50% of manufacturing cost in
comparison to silicon cell. Though perovskite solar cells can drastically reduce ecologicalfootprints of the manufacturing of PV cells, it also includes the use of toxic heavy metal leadas central atom of ABX3 structure. In this review, the optoelectronic properties, ramificationson the environment, recent progress, and future challenges for perovskite solar cells arediscussed.

SCHEMCON-2020

Epoxidation of Karanja Oil (KO)

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Abstract

Epoxidation of karanja oil (KO); a nondrying vegetable oil, was carried out with peroxyaceticacid that was generated in situ from aqueous hydrogen peroxide and glacial acetic acid. KOcontained 61.65% oleic acid and 18.52% linoleic acid, respectively, and had an iodine value of89 g/100 g. Unsaturated bonds in the oil were converted to oxirane by epoxidation. Almostcomplete epoxidation; of ethylenic unsaturation was achieved. The effects of temperature,hydrogen peroxide-to-ethylenic unsaturation ratio, acetic acid-to-ethylenic unsaturation ratio, and
stirring speed on the epoxidation rate and on oxirane ring stability were studied. The rateconstant and activation energy for epoxidation of KO were 10^{-6} $L \cdot mol^{-1} \cdot s^{-1}$ and 14.9 $kcal \cdot mol^{-1}$,respectively. Enthalpy, entropy, and free energy of activation were 14.2 $kcal \cdot mol^{-1}$, $-51.2 cal \cdot mol^{-1} \cdot K^{-1}$, and 31.1 $kcal \cdot mol^{-1}$, respectively. The present study revealed that epoxides can bedeveloped from locally available natural renewable resources such as KO.

Keywords : Karanja Oil, Epoxidation

Optimization of biodiesel production from Cucurbita pepo L.

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Abstract

In the last decade, the demand for fatty acid methyl esters as a substitute to petroleum diesel hasconsiderably risen. The raw materials for biodiesel production in India mainly include non-edible traditional seed oils. Our study focuses on the evaluation of pumpkin seed oil as a feedstock for biodiesel production. The e oil content of pumpkin seeds was found to be considerably high of around45%. The fatty acid profile of the oil showed that it is composed majorly of linoleic, oleic, palmitic andstearic acids. The oil was chemically converted via an alkaline transesterification reaction with methanolto methyl esters, with a remarkable yield. All of the measured properties of the produced biodiesel metthe current quality requirements. Although our study proved that pumpkin oil could be a promisingfeedstock for biodiesel production, scale-up methods are still requires further evaluation. Parametricoptimization was performed to maximize the yield. They can therefore be commercialized for largescale utilization as biodiesel fuels or as blends with existing feedstocks which would be moreenvironmentally friendly.

Keywords: fatty acid, transesterification, fuels, feedstock.

Recent Advancement in Green hydrocarbon production from refinery

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Abstract

Green hydrocarbon production from second generation biomass is a powerful fuel to increasethe sustainable energy in the future. The ultimate aim is to redesign second generationbiomass into stable and dense bio crude based on the derivative of sugar ketal, since the properties of biomass are not suitable for refinery condition. Biomass was first converted into a dense and stable bio crude composed mainly of ketal-sugar derivatives by using acetone in diluted acid. The conversion of a representative compound of this biocrude, 1,2:3,5-di-O-isopropylidene-α-D xylofuranose (DX), by two processes; usually carried out in oil refinery.Mixtures of DX of up to 70 wt% in n-hexane were converted by fluidized catalytic cracking(FCC) and 14.3 wt% of DX in n-hexane was converted by the hydroconversion process(HDC). HDC yielded mainly saturated and naphthenic hydrocarbons containing more thanseven carbons, whereas FCC produced mainly mono-aromatics. The efficiency of DX for theproduction of green hydrocarbon by FCC and HDC process are 66% and 85% (approx)respectively. These green hydrocarbons could be used as gasoline, diesel and jet fuel.Therefore, this ketalization approach builds a bridge that has not existed until now betweenthe refinery and the biomass.

Keywords: Green hydrocarbon; Fluidized catalytic cracking; hydroconversion process.

Biofuel synthesis through Microalgae- Opportunities and Challenges

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Abstract

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Rising dependence on natural fuel resources is an increasing concern for the globalenvironment and society. Biofuel is an alternative source of energy which assuresenvironmental concerns and energy security. Following the same, microalgae can deliver asustainable and complementary biofuel platform with some important advantages. They arefeatured with distinct ability to provide ecological services and response to thesustainability challenges. The present study revolves around the identification ofmicroalgae as a potential candidate for an alternative source of energy. The optimal use oflight energy through photosynthesis is the most efficient pathway executed by microalgae.They possess higher photosynthetic levels and can produce oil more efficiently (i.e. >300times) than other existing resources such as terrestrial plants. The added advantage ofmicroalgae includes the use of non-cultivable soil and wastewater for its operations whichrenders the process more efficiently from the economic perspective. Hence, the usage ofmicroalgae for biofuel production doesn't affect the agricultural land and drinking waterbalance in the environment. This review critically discusses the use of algal biomassconversion methods into various biofuel products i.e. biodiesel, syngas, biogas, andbioethanol. Moreover, the techno-economic and commercial viability of microalgae-ledbio-refinery is intensively reviewed to drive this technology towards practicality.

Keywords: Biofuel; Microalgae; Sustainability; Energy; Wastewater; Biomass.

SCHEMCON-2020

The Recent Advances in Carbon Based Aerogel Materials for Hydrogen Storage

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ID: OP- 02-027

Abstract

Safe and efficient Hydrogen storage is considered to be one of the main challengesassociated with using it as fuel. Porous Carbon materials can be used as Hydrogensorbents. The hierarchical 3D morphology of Carbon aerogels and the fact that itsstructural parameters can be systematically controlled, make Carbon aerogels attractivematerials for Hydrogen storage. They can be used for Hydrogen storage by directadsorption or they can be used as scaffolds for the incorporation of metal hydrides.Conventional aerogels, such as R-F aerogel, have a Hydrogen binding energy of theorder of 3-6 kJ / mol and can only store Hydrogen at cryogenic temperatures. However,thermodynamic studies indicate that the binding energy should be 10-25 kJ / mol forambient temperature, pressure operation. Numerous approaches have thus beenemployed to improve the thermodynamics of Hydrogen binding in porous Carbons. Forexample, the incorporation of metal species into the aerogel frameworks has drawnmuch attention for the purpose of structure modification and improvements in catalyticactivity due to the Hydrogen spillover effect, the use of scaffolds of light metal hydrideshave improved the reaction kinetics significantly. This review summarizes such latestdevelopments in the carbon-based aerogels for Hydrogen storage and the associatedfuture challenges.

Keywords: Carbon aerogels; Hydrogen storage; Hydrogen binding energy; Advancedmaterials.

SCHEMCON-2020

Cellulose-based hydrogel materials: Chemistry, Preparation, and their Properties

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Abstract

Recently, efforts have been made to produce organic chemicals by using biomass asfeedstock. The current work deals with the development of a biodegradable superabsorbenthydrogel by using waste biomass as feedstock. Hydrogels are macromolecular networksthat can hold and reversibly release large amounts of water. The cellulose-based hydrogelwas prepared by using wheat straw and peanut shells. These lignocellulosic agricultural by-products are a cheap source for cellulose fibers. Isolation of cellulose was confirmed byFourier-transform infrared spectroscopy (FTIR) analysis. Super absorbent hydrogel has been synthesized through copolymerization of acrylic acid and cellulose. N,N-methylenebisacrylamide (MBA) was used as a cross-linker and ammonium persulfate(APS) was used as an initiator. Dynamic swelling tests were conducted at differenttemperatures to investigate the swelling properties of the cellulose hydrogel. Increasingsalinity decreased swelling, indicating that sorption capability was affected by the salinitypresent in the water. The sorption capability at different concentrations of cellulose wasevaluated. The soil amendment with hydrogel enhances water holding capacity, reducinginfiltration rate and cumulative evaporation compared to the untreated soils. These resultsshow that cellulose-based hydrogel seems to be of great promise in the field of agriculture.

Keywords: Cellulose, hydrogel, water content capacity, water retention

SCHEMCON-2020

Let's Make the Sun (Fusion Technology)

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Abstract

Fusion powers the sun and the stars, where gravity compresses hydrogen gas to the temperatures
required for fusion. The challenge for fusion energy is how to create those conditions on Earth in acontrolled way that can be used to provide power. The most practical fusion reaction uses isotopesof hydrogen named "deuterium" and "tritium". These can be extracted from seawater and derivedfrom lithium, both in abundant supply. There is enough fusion fuel on earth to power the planet forhundreds of millions of years. The challenge that scientists face is to achieve the requiredtemperature to ignite the fusion reaction. To keep the plasma together at this temperature longenough to get useful amounts of energy out of the thermonuclear fusion reactions. To obtain moreenergy from the thermonuclear reactions than the amount of energy used to for the ignitiontemperature of the plasma.

SCHEMCON-2020

Sodium Borohydride Activated Hydrogen Generation through Water Splitting Reaction

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ID: OP-02-030

Abstract

The energy requirement is fulfill by fossil fuel, Energy based on the fossil fuel are notsustainable for future generation. Considering current scenario necessity to find alternateenergy source. Hydrogen gas as energy source has the capability to replace fossil fuel. Ourstudy focus on the generation of hydrogen gas through water splitting reaction with NaBH4 .Inour process water NaBH 4 ,NaOH,catalyst are reactant. The reaction is carried out at ambienttemperature condition. To increase rate of hydrogen gas catalyst is introduced, the catalystCo/Al 2 O 3 is prepared by CO(II) Schiff base Complex which shows higher catalyticperformances. The reusability of catalyst in the process is up to 8 times. The objective of ourstudy to provide economical on-site hydrogen gas with desired rate. We will be also deal withoperating parameter of our reaction which make reaction more feasible.

Keywords: Cobalt complex Catalyst, Hydrogen generation, Sodium borohydride.

SCHEMCON-2020

Studies in Hydrogen Generation using Waste Aluminum and Water

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Abstract

The dependency on conventional sources of energy and its rapid depletion in upcoming timesintensified the search for non-conventional, perpetual and economical sources of energy. Hydrogen isone such promising alternative source of energy. Our study focuses on the generation of hydrogen bywater splitting reaction using waste aluminium. The water splitting reaction accompanied by the metalaluminium for producing hydrogen gas is one of the ideal methods of in-situ hydrogen generation. Theprocess involves materials such as water, aluminium, sodium hydroxide, gallium as a reactant and theobtained product is pure hydrogen gas. The gallium used in the reaction is used for the activation ofaluminium metal and is recovered back and can be used again. This process of hydrogen generationhas various advantages like mild conditions required for the reaction, controlled and pure hydrogengeneration, and useful by-products. The objective of our study is to achieve on-demand, in-situ, local,continuous, economical production of hydrogen. The experimental setup proposed in our studyeffectively addresses the aim of our study. We will be also be studying various operating parameters ofour reaction in this study to make the reaction more efficient.

Keywords: Hydrogen Generation;Water Splitting Reaction; Continuous Process

SCHEMCON-2020

Sustainable energy generation using Rice Straw

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ID: OP-02-032

Abstract

India produces over 100 million tons of agricultural waste in the form of paddy strawannually. The process of cleaning of land for future use involves a lot of manual work.More than 80% of it is burnt away due to lack of sufficient resources. The resultingsmoke creates a cloud of hazardous gases. This degrades the air quality to such anextent that can cause several health issues. To overcome this problem, the governmentand some industries are working to create a technology that converts paddy straw intousable products. Paddy straw simply undergoes anaerobic digestion for the productionof methane that is used as a feed for the generator to produce electricity. The process ofanaerobic digestion produces biogas that can be used directly as feed for generator or asa fuel in combined heat and power gas engines. The nutrient-rich digestate can be usedas a fertilizer. There can be some reduction in greenhouse gases too. The concept of thistechnology is to generate power from paddy straw and to also create additional revenuesfor farmers.

Keywords: paddy straw, agricultural waste management, energy generation, biofuel

SCHEMCON-2020

Green and sustainable Energy

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ID: OP-02-033

Abstract

Green Energy is energy resources that are renewable, can be naturally replenished. Green Energy isClean, Safe and not harmful to the environment. It is also called as mother earth. Types of GreenEnergy are Biomass, Solar, Geothermal, Water and Wind. Green energy technologies turn these fuelsinto usable forms of energy like electricity, heat, chemical or mechanical power. Biomass isbiological material derived from living organisms. Biomass is highly diverse in nature and classifiedon the basis of site of origin as follows Field and plantation biomass, Industrial biomass. SolarEnergy is produced by using photovoltaic cells, which capture sunlight and turns that into energy.Giant pinwheels spin from strong winds which spins a turbine of generator to produce Wind Energy.Large space areas Fields requires Winding areas. The advantages of Green Energy is Negative impactto the environment is zero, make Pollution Free Environment, Green energy solutions and moreefficient. So the Conclusion on Green Energy is that to make sure we have plenty of energy in thefuture, it's up to all of us to use energy wisely. The future is ours, but we need energy to get there.The Major Renewable Energy Sources Solar Energy and Wind Energy. Any sustainable source thatcomes from natural environment is Renewable Energy. Sustainable Energy is the sustainableprovision of energy that meets the needs of present. Technologies that promote sustainable energyinclude renewable energy sources such as solar energy and wind energy. Energy which isreplenishable within a human lifetime and causes no long-term damage to the environment. Theimportance of Sustainable energy are Environmental, Energy for future generations and Energysecurity. "THE FUTURE IS GREEN ENERGY, SUSTAINABILITY, RENEWABLE ENERGY."

Keywords: Green Energy; Renewable energy; Sustainable Energy

SCHEMCON-2020

Novel Techniques for Conversion of carbon dioxide to methanol: A Review

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Abstract

Global warming is adversely affecting human health, theenvironment, as well as social and economic factors, and as we all knowCO 2 also plays a major role in global warming. So, if CO 2 is evolved tovalue-added chemicals like methanol, ethanol, or formic acid, can lessenenergy crisis, global warming, and storage issues. Coupling the reductionof CO2 with renewable energy and converting it into methanol can be apromising solution. This CO 2 should not be considered as an unwantedproduct, but as an asset that, with human ingenuity, could be usedsustainably. Methanol is a renewable energy source and hasadvantageousness like can be made from any raw material, a cleansource of energy, sustainable, used by most production companies as araw material to produce different products, major organic feedstock,used in producing solvents like acetic acid which represents 10% ofglobal demand and direct methanol fuel cells (DMFC) for the conversionof chemical energy in methanol directly to electrical power underambient conditions. Methanol is produced conventionally from naturalgas using steam reforming which requires a high-pressure loop and theother is from syngas by coal gasification which also requires highpressure and range of temperatures. The major drawback of the abovetechniques is the utilization of a huge amount of natural resources i.e.,fossil fuel, and the production of large amounts of CO 2 . Varying noveltechnologies like heterogeneous catalysis, homogeneous catalysis, theelectrochemical, photochemical, and photoelectrochemical conversionhas captured the attention in converting CO 2 to value-added products likemethanol that has the potential that it can contribute to economic growthas well as to attenuate hazardous emissions for a better environment.This review focuses on the current trend for the application of such noveltechniques to minimize the amount of CO 2 by converting it into methanolover the conventional method. Also, a detailed comparison betweenthese techniques is portrayed on the basis of environment friendly, cost,efficiency, industrial-scale feasibility, approach, and recycling.

Keywords: heterogeneous catalysis; homogeneous catalysis;electrochemical conversion; photochemical conversion;photoelectrochemical conversion.

SCHEMCON-2020

Estimation of Bio-butanol production from plantain pseudostem fibers of Musaceae paradisiaca as a substrate using a metabolically altered strain of Saccharomyces sp

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ID: OP-02-035

Abstract

Production of higher alcohols utilizing microbial activity has been a topic of wide interestsince higher alcohols address the shortcomings of bio-ethanol and present scope forapplication as an alternative biofuel. Our work is focused on the production of Bio-butanolfrom pretreated plantain pseudostem fibers (PSF) using an engineered strainof Saccharomyces cerevisiae which is subjected to metabolic alterations. The PSF samplesare tested for various alkali pretreatment conditions and their delignification and celluloserecovery showed that the optimum alkali concentration is 15-20% (w/v) at 50°C. Enzymaticsaccharification is carried out by cellulase supplemented with β-glucosidase and the glucoseyield of pretreated PSF(al) was found to be 2.4 times untreated PSF(ut) sample. Sugarfermentation of hydrolysate sample PSF-EH is carried out for 5 days using metabolicengineered Saccharomyces sp for butanol production. Following the metabolitemeasurement, gives the maximum ethanol and butanol production of 4.72 g/L and 11.07 g/Lrespectively at 72hr. A comparison of SEM images showed PSF(al) has more pores thanPSF(ut) and also hydrolysis residue PSF-EH(rd) showed greater pores due to the complete
rupture of the cell-wall.

Keywords: pseudostem fibers; bio-butanol; delignification; enzyme saccharification.

SCHEMCON-2020

Pyrolysis of Agricultural Biomass

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Abstract

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Pyrolysis is a thermochemical technique that converts biomass into solid(biochar), liquid (bio-oil) and gaseous fractions at moderate temperatures, either in the absence of air or in stoichiometric quantities of oxygen. Pyrolysis could be a suitablemethod for the enhancement of this agricultural biomass, cashew nutshells (CNS). Indiais the largest producer, processor and exporter of cashews, Anacardium occidentale.Cashew nut shells are a residue obtained from cashew shelling. The Cashew nut has ashell of about 1/8-inch thickness, with a soft honeycomb structure inside, containing adark brown viscous liquid. It is called Cashew Nut Shell Liquid (CNSL). The CNSL isreported to be 15 –20% by weight of the unshelled nut in Africa, 25 –30% by weight inIndia and 25% overall. CNSL forms the basic raw materials for vast number of chemicalsand intermediates including bactericides, germicides, insecticides, disinfectants,emulsifying and surface-active agents. Cashew nutshell (CNS)–based biochar is obtainedas a by-product which can be used as activated charcoal. In this study we have seen Biooil (40wt%), Biochar (30wt%), gas products (30wt%) in the temperature range of 400-600oC. The residue generation is negligible.

Keywords: Pyrolysis; biochar; bio-oil; agricultural biomass; Anacardium occidentale;

SCHEMCON-2020

Magnetoelectrolysis: Insights

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ID: OP-02-037

Abstract

Water electrolysis has the advantage to produce hydrogen at an improved efficiency underexternal fields. Among overall world technologies for hydrogen production today, only 5% isproduced by electrolysis. The reason for such low contribution is due to the efficiency of theprocess. Electrolysis of water under external fields enhances the electrolyser efficiency byinfluencing the process parameters like magnetic field effect on electrolyte properties, masstransport, magneto hydrodynamic convection (MHD), IR-drop, electrolyte concentration, iondiffusivity, electrode kinetics, and more. Industrial high pressure electrolysers systems operatedat high current densities which require external magnetic field to impart magneto hydrodynamic(MHD) convection to reduce IR-drop that improve the void fraction and the surface coverage aswell as forced convection of gas bubbles which contributes to the high energy consumption.To expand the use of water electrolysis, it is mandatory to reduce energy consumption, cost ofelectrodes, and maintenance of current electrolysers, high current densities have to be maintainedat reduced cell voltage, and to increase their efficiency, durability, and safety. Hereby the paperelucidates the magnetic field effects on electrolysers efficiency and studies the insights ofmagnetoelectrolysis.

Keywords: Electrolyser, Magneto hydrodynamic convection, Efficiency, Magnetic field

SCHEMCON-2020

Developing Aluminum-Air Cells as A Sustainable Energy Source And Proposing Optimizations

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Abstract

ID: OP-02-039

Batteries and Fuel Cells happen to be a potential answer to the society's energy problems.However, they are still limited by issues such as low energy density, high material costs,short lifetime etc. The Metal-Air technology that uses O2 from air as cathode seems to bean fitting solution. The paper discusses the advantageous use of Aluminum as the metalanode owing to reasons like low cost & abundance, high energy density, easy recyclabilityetc. Various challenges faced while designing Al-air cells are discussed and some viablesolutions in the form of optimizations are proposed. An account of an inexpensive, self-designed Al-air cell that can serve as a scalable primary source of energy is provided. Theself fabricated cathode was based on multiple carbon mixtures. Activated Carbon +Graphite Mixture was applied onto SS 316 Mesh (120 Mesh size) via a novel procedure.15% (w/v) NaOH provided best output with controlled anode corrosion (Open CircuitVoltage: 1.44 V, Current Output: 132 miliAmperes for a 4cm x 5cm cell). Two Al-air cellswere able to run 5 LEDs (0.75 Watt lamp) for 11+ hours in full brightness beforeelectrolyte refill. Four cells were able to charge a mobile phone via USB. Cells lasted for ~72 hours in full use (3 days) before the anode was replaced. Cost effective synthesis ofnovel materials like multi-doped graphite and possible engineering optimizations are beingexplored for developing a bigger cell stack and overcoming present challenges asdiscussed.

Keywords: Sustainable Energy; Metal-Air; Battery Chemistry; EngineeringOptimizations; Electrochemistry

SCHEMCON-2020

Renewable Energy Supply and Energy Efficiency Technologies in India

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ID: OP-02-040

Abstract

Electricity consumption is going to comprise an increasing share of global energy demandduring the next few decades. In recent years the increases in the price of fossil fuels andconcerns about the environmental consequences of greenhouse gas emissions have increasedthe interest in the development of alternative energy resources all over the world. Fordeveloping countries such as India renewable energy sources and technologies are thesolution to energy related problems. Renewable energy sources such as wind energy, solarenergy, geothermal energy, ocean energy, biomass energy, and fuel cell technology can beused to solve the energy shortage in India. For a country like India whose economy isgrowing fast, energy requirement will increase 3 to 4 times the current requirement. In thelast two decades, a lot of research, development, demonstration, production, and applicationhas been done in the renewable energy sector in India. This paper assesses the availability,current status, major achievements and future potential of renewable energy in India.

Keywords: Renewable energy, solar, wind, biomass, geothermal, hydro.

SCHEMCON-2020

Conversion of Co_2 Into Methanol

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ID: OP-02-041

Abstract

The global warming, mainly sourced from the human induced emission of CO2, is oneof the major environmental threats we are facing in the 21st century. Methanol (MeOH)can be synthesized from CO2 hydrogenation and is one of the most celebrated andwidely suggested alternatives for chemical energy carrier. Methanol is widely regardedas a promising alternate to automobile fuel. Some of the positive effects for developingworld-wide market for methanol as a fuel are (a)Decrease in dependency on foreignenergy resources,(b)conservation of existing petroleum based energyreserves,(c)Increase competition among energy providers resulting in lower cost and(d)environmental benefits from improved emission inherent in the combustion of
methanol as compared to petroleum based fuels. The dominant method of producingmethanol is a two step process but this step is very energy intensive and represent themajor expense in the methanol production. Instead of using two step method, one stepmethod seems to be beneficial. There many one step methods but Catalytichydrogenation of CO2 with renewable H2 to methanol represents a promising pathwayfor reducing anthropogenic CO2 emission. Catalyst play a key role in enhancing boththe hydrogenation rate and methanol selectivity. For this process, sources are easilyavailable for e.g. CO2 can be obtained from blast furnaces, cement plant, power stationand Hydrogen from electrolytic splitting of water by usingrenewable energy sources.Hence , we can say that this method is high efficient considering all environmentalaspects.

Keyword : Sustainable, Catalytic Hydrogenation, Blended Methanol.

Waste Management: Land/ Water/ Enviornment (WM)

SCHEMCON-2020

Adsorptive Removal of Nickel from Aqueous Solution Using a Red Algae

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ID: OP-03-001

Abstract

The adsorption of nickel was studied by using a red algae Gracilariachangii. Theinfluence of different operating parameters viz. pH (2 - 6.5), temperature (20-40 o C), sorbentdosages (0.5-10 g/L), initial concentrations of nickel in solution (0.01-5.0 g/L), and contact time.The maximum removal of nickel occurred at pH 5.2 and temperature - 38.1 o C for a sorbentdosage of 5.0 g/L. The results were modeled by response surface methodology (RSM), whichdetermines the maximum sorption of nickel as a function of the above five independentvariables, and the optimum values for the efficient sorption of nickel were obtained. Acoefficient of determination R 2 value 0.96 shows the fitness of RSM in this work.

Keywords: Optimization, Nickel, Gracilariachangii, Sorption, Response surface methodology,
Algae

SCHEMCON-2020

Effective Utility of Waste Cashew Nut Shell Liquid in the synthesis of resins-A valuable pre-polymer resin in Industry

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ID: OP-03-002

Abstract

Today, polymers are used as replacements for wood, glass and metals and for avariety of applications in industries such as packaging, automobiles, buildingconstructions, electronics, aerospace, electric equipments etc. The decline of petroleumbased resources for the polymer industry has forced to explore the naturally availablerenewable resources as alternate raw material, which hold beneficial characteristics forbeing non-toxic, bio-degradable and environmental friendly. Cashew Tree is animportant tropical tree crop, well known agro-forestry species, a crop of high economyand commercial value. The waste cashew nut shell liquid (CNSL) is a versatile by-product of cashew industry, is unique natural source, unsaturated long chain phenol.4-chloroaniline has been diazotized and coupled with cardanol, the main ingredient ofCNSL to prepare dye (bio-monomer). The dye has been condensed with formaldehydeto form homopolymer resin. The homopolymer resin has been further condensed withthiourea to form a copolymer resin. The resin has been characterized by spectral studies.Thermal behavior of resins has also been studied.

Keywords: Cashew Nut Shell Liquid (CNSL), Cardanol, Formaldehyde.

SCHEMCON-2020

Wastewater Treatment using Biosurfactants

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ID: OP-03-003

Abstract

The recent development in wastewater treatment is the use of biosurfactants produced from yeast orbacteria. This review paper illustrates the nature of effluents from four of the most common industriesand their methods of treatment using biosurfactants. The effluents are from the distilleries, dairies andslaughterhouses, petroleum and oil refineries and industries that process metals. Each of these employthe use of bacteria and fungi systems for the biodegradation process. The distillery spent wash is treatedusing the reactor systems involving biomethanation in addition to fungal and bacterial systems. Lipasesobtained from fungi of certain genera have been used to treat wastewater from dairies, slaughterhouses,restaurants and the like. Some novel processes such as the ion floatation method and micellar-enhancedultrafiltration have been employed to treat water containing metals such as copper, cadmium and lead.Enzymatic biodegradation process have been used to treat the effluents from petroleum industries.Rhamnolipids are the most commonly used class of biosurfactants to remove a multitude of pollutants.As industries are moving towards sustainability and biodegradability in all realms, this review articlefocuses on potential application of biosurfactants to treat the effluents.

Keywords: biosurfactants; sustainability; effluent; rhamnolipids

SCHEMCON-2020

Waste to Value

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ID: OP-03-004

Abstract

Burgeoning population, scarce financial resources and limited capacity to manage environmental issues are some of the common problems faced by most developing countries. With growing populations and changing lifestyles, the quantum of waste generated is growing apace. Inadequate awareness and willingness to responsibly dispose waste results in steep increase in amount and costs of garbage that the countries will be required to deal with by 2025. This enormous amount of waste generated in developing countries and the significant potential for resource recovery are primary triggers for waste-to-value based models. In addition to generating high valued products and minimizing pressure on landfills, these models provide an opportunity for informal waste workers to enhance their quality of life and earn higher income.It is estimated that a country generates nearly 100,000 metric tons of solid waste per day of which 40% is recyclable. Ironically, much of this waste has value and can be recycled and reused if segregated and collected in sufficient quantities.This is where the Waste-to-Value models come into play for a better perspective. These models help minimize the amount of waste lying on street and in open dumps. They aim to build a sustainable business around recycling and reuse of waste that are either difficult to treat or harmful if left untreated

SCHEMCON-2020

Manufacturing of Alcohol from Whey

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ID: OP-03-005

Abstract

Introduction to the formation of alcohol from whey, with the use of differentyeast.

The whey is a raw material carried out from the dairy industries, which is thewaste material collected from the upper liquid part of the cheese, butter,buttermilketc the specific gravity of the whey is firstly measured and with theuse of “HYDROMETER” the measured specific gravity of the whey liesbetween 0.9921 to 0.9999.

After measuring the specific gravity of whey , the whey is collected in theround bottom flask , with the use of yeast whey is kept under observation forfermentation at a moderate room temperature for 72hrs. At a time interval of8hrs the specific gravity of whey is measured.

After the fermentation of whey, the whey is collected for the distillation setup,where the fermented whey is filtered, and proceed to the distillation column Theprocess carries out the fermented whey into alcohol.The fermented alcohol is separately collected and passed for further tests suchas specific gravity, (ABV) Alcohol by volume.

Keywords- whey, fermentation, yeast

SCHEMCON-2020

Investigation of Carbon nanotubes as efficient electrode material deionizing the RO reject

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ID: OP-03-006

Abstract

Deionizing the reject stream from reverse osmosis (RO) system has been one of the majorlimitations of RO which needs greater attention due to water scarcity. Treatment of streamtill date has not been commercial adapted due to pros and cons of technology as well as thelocation specific characteristics of stream. Carbon nanotubes (CNT) is well known memberof carbon family but with higher specific surface area (3000 m 2 /g) and acceptable to the fieldof ion sorption or any other waste stream. Henceforth, focusing the capabilities CNTpossess, a successful fabrication of CNT electrode (2.5 * 2.5 cm 2) was attempted in theinvestigation and it was found that it had a specific capacitance of 23 F/g. Further, theelectrodes were applied with electric potential of 1.0 V for 1000-1500 ppm revealing amaximum electro sorption capacity 6.9 mg/g.

Keywords: RO reject; capacitive deionization; Carbon nanotubes

SCHEMCON-2020

Degradation of Atrazine in Water Using on Photocatalytic Ozonation

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ID: OP-03-007

Abstract

The present work investigates the degradation of pesticide atrazine in water usingadvanced oxidation processes based on photocatalysis and ozone. The degradation ofatrazine was done using UV light and ozone alone and the combined processes such asUV+TiO2 ,UV+TiO 2 +H 2 O 2 and UV+TiO 2 +H 2 O 2 +O 3 . The effect of various parameterssuch initial atrazine concentration, initial solution pH, concentration of photocatalystTiO 2, concentration of H 2 O 2 , concentration of ozone on degradation rate were studied.The optimum parameter established are 20 ppm of initial atrazine concentration, initialpH of 7, TiO 2 concentration as 80 ppm, H 2 O 2 concentration as 80 ppm, ozone flowrate as50 mg/h. The degradation was lowest using UV light alone (31.5%). Near completedegradation (99.8%) was obtained using combined photocatalytic ozonation(UV+TiO 2 +H 2 O 2 +O 3). The BOD and COD removal obtained were 16.51% and 16.25%respectively.

Keywords: Advance oxidation process; photocatalysis; photocatalytic ozonation.

SCHEMCON-2020

Textile dye removal using Coriolus versicolor from aqueous solution

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Abstract

Decolourization potential of white rot fungal organism, coriolus versicolor, wasinvestigated in a batch reactor, for reactive red 120 dye from aqueous solution. The influence ofprocess parameters like pH, temperature, agitation speed and dye wastewater concentration on thedecolourization of textile dye wastewater was examined by using Response surface methodology(RSM). The maximum decolourization was attained at: pH- 6.2, temperature – 28.6oC, agitationspeed – 155 rpm and dye wastewater concentration – 1:2. From the analysis of variance (ANOVA)results it was found that, the linear effect of agitation speed and dye wastewater concentration weresignificant for the decolourization of textile dye wastewater. At these optimized condition, themaximumdecolourization and chemical oxygen demand (COD) reduction was found to be 76.9%and 87.5% respectively. Kinetics of textile dye degradation process was studied by first order anddiffusional model. From the results it was found that the degradation follows first order modelwith R2 value of 0.9330.

Keywords : Wastewater ; COD ; White rot fungi

SCHEMCON-2020

A novel activated sludge-graphene oxide composites for photocatalytic application

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ID: OP-03-009

Abstract

With the continuous development of society, energy depletion and environmental pollution get worse. It has no doubt that increasing demands for clean energy. The demand for energy isproportionately increased with the growing global economy. These forced the researchers towork towards sustainable and renewable resources for energy production, energy storagedevices. The renewable energy power generation requires its energy storage components tohave fast response characteristic, high reliability and flexible energy management. Batteries,capacitors, and fuel cells are commonly available energy storage devices. The continuedincrease in the energy demand, forced to improve the performance of these energy storagedevices to meet the power requirement systems. This gap can be bridged with theincorporation of novel material in energy storage device applications. Electrode materials,generally as the crucial components of flexible energy storage devices, should endowthemselves with outstanding conductivity, good mechanical properties as well as high electro-chemical stabilities. In recent years, researchers focusing on to incorporate the carbonmaterials as they contribute to enhance the conductivity to enhance the specific capacitancevalues. Among various carbon materials such as activated carbon, graphene, carbon fibers, andcarbon nanotubes (CNT), have been investigated as electrode material for energy stage deviceapplications. To date, large number of energy storage such as lead acid-batteries and Li-ionbatteries have been developed and utilized. The scientific community has shown interest inrecent years to develop high power and energy density storage devices. Graphene, a two-dimensional (2D) monolayer of carbon atoms with packed honeycomb lattices, displaysabundant fascinating properties, such as large surface area, good thermal and chemicalstability, high conductivity, and mechanical flexibility. However, most of the multi-dopedcarbon nanomaterials were developed by using multiple hazardous chemicals as precursors.

In is known fact that the conventional disposal methods of sewage sludge causesenvironmental risk in addition to covering a large area, resulting conversion of into usefulresources. Pyrolysis of solid sludge produces carbon material, which further synthesized forgraphene. It is attempted in this study to convert sewage sludge into the graphene and thesynthesized graphene is used as electrode material for energy storage.

SCHEMCON-2020

Removal and Recovery of Phosphorus from Waste Water - Technology Perspective

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ID: OP-03-011

Abstract

India is developing country and the agriculture sector is an inseparable part of our economy.Phosphorus is essential mineral for the growth of plant which is supplied in the form of fertilizers. Typically the runoff rainwater takes the phosphorus from the fields to the waterbodies. The excess amount of phosphorus in the water bodies cause eutrophication and haveadverse effect on aquatic life. Phosphate removal is essential to control the eutrophication of
water bodies and adsorption is one of the promising approaches for this purpose. This paperpresents a comparative review of the literature on different methods of removal and recovery ofphosphorous. Adsorption stands out among the processes and has many fold advantages. Hereinwe discuss different adsorbents, there behaviors, mechanisms, and ways to the regeneration ofmaterials. The adsorbents are categorized under different heads; iron-based, silica-aluminabased, calcium based, natural or manmade clays and metal oxides that are employed inphosphorous removal. The adsorption capacities of the adsorbent varies widely between 10mg/g to 300 mg/g. The attractive feature of adsorption is the usage of nutrient-loadedadsorbents, which can be used as a phosphate fertilizer and a soil conditioner in agriculture.Metal oxides are promising materials for the effective adsorption as well as for recoveryprospective. Analysis of recovery technology to generate effective fertilizer is there as well asregeneration of sorbents for reuse using acids, bases, and salts, are critically examined.

SCHEMCON-2020

Fish-Hydroxyapatite/Shrimp Chitosan/PES Membrane for Industrial Effluents Treatment

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ID: OP-03-012

Abstract

This study was designed to short out the problem of wastewater treatment using Fish-shrimp chitosan(CS) based cross linked polyethersulfone (PES) based membrane.Herein, chitosan was prepared by deacetylation of fish shrimp, whereas PES wasprepared by phase inversion method. The prepared 18% polyethersulphonewasdissolved in dimethylformamide (DMF) in which 2gm of polyvinylpyrrolidone (PVP)was added as a pore performing agent. The (1gm/1gm) fish shrimp chitosan solutionwas prepared with dilute acetic acid and cast on the top of PES membrane and thencross-linked with 2% glutaraldehyde. The resulting Fish Shrimp composite membranewas extensively characterized using several methods such as X-ray powder diffraction(XRD), scanning electron microscope (SEM), thermogravimetric analysis (TGA) and
Fourier transform infrared spectroscopy (FTIR). The 18% fish shrimp membrane and18% commercial membrane molecular weight cutoff was found to be 9180 and 9022 Darespectively. The pure water flux for fish shrimp membrane with thickness of 0.2 mmwas 62 L/m 2 h.

Keywords: Membrane, Chitosan, Fish, Shrimp and Polyethersulfone.

SCHEMCON-2020

An overview of challenges and solutions of Plastic Waste Management in New Delhi and Chandigarh

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ID: OP-03-014

Abstract

This study aims to compare the mechanisms of disposal, collection, segregation, recycling anddisposal of plastic waste in two large metro cities namely, New Delhi and Chandigarh. It further highlights the impact of increasing plastic waste in both the cities. In an attempt to do so, wehighlight the role of authorities and citizens in facilitating the mechanism of plastic recycling. Theanalysis also highlights differences in approach used by both the cities and chalk out what can belearned from them. It was observed that the lack of segregation of waste in both the cities posed tobe a major deterrent to the increase in percentage of recycled plastic waste. The study furtheroffers insights on possible solutions to increase this percentage.

Keywords: Plastic Waste Management, Solid Waste Management, Plastic Recycling

SCHEMCON-2020

Development of low cost water purifier for simultaneous arsenic and fluoride removal

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ID:OP-03-015

Abstract

Fluoride and Arsenic are the two main contaminants in groundwater present naturally in India,China and Bangladesh in South Asia, causing a set of health symptoms known commonly asFluorosis and Arsenicosis respectively. For many rural areas where hand-pumps and tube-wellsare the only source of safe drinking water, these two contaminants have emerged to cause aserious crisis threatening public health. High Fluoride concentrations in groundwater present inthe western states of Rajasthan and Gujarat and in the southern states of Andhra Pradesh,Karnataka and Tamil Nadu. while the ground water in north easter India contains arsenic concentration above the statutory limitation.

As compared with Fluorosis, the skin afflictions of Arsenicosis carry greater social stigma andincur higher costs on patients. In Nadia district in West Bengal, the impacts of Arseniccontamination are more severe with increasing age. Cumulatively over the entire afflicted population, both Fluoride and Arsenic contamination have a high cost on society andaddressing the problem would require more attention from government agencies and societyapart from individual awareness.

Many technologies have been developed for removing arsenic or fluoride from groundwater. However, only few studies have been carried out to investigate the simultaneous removal of arsenic and fluoride, although both contaminants can co-present in groundwater in many cases.
However, none of these studies considered the simultaneous removal of arsenic and fluoride.

Further a portable cartridge for effective removal of arsenic and fluoride will be very muchbeneficial for our societal need. Thus, the objectives of the present study to develop a portablecartridge using activated alumina/carbon filter for simultaneous removal of arsenic andfluoride.

SCHEMCON-2020

Investigative Study on Waste foodstuff – Adsorbent Preparation

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ID: OP-03-018

Abstract

Chitosan is amino polysaccharide and it is one of the most promising and applicable materials inadsorption applications. Chitosan is commercially obtained by deacetylation of chitin produced fromcrustaceans and waste food stuffs like eggshells as the most abundant natural sources. The existence ofamino and hydroxyl groups in its molecules contributes many adsorption interactions between chitosanand pollutants. In this experimental study, Chitosan was first prepared by proper treatment of eggshellsand adsorption is compared of commercially available chitosan with the prepared chitosan from eggshell.Adsorption capacity of chitosan was also checked by use of Langmuir and Freundlich adsorptionisotherms. This research work reveals that information that chitosan prepared by waste food stuff can beused as potential adsorbent for wastewater treatment.

Keywords: Chitosan; Marine creature; Eggshell; Wastewater treatment.

SCHEMCON-2020

Hydroponics - A Novel Farming Method

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ID: OP-03-019

Abstract

In these crucial times, health is a major concern, hence we are bound to have a dramaticincrease in demand of vegetables and fruits of superior quality, but there is a limit towhich conventional farming techniques can scale their produce. This can be resolved byhydroponic type of farming. Hydroponics means growing plants directly in water, not insoil, and providing it a balance of nutrients, hence increasing its rate of growth, gettingmore nutritious vegetables and fruits, reducing man work and catalysing the productionof exotic vegetables and fruits at a cheaper rate as well as all year round. Apart fromthis, it occupies relatively lesser space which can help cultivate more number of plantsper area and reduces the possibility of plants being infected by soil and water bornediseases since water is Reverse Osmosis purified and Ultraviolet treated. This paper hascovered types and technology for hydroponic farming, aspects that affect produce,increase in profitability and decrease in the price borne by the consumers. Moreover,
this method helps in soil management as exhausted land can be utilised for farmingpurpose because it doesn't concern with soil. This also helps water management as theremaining water, after absorption by the plants, is recirculated through the system.

Keywords: Hydroponic Farming; Soil management; Water based plants; WaterManagement

SCHEMCON-2020

Recent Trends in Recovery of Gold from E-wastes

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ID: OP-03-020

Abstract

The rapid global development in technology along with pressures for upgrade infunctionality and design has generated advanced electrical and electronic equipmentwith shorter life span. Waste electronic and electrical equipments releases variety oftoxic substances which can contaminate the environment and threaten human health, ifdisposal protocols are not meticulously managed. According to the UN's Global E-waste Monitor 2020, a record of 53.6 MT of E-waste was generated worldwide in 2019and by 2030 the number would reach 74 MT. The latest data from Ericsson estimatesthat 74% of the world's population uses mobile phones and also the survey byConsumentenboard, non-profit organization recorded an average life span of asmartphone as 2.5 years, thus producing a large amount of wastes. A study showed that
the recycling of one tonne of mobile phones would yield 0.34 kg of gold which is 18000USD today. This review highlights the various challenges and opportunities in therecovery of gold from E-wastes using metallurgical techniques like Pyrometallurgy,Hydrometallurgy and Biohydrometallurgy from PCBs. In addition to that, a specialfocus has been given on the technique developed by the Indian researchers on recoveryof gold using the leaf extracts of Lagerstroemia speciosa.

Keywords: E-waste; Mobile phones; Gold recovery; PCBs; Metallurgical techniques.

SCHEMCON-2020

Selective production of aromatic compound from the waste plastics by catalytic pyrolysis

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ID: OP-03-022

Abstract

Today waste plastics become an important threat to plant and animal on land mass. It becoming an increasingly challenging to manage and control the use of plastics due to their adverse environmental effects. The landfill deposition of municipal waste plastics (MWP) may cause environmental problems and is becoming more expensive. Due to increasing volume of MWP and decreasing landfill capacity for disposal, landfill becomes more challenging. In addition, landfill can release hazardous sub-stances and plastic wastes take long time to degrade. Thermochemical conversion of plastic wastes is a promising approach to produce alternative energy-based fuels. Herein, we conducted two stage thermal pyrolysis by utilizing the porous waste carbonaceous material as catalyst Study the effect of catalytic temperature, residence time and plastic waste component on the production of Aromatic compound.The entire process is undertaken in closed reactor vessel followed by condensation, if required. Waste plastics while heating up to 500 to 900 o C convert into liquid-vapour state, which is collected in condensation chamber in the form of liquid fuel.

Keywords: Waste plastics; Aromatic production; Catalytic thermochemical conversion

SCHEMCON-2020

Biosorption of Heavy Metals By Activated Sludge And Their Desorption Behaviours

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ID: OP-03-023

Abstract

The biosorption of five metals (Cu2+, Cd2+, Zn2+, Ni2+ and Pb2+) was tested usingactivated sludge. The most favorable pH was 4 for Cd, Cu and Pb sorption and 5 for NiandZn.Biomass metal uptake clearly competed with protons present in the aqueous medium,which made pH an important variable in the process. Protons consumed by biomass incontrol tests v/s protons exchange in biosorption tests proved that a maximum exchangeof metal cations and anions is seen at pH 2. This study tells that the amount of protonsthat are released from biomass have increased with biomass concentration .Themaximum sorption uptake of the five metals by the activated sludge exhibited thefollowing decreasing order: Pb>Cu>Cd>Zn>Ni.Desorption experiments were conducted using HCl and it was found to be a good eluentfor the five metals tested, especially at low pH values (1 and 2). At pH 3 or 4 thedesorption yield was comparatively lower. Although its use did not allow the reuse ofbiomass. EDTA was also a good desorption agent which completely recovered the fivemetals that were tested at a concentration of 1mM with the advantage that biomasscould be reused for three sorption–desorption cycles.This study focuses specifically on removal of heavy metals from industrial effluents inan eco-friendly way.

Keywords: Activated sludge; Biomass; HCl ; EDTA; pH; Metals; Eluent

SCHEMCON-2020

Economical Sustainable Way for De-fluoridation of Water

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ID: OP-03-024

Abstract

In 2019,Central Ground Water Board (CGWB) of India had cautioned that the levels offluoride are beyond the acceptable limits in various states. Across the country, 370 districts are facing the problem of excess fluoride. World Health Organization (WHO) hasset the upper limits of drinking water standards at 1.5 mg/l, and the Bureau of IndianStandards(BIS), has therefore, laid down Indian drinking water standards as 1.0 mg/l asmaximum permissible limit of fluoride .Excess exposure of fluoride may lead to dentalfluorosis or crippling skeletal fluorosis, which is associated with osteosclerosis, calcifi-cation of tendons and ligaments, and bone deformities. In this project, We have done ananalytical examination on different methods for fluoride removal from drinking watersuch as coagulation-precipitation, membrane separation process, ion exchange, adsorp-tion techniques, Fluoride Nilogon and so on. Fluoride Nilogon is found to be an uniquelow cost effective water treatment technology that has been developed recently. Our aimis to find a sustainable economically feasible process to minimize the amount of fluo-ride to it's permissible limits. We have also studied some under-developed projects likegraphene based filtration system for the effective removal of ions from the water.

Keywords : Fluorosis; Ion Exchange; Adsorption ; Fluoride Nilogon

SCHEMCON-2020

Municipal solid waste management

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Abstract

ID: OP-03-026

Waste management is becoming more hot topic in our country. Municipal governments, whichare largely responsible for building & maintaining waste disposal networks, are desirous to findways of reducing the waste & final disposal. This includes the collection, transport, treatment,disposal of waste. Waste can be solid, liquid or gas. Waste management deals with all types ofwaste including industrial, biological and household.

Municipal solid waste management (MSWM) is one of the major issue in policy circles.Municipal solid waste (MSW) is known as waste consisting of furniture, plastic products, foodwaste, paper left over. There is a rapid increase in MSW due to the urbanization and populationgrowth.

This paper gives current situation of India with respect to MSW. We have presented theoverview of MSW in major cities and we have included quality, quantity and its management.
We have also presented the outcomes on MSW small-scale and large-scale.

Keywords: Municipal solid waste; transportation; collections.

SCHEMCON-2020

A Review on Hydrothermal Liquefaction of wastewater to bio-oil

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ID: OP-03-027

Abstract

UN Sustainable development goals SDG 11.6 aiming at reducing per capita environmentalimpact of cities by better way of municipal and other waste management and SDG 7, atproviding access to clean, affordable and sustainable energy by 2030 can be achievedtogether by developing appropriate Waste to Energy (WTE) technologies. Anaerobicdigestion (AD) a WTE employing biochemical process, produces biogas containing nearly50% of CO 2 and inherently slow. Microbial Electrolysis cell (MEC) process produceshydrogen by breaking down the organic matter in the wastewater bio-electrochemically butrates and yields of hydrogen needs to be increased to make it a viable WTE. Hydrothermalliquefaction (HTL), the only WTE technology among thermochemical conversions toproduce bio-oil, which upon hydrotreating will be a substitute for diesel, kerosene andgasoline. Pacific Northwest National Laboratory, USA converted sewage Sludge to bio-crude as energy product of 44% yield using HTL. HTL of synthetic wastewater in thepresence of iron-molybdenum oxide and hierarchical Fe-Co-ZSM-5 have resulted in bio-oilyield of 36.5 and 34.7% respectively, thus making it a more promising WTE technology.Detailed comparison of AD, MEC and HTL as WTE technologies will be reviewed andpresented.

Keywords: HTL; Anaerobic Digestion; Wastewater; bio-oil.

SCHEMCON-2020

Optimization of Emulsion Liquid Membranes for the removal of harmful dyes from industrial wastewater

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Abstract

ID: OP-03-028

In the present study, various harmful dyes like methylene blue, malachite green, crystal violet,and rhodamine 6G which were drained in the water from industrial waste having a certainadverse effects on the human body, aquatic life have been studied and optimized. The majorityof dyes were basic which were removed using emulsion liquid membranes (ELM). Sinceemulsion liquid membranes have a high mass transfer rate, extraction and stripping in a single-stage make this membrane very efficient. Various parameters like carrier concentration,surfactant concentration, oil phase to stripping phase ratio, internal phase, emulsification time,emulsification speed, and others were studied and optimized. The model has been developed for
the extraction yield with the help of Minitab 17 software.

Keywords: emulsion liquid membrane, surfactant, carrier, wastewater

SCHEMCON-2020

Waste Minimization Challenges Post COVID-19

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ID: OP-03-029

Abstract

The COVID-19 pandemic has expanded all over the globe. It has created an enormousimpact on the environment leading to severe consequences. The waste sector is one suchwhich is in trouble and ensuring for its safe disposal. Research studies have revealedthat waste materials like plastics, cardboards, steel, etc are carriers of COVID-19 virusand it can stay on these for up to 72 hours. Thus, there is a need to look for healthsituations of waste stream workers and recyclers and to deal with growing challenges inwaste minimization practices. On the other hand, a rapid increase in biomedical wastehas become an issue due to the need for proper destruction of the residual virus. InIndia, biomedical waste generation has increased from 94 tonnes to 761 tonnesasreported by the Central pollution control board (CPCB) and thus creating a dilemma onthe establishment of new facilities to handle the increased waste volume. The emergingchanges in composition and quantity of waste highlight the need for optimum changes in waste management systems. The public authorities and municipal waste operatorshad to rapidly adopt effective measures for careful handling and disposal of such wasteto overcome the long-term dangers. The paper gives the outlook on how during andpost-pandemic the waste management practices are adversely affected. Wastemanagement recommendations regarding COVID-19 waste are also discussed. Theincrease in the percentage of plastic and biomedical waste from pandemic threatens todominate existing waste management practices.

Keywords: Biomedical; pandemic; waste minimization; waste management

SCHEMCON-2020

Sustainable Biomedical Waste Management amidst the Pandemic

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ID: OP-03-031

Abstract

Environmentally sound management of biomedical waste is a key challenge faced by ustoday. The emergency declared in the response to COVID-19 has resulted in individualsproducing more waste than usual, including masks, gloves, and other protective equipmentthat could be infected with the virus. This has led to an increase in the production of single-use plastics. When not managed properly this biomedical waste could be subjected touncontrolled dumping (in oceans and land) or incineration, leading to the release of toxinsand increasing our carbon footprint in the environment.

The idea is to disinfect the used Personal Protective Equipment and the masks made ofpolymer (generally polypropylene) by physical as well as chemical means, using a virucidalsolvent such as ethyl alcohol and ultraviolet radiation (to eliminate the risk towards publichealth which is a prime concern in these unprecedented times). This disinfected biowaste isthen transferred to a pyrolysis chamber where polymers are broken into hydrocarbonswhich are segregated by fractional distillation method. The hydrocarbons obtained asproducts are combustible and can be used as fuels. This process will help in reducingadverse effects on the environment while promoting the recycling of polymers.

Keywords: Biomedical Waste; Pyrolysis; Fractional Distillation

SCHEMCON-2020

Plastic Waste Management under COVID-19 Pandemic – A Review

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ID: OP-03-032

Abstract

The corporeal attributes of plastics like durability, low density, tensile strength andminimal cost, makes them useful in various sectors. Regardless of their degree ofoperation and utilization, plastics deteriorate the environment and thus its disposal hasgained critical attention. In addition to the already existing challenges, the COVID-19scenario has made conditions worse. This paper provides an overview of differentplastic disposal policies and discusses the readjustments of these policies amidst theCOVID -19 pandemic along with their potential environmental implications. This paperhas also emphasized the issue of plastic waste management policies, sustainable andgreen plastic solutions and development of dynamic and responsive waste managementsystem followed by recycling of the plastic waste. Advances in technologies and
systems for the collection, sorting and reprocessing of recyclable plastics are creatingnew opportunities for recycling, and with the combined actions of the public, industry and governments it may be possible to divert the majority of plastic waste from landfillsto recycling over the next decades.

Keywords: Plastic Waste Management; Covid-19; Sustainable and green solutions.

SCHEMCON-2020

Biosaviours of environment from oil spills

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ID: OP-03-033

Abstract

The oil spills are posing a great threat as seen in the latest ”mauritius oil spillanddeepwater horizon oil spill”. The reason for oil spills are oils leaking from tankers,offshoreplatforms,drilling rigs and wells and spills of refined petroleum products etc .Theoil spills adversely effect the marine ecosystem, thus resulting in loss of biodiversity.Theoilspill treatment depends on various factors and the treatment of oil spills originallyconsumes a lot of time which results in emulsification of oil and water . There have beenvarious methods to treat oil spills like using oil booms,skimmers,usage of surfactantsburning,sorbentsetc.few have been used effectively for spills in the middle of the sea butthe major threat is at the shores due to accumulation of the floating oil.For past few decadesresearch has been done for remediation of environmental contaminants , because of the higheconomic cost of physicochemical strategies, the biological tools for remediation of thesepersistent pollutants is the better option.Major have been considered on organic chemicalsi.e.polyaromatic hydrocarbons (PAHs) due to their occurrence,bioaccumulationpotentialand carcinogenic activity. Rhizoremediation, a specific type of phytoremediation thatinvolves both plants and their associated rhizosphericmicrobes .We found thatPseudomonas aeruginosa, Pseudomonsfluoresens, Mycobacterium spp., Haemophilusspp.,Rhodococcusspp are some of the commonly studied PAH-degrading bacteria. We first usedispersants to break up the complex oil molecules and then the microbes feed on thedispersant and thus dispersant not causing any environmental contamination as well. Weresearched on how to treat oil spills effectively ,economically and within the timebounds.Thus the methods of natural bio augmentation and bio stimulation proved to beeffective methods in the treatment of oil spills.The rate of degradation can be increased bythe use of fertilizers like nitrogen and phosphorus.

Key words : PAH ; Bioremediation ; Rhizoremediation

SCHEMCON-2020

Composite material from Tannery wastes

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ID: OP-03-036

Abstract

The leather processing industry produces large amount of solid organic wastes in the form of un-tannedand tanned waste from raw hides and skins are heavily polluted containing appreciable amount ofinorganic substances like chromium, sulphide, chloride etc. So it is incompatible and harmful for directbiologicaltreatment.Though there is various methods are applicable for disposal have beenpractised,there is a huge leftover of these wastes to be managed.Itpostes serious issue on thesecase.These study is aimed at providing additional method of managing tannery solid wastes generated inthe leather industry into a useful composite material.The tanned leather shavings werecollected,cleaned,dried and ground to particle size and used as reinforcement in the matrix(HDPE).Thenit is compounding by the roll mill and subjected to the compression moulding at the compressiontemperature and pressure. Stabilizers and compatibilizers are used to maintain long term properties andto enhance the mechanical properties of polymeric mixtures.The reinforcement fibres from theanimals,leaves,grasses and other source for the composites had used in the vast applications likeautomotives,shippingsetc.This natural fibre reinforced composites have numerous advantages inautomotives and other industries.

Keywords: Tannery solid wastes,compressionmoulding,Naturalfibre reinforced composites.

SCHEMCON-2020

Preparation and Estimation of characteristics of Partially Replaced Cement with prosopisJuliflora ash

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ID: OP-03-037

Abstract

Cement is a binder, substance used for construction that sets, hardens and adheres toothermaterials to bind them together. Rise in price of cement leads to rise in constructioncost.Replacement of Cement with another material which completely satisfies all therequiredproperties is difficult. Partial Replacement of cement with a substitute material is a efficacioussolution. Prosopis Juliflora is a shrub belonging to fabaceae family, a kind of mesquite havingroots which are capable to grow at a greater depth in search of water which is challenging toremove. Partial Replacement of cement with ash of prosopisJuliflora will be a good strategy forsolving both of the troubles. This study focusses on investigating the characteristics of partiallyreplaced cement with prosopisjuliflora ash. The main objective of the study lies on combiningdifferent proportions of ash say 0,20,40,60,80 with cement and estimating the effectiveness ofdifferent combinations by evaluating physical and strength properties such as workability, settingtime, density, compressive strength and comparing it with ordinary Portland cement.

Keywords : Partially Replaced cement; Prosopis Juliflora ; Ash; Initial setting time

SCHEMCON-2020

Thermal Decomposition kinetics for agricultural residue

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ID: OP-03-038

Abstract

In this study, we report the thermal decomposition kinetics of agricultural residueswheat straw using thermogravimetric analysis (TGA). TGA was carried out at differentheating rates (5, 10, 30 and 50 °C /min) under inert conditions in the temperature rangeof 303 – 1173 K. The kinetics of thermal degradation was separately studied in theactive zone of pyrolysis (120-600 °C). The results show that the n th order reaction modelis applicable for in all heating rates with order of reaction in the active zone ~3.0,activation energy ~100 kJ/mol and pre-exponential factor ~10 5 sec -1 .

SCHEMCON-2020

Industrial Waste Water Treatment

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ID: OP-03-039

Abstract

In an ever growing industrialized world the natural resources are depleting at an unprecedented rate, and one of the most crucial resource is water. Water scarcity and water treatment is a globalconcern. This paper discusses about an integrated system for waste water treatment thatcombines the existing industrial waste water treatments with a cost effective and environmentfriendly biological treatments that work on the principles of bio-mimicry by using plants like‘canna indica’ which absorb nitrates, phosphates. A plant ‘cyprus papyrus’ can be used for betterremoval of ammonical nitrogen demand, chemical oxygen demand, and latifolia breed of plantsfor removal of heavy metals etc. Apart from this, the paper has laid emphasis on majorindustriesthat generate maximum waste water i.e. the textile industry and the sugar industry.This paper has also emphasized on reuse and safe disposal of waste water which is oftenneglected due to high cost. It is an attempt to encourage water reuse and treatment to help inconservation of water resources

Keywords: Industrial waste water treatment, Economics, Bio-mimicry, Water resources.

SCHEMCON-2020

Waste to energy conversion in India

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Abstract

Previously, wastes were considered as the products formed by a process those have novalue(use) and were simply discarded. But, now people have come to know that wastes arenot really 'waste' and are extremely valuable in energy production. As a country develops,it's energy requirement and waste generation increases. So, we need to increase energyproduction and manage the increasing wastes(waste management). Waste to energytechnologies(WTE) can serve both these purposes. The first WTE plant was commissionedlong back in 1987. But, these WTE plants are not very successful in India. Moreover,many plants have been shutdown due to their inability to handle mixed, unsegregatedmunicipal solid wastes(MSW), pollution caused and high cost of electricity produced bythem that renders it unattractive to power companies. This paper discusses different WTEtechnologies like incineration, gasification, pyrolysis and anaerobic digestion and theirpresent situation in India. Advantages, disadvantages and challenges faced due to thesetechnologies. Paper also suggests solutions for some problems. Deep research must be donein WTE area for bringing down the cost of power production and reduce emissions fromthese plants.

Keywords: WTE; Waste management; Incineration; Anaerobic digestion; Unsegregated waste.

SCHEMCON-2020

Multi-Mix-Bed Adsorbents for Simultaneous Multi-Pollutant Removal

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ID: OP-03-042

Abstract

With this industrialization time, when more and more heavy metals are utilized for bettermanufacturing finally leads to more and more pollution one or another way. These will beprimarily discharged in the outer water environment adding up the pollutant content of thewater body. More the number of heavy metals and other chemicals utilized lies thepresence of multiple chemical and heavy metals to be present in the effluents as thepollutants. This shows a greater requirement of an effective method for the removal of themultiple pollutants available in the effluent before it's mixing to the outer world.Adsorption is one of the most basic methods which have been proven to be effective for theremoval of different pollutants whether it is heavy metal, dyes and other phenoliccompounds. Therefore, there is a lot of possibility for the utilization of the adsorption forthe removal of multiple pollutants at the same time. To enhance its, capability, this paper isdealing with utilization of the multiple adsorbents to prepare a multi-adsorbent bed for theremoval of multiple metal ions.

Keywords: Environmental Sustainability, Wastewater, Multi-metal removal, Adsorption

SCHEMCON-2020

Process of Decomposition Of Plastic By Nano Clay

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ID: OP-03-043

Abstract

Plastics have woven their way into our daily lives and now pose tremendous threat to theenvironment. Over 100 millions tons of plastics are produced annually worldwide, and the usedproducts have become a common feature at over flowing bins and landfills. for examplenormalplastic items takes up to 1000 years to decompose in landfills, while plastic bottles take 450years to decompose in the earth to overcome this problem government made a descusionthatavoid usage of plastic (more than 35 microns) in that place we are using biodegradable plasticcould decompose much faster than existing ones, safely breaking down in the environmentinstead of polluting the world for centuries.

Since in 1980s, it has seen limited use because of its brittleness and unpredictable rates ofbiodegration now scientists at cornell university in New York have designed a new form of theplastic that at first glance is paradoxically both stronger and decomposes faster the key isadditional of plastic of particles of clay only nano meter-billionths of a meter -in diameter .thesenano clays help the PHB crystalise, enhancing its strength . at the same time, the nano claysact as catalysis, eventually helping the plastic decomposes fastly.

India consumes an estimated 16.5 million tonnes, about 1.6 million truckfull, plastic annually,India generates nearly 26,000 tones of plastic waste every day , making in the 15 the biggestplastic polluter globally , discard ed plastic waste litter the country's roads, rivers and also formhuge mods in garbage dumps across the country.as we know that in 1976 congress passed theresource conservation and recovery act to increase recycling and conservation efforts as wastebecome a bigger problem. It is estimated that the slogan "reduce, reuse, recycle" was born atthat time so people are making an increasing efforts to recycle, reuse items that have anotherpurpose, and reduce our waste. soon enough, tos sing an aluminum can will have you runningto the nearest recycling bin.

KEYWORDS:- NANOCLAY, PLASTIC CONSUMPTION,SAFETYMEASUREMENTS

SCHEMCON-2020

Technical approaches towards waste minimization

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ID: OP-03-045

Abstract

Waste management is nothing but the activities and actions required to manage thewaste. It includes collection, transport, treatment, disposal and monitoring of wastematerials. Sources of waste can be broadly classified into four types i.e. Industrialwaste, Domestic waste, Commercial waste, Agricultural waste. In India a largenumber of WMP deals with Municipal Solid Waste (MSW). One of the mostImportant principals of waste management is The Waste Hierarchy which refers tothe "3 R s"; 'Reduce', 'Reuse', 'Recycle'. It classifies waste according to their
desirability and extracts the maximum principal benefits from product in terms ofwasteminimisation. There are many companies in India which served wastemanagement facilities like, Antony Waste Handling Cell Private Limited, AtteroElectronics, Let's recycle etc. Some major initiatives and activities such as SwachhBharat Abhiyan, Mahatma Gandhi Swachhata Mission, SwachhataSurvekshanetc.Has been taken by Government for the welfare of the society and human being. Themain purpose of writing this paper is to spread awareness among the people and toprovide some suggestions and recommendations to improve the waste managementpractices in India.

Keywords: Waste Hierarchy, Reduce, Reuse, Recycle, MSW

SCHEMCON-2020

Combined hydrodynamic cavitation and advanced oxidation processes for industrial effluent treatment

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ID : OP-03-046

Abstract

Industrial effluent is a major source of water pollution which imposes severe effects in theenvironment and ecosystems. The industrially processed water may contain complex organicpollutants such as heavy metals, pesticides, dye intermediates, pigments, solvents,pharmaceuticalSdrugs, etc. which must be completely removed before being discharged to natural resources. In recent years, various advanced oxidation processes (AOPs) have been used for treatment of both simulated and real industrial wastewaters. AOPs include the use of ozone (O3), hydrogen peroxide (H2O2), persulphate, UV irradiations, etc. Cavitation leads to generation of free radicals, local hot spots, and release of large amount of energy associated with intense turbulence are helpful for breakage of complex refractory materials and also partial conversion into simple biodegradable molecules. Hence, the current work focuses on the implementation of hybrid strategies using hydrodynamic cavitation (HC) combined with oxidants followed by biological oxidation using oxidants such as ozone, Fenton's reagent, hydrogen peroxide, etc. to increase the treatment efficiency. It was reported that COD reduction by such hybrid techniques is up to 85% using a HC reactor. Therefore, there is an urgent need to develop such efficient processes to degrade compounds present in industrial effluent in a proper manner and bring the concentration to a certain minimum level so as to comply with the environmental laws.

Keywords: Industrial Effluent; Advanced Oxidation Process (AOP); Hydrodynamic Cavitation (HC)

Biochemical Engineering: Bioreactor, biomedical engineering (BE)

Silver Nanoparticles-doped Gel-MA and Alg-MA Antimicrobial Bio-composite as Potential Wound Dressing

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Abstract

ID: OP-04-001

Skin is the largest organ in human body and the first line of defence to protect us fromexternal harmful factors. Once the skin is injured, its function as a barrier to disease causing microorganisms is lost. So, development of novel wound dressing with potentantibacterial activity is crucial for wound healing and tissue regeneration. As a naturalbiocompatible polysaccharide, Alginate is extensively used in the pharmaceutical andbiomedical fields. Alginate chains are modified with functional groups (i.e.,methacrylates) followed by the free-radical polymerization in the presence of a UV lightirradiation. Gelatine possesses good biocompatibility and excellent haemostaticfunction. Gelatin is modified into GelMA by introducing methacrylates exposing toultraviolet (UV) light. Meanwhile, Gel-MA and Alg-MA composite possessedsignificant water uptake behaviour and mechanical properties, which support localtissue and promote cell adhesion and growth. Then introducing Ag- nanoparticles due toits higher toxicity to microorganisms, results in excellent antibacterial activity. In thisresearch, we discussed the green synthesis of silver nanoparticles (Ag-NP's)-doped Gel-MA and Alg-MA bio-composite, which possess antibacterial activity and be used aswound dressing.

Keywords: Ag NPs; Gel-MA; Alg-MA; Wound Dressing

SCHEMCON-2020

Efficient uptake of paclitaxel-loaded nanoparticles by donor corneal endothelium towards prophylactic drug delivery

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ID: OP-04-002

Abstract

The standard care for treating corneal disorders is corneal transplantation. The barrierfunction of corneal endothelium (CE) maintains corneal transparency. During storage, donor CE is inevitably exposed to hypothermia and challenged by cytokines after transplantation.They both induce microtubule disassembly and subvert barrier function of CE. Therefore, theobjective of this project is to develop a nanoparticle (NP)-based strategy for deliveringmicrotubule stabilizing drug paclitaxel sustainably to donor CE during storage and aftertransplantation to enhance the success of corneal transplantation.

In this direction, CE cells were isolated from fresh porcine cornea and grown using a defined medium. Paclitaxel was mixed with biodegradable poly-L-lactic-co-glycolic acid (PLGA)polymer and nanoparticles (PNPs) were prepared using nanoprecipitation technique. PNPswere spherical and homogeneously sized with an average size and zeta potential of 95 ± 10nm and -25 ± 2 mV, respectively. Drug entrapment efficiency of PNPs was 91% and drugrelease sustained up to 3 weeks and followed zero order kinetics at 4 °C and first orderkinetics at 37 °C. The surface charge of PNPs was increased to +25 ± 4 mV by coating poly-L-lysine, which resulted in a better uptake of PNPs by CE cells, confirmed by confocalfluorescence imaging.

Keywords: Paclitaxel, microtubules, barrier function, corneal endothelium, nanoparticles,controlled drug delivery

SCHEMCON-2020

Biodiesel and its production

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Abstract

Made from an increasingly diverse mix of resources such as recycled cooking oil, soybean oil andanimal fats, biodiesel is a renewable, clean-burning diesel replacement that can be used in existing dieselengines without modification. The chemical name for biodiesel is methyl ester. Biodiesel is a fuelcomprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats,designated as B100. Biodiesel Blend is a blend of biodiesel fuel designated BXX, where XX representsthe volume percentage of biodiesel fuel in the blend. Although being functionally similar, biodiesel ischemically different than petrodiesel because it contains oxygen atoms and as a result, has differentchemical and physical properties and has higher cetane number, contains no aromatics, and is non toxicand biodegradable. The major steps required to synthesize biodiesel are feedstock pretreatment, processreactions and product purification. Biodiesel is made through a chemical process calledtransesterification, which involves reacting vegetable oils or animal fats catalytically with a short-chained aliphatic alcohol (typically methanol or ethanol). The process leaves behind two products – methyl esters(product, biodiesel) and glycerin(byproduct). Overall, despite many achievements, the industrial production of biodiesel using homogeneous catalysts encounters major challenges such asrequiring longer residence time, resulting in increasing reactor volume, high capital cost, and a largefootprint, and are difficult to control. Sustainability and environmental benefits include: Reduction inlifecycle greenhouse gases by 86 percent, particulate matter by 47 percent, hydrocarbon emissions by 67percent. For every unit of fossil energy it takes to produce biodiesel, 3.5 units of renewable energy arereturned, the best of any fuel.

Keywords: Cetane Number; Feedstock pretreatment; Transesterification; Productpurification; Blending

Plastic Eating Bacteria

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ID: OP-04-004

Abstract

Plastic is a synthetic material made from a wide range of organic polymers such,polyethylene, PVC, nylon, PET, can be moulded into shape \ while soft and then set intoa rigid or slightly elastic form. PET-polyethylene terephthalate 1 , IUPAC name is poly(ethyl benzene -1,4-dicarboxylate. About 311 million tons of plastics are producedannually worldwide, mostly used for packaging such as drinking water. Most plasticsdegrade extremely slowly, constituting a major environmental hazard, especially inoceans, where micro plastics are matter of major concern. To resolve this problem manyscientists in the world had tried many ways. A scientist named Kohei Oda and his teamfrom Kyoto institute of technology first identified a bacteria named Idonellasakensis 2after collecting a sample of PET-contaminated sediment near a plastic bottle recyclingfacility in Japan. This bacterium uses two hydrolytic enzymes 3 to degrade the commonplastic polymer PET.Theseenzymes converts the PET into its monomers. Idonellasakensis is a gram negative 4 , aerobic beta proterobacteria. It first adheres to the PETmaterial and secrete enzyme which generate mono(2-hydroxyethyl) terephthalic acid.Then MHET taken up bythe cell and hydrolyzed by second enzyme MHETase tofurnish the two starting monomers. These monomers are then catabolized by thebacterium as its sole carbon source.

Keywords: 1-PET- polyethylene teryphthalate;2-Idonella sakensis-plastic eatingbacteria;3-PETase and MHETase;4-Dangerous bacteria**.**

Cloaking of nanoparticles with stem cell membranesto render stealth and tumor targeting properties for targeted drug delivery

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ID: OP-04-005

Abstract

Anticancer drugs loaded into biodegradable polymer-based nanoparticles possess enhancedbioavailability. However, the host immune system can recognize these nanoparticles andphagocytose them, thus reducing the efficiency of treatment. In addition, thenanoparticlesdo not possess active tumor targeting properties. Thus, the drug releasedcancause toxicity to normal cells as well. Mesenchymal Stem Cells (MSCs) are immuneprivilegedcells possessing innate tumor-targeting abilities primarily due to their uniquemembrane biochemistry. Hence, we hypothesize that by cloaking the nanoparticles withMSC membranes, phagocytosis can be avoided and active cancer targeting may beachieved. In this direction, MSC membrane vesicleswere derived using a simple spin-cupcentrifugation method. Poly-l-lactic-co-glycolic acid (PLGA)nanoparticles (NPs) weresynthesised by nanoprecipitation method. Fusion of the membrane vesicles with NPs wasachieved by extrusion throughpolycarbonate membranes.The average size of NPs was 90 ± 10 nm with high monodispersity. The size of the MSCmembrane vesicles was reduced from 5500 nm ± 500 nm to 700 ± 100 nm during spin-cupcentrifugation. Upon fusion, the average size of the membrane vesicle-cloaked NPs was120± 20 nm. Cryo-TEM imaging with uranyl acetate dye confirmed the structure and integrityof the membrane vesicles and the cloaking process.

Keywords: Nanoparticles; Mesenchymal Stem Cell; membrane vesicles; targeted drug delivery.

Hydrothermal liquefaction of algae into bio-crude: Comparative study on different species and operating parameters

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Abstract

The macroalgae species of Gracilariacorticata, Turbinariaconoides, Sargassumwightii and microalgae Nannochloropsis sp., Chlorella vulgaris species are collectedfrom Gulf of Mannar for bio-crude production under Hydrothermal Liquefaction (HTL)condition. The effect of influencing parameters on the yield of bio-crude have beeninvestigated. All the 5 algae species were processed under HTL in the temperature rangebetween 300 and 350 °C, residence time 15-60 min has been studied. It is found that thebio-crude yield for Nannochloropsissp. and Chlorella vulgaris was 38.2 and 36.2 wt.%,respectively with higher heating value (HHV) of 35.92 and 34.3 MJ/kgwhile Gracilariacorticata, Turbinariaconoides, Sargassum wightii yields about 29.63,18.46, 16.33 wt.%, with higher heating value (HHV) of 16.9, 20.3 and 33.63 MJ/kg.Based on the suggested reaction pathway, the identification of the existing componentin their respective source of bio-crude was done using GC-MS. The composition of
triglyceride and fatty acids in individual species are responsible for the formation ofbio-crude. The results from GC-MS showed the occurrence of amides and heterocyclicgroups due to protein presence. Moreover, the aqueous solution can be recycled asloading solvent to enhance the bio-crude yield significantly.

Keyword(s): hydrothermal liquefaction; bio-crude; algal biomass; high heating value; thermochemical conversion.

SCHEMCON-2020

Ultraviolet light (UV-C): An effective tool to Mitigate Pandemic Spread

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ID: OP-04-007

Abstract

Ultraviolet light is divided into three wavelength ranges UV-A (315-400nm), UV-B(280-315nm) and UV-C (100-280nm). Among these, the short- UV (UV-C) is found tohave germicidal properties and at the same time is harmless to humans. UV-C light canbe produced using tube-lights, smartphone flashlights, torches or any light source byincorporating a biochemical reaction using a fused amorphous silica (SiO_2) baseddichroic mirror filter accompanied by Ultraviolet Germicidal Irradiation and DiffractionGrating splitting of white beams. This arrangement allows UV-C rays (wavelength 222nm) to pass while blocking other higher wavelengths. When such light falls on surfaces,it gets absorbed by nucleic acids of micro-organisms. The absorbed energy can result indefects like formation of pyrimidine dimers via a photochemical reaction. Dimerizationprevents replication by forming covalent bonds between adjacent bases in the DNA,resulting in the inactivation of the organism. Such apparatus can be used to disinfecthands, groceries, electronic equipment, closed rooms and public places. This reviewwork is intended to analyse this cutting-edge technology and its lucid implementation ineveryday life, which is most relevant in today's time. This paper has also scrutinised itspotency to eliminate bacteria and novel viruses like SARS CoV-2.

Keywords: Biochemical Reaction; Photochemical Reaction; Ultraviolet GermicidalIrradiation and Diffraction; UV-C, 222 nm.

SCHEMCON-2020

Removal of copper (as heavy metal) from aqueos solution using popaya seed by adsorption

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ID: OP-04-008

Abstract

Papaya seed was evaluated as a new biosorbent of heavy metals. On contacting 10 mgcopper(II), cadmium(II) and zinc(II) solutions with 5g papaya seed, during shake flask contacttime of 60 min, the respective metal removal was noted to be 97.8, 94.9 and 66.8%. Sorption was
most efficient at pH 5. Metal ion biosorption increased as the ratio of metal solution to thebiomass quantity decreased. Conversely,biosorption/g biosorbent decreased as the quantity ofbiomass increased. The increase in initial metal ion concentration was associated with steepincrease in biosorption at lower concentrations, progressively reaching towards plateau at higher
metal concentrations. At equilibrium, the affinity of papaya wood to biosorb metals was in theorder of copper(II) > cadmium(II) > zinc(II), which remained the same during the testing ofvariables of different factors. The biosorption data perfectly fit the Langmuir adsorptionisotherms model with 0.99 regression coefficient (r2) for all the metals.

Keywords:-Bioabsorbant , copper removal , adsorption

SCHEMCON-2020

Extraction of Azadirachtin (A Biopesticide) From Neem Kernels

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ID: OP-04-009

Abstract

Despite the harmful implications involved in the use of synthetic chemicals to control pests, still theyare extensively used in all countries all over the world. The increased social pressure to replace them graduallywith other alternatives that are safe to humans and non-target organisms has led to increased development ofcompounds based on the models of naturally occurring active ingredients of biological origin, having variousbiological activities known as "biopesticides". The use of biopesticides for pest control today is an evolvingfield in pest management. Azadirachtin is one of the biopesticide with is extracted from the neem kernels.Itis the perfect replacement for harmful, chemical pesticide used world over.Being natural and organic bio-pesticide it does not harm the crops,environment,soil and human beings who are handling it. There are fewunits in india which are producing azadirachtin.The overall aim of our project is to make these azadirachtinproducts available at farm level at an affordable price, and this would become a possible tool in the integratedpest management strategy.

Key words: Biopesticide,Azadirachtin,neem

SCHEMCON-2020

Is hydroxychloroquine effective in the treatment of COVID-19

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ID : OP-04-010

Abstract

Corona Virus Disease was first registered on 17 th November 2019. Ever since the pandemicstartedthe researchers and scientists started working for developing vaccine for the treatment of COVID-19. In spite of research being done by scientists and researchers currently no treatment specificallyapproved for COVID-19. Some of the researchers have suggested to use quinine derivatives i.e.hydroxychloroquine (HCQ) and chloroquine as temporary vaccines. Use of hydroxychloroquine fortreatment of COVID-19 has several issues however its positive effect outweigh the negative effectthat the patient will have. Another issue is if it can be used then whether the world is equippedwith so much of stock to cure the rising COVID-19 victims. Many researchers have been workingon the efficaciousness of hydroxychloroquine however the effect of hydroxychloroquine is yet tobe seen. Also there has been no clinical evidence for hydroxychloroquine as of now. Efforts arebeing made to support universal decision of clinic and laboratories for the faster attainment of avaccine. This work is a thorough study on experimental ideas and finding out whetherhydroxychloroquine is an effective method of treating corona virus patients.

Process Modeling, Simulation & Optimization(PMS)

SCHEMCON-2020

Novel process modelling and optimization methodology for design of a tubular reactor

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ID: OP-06-001

Abstract

The present work developed an Aspen model of a tubular reactor to produce methyl lactate from lactic acid and methanol. Reaction is carried out at very high temperature (340 K) to promote auto-catalysis. Operating conditions like the temperature and pressure of the reactor, the mole flow rate of two raw materials- lactic acid and ethanol and reactor design parameters like length and diameter has a profound effect on product purity i.e. reactor conversion. The effect of those parameters on reactor conversion is calculated by sensitivity analysis in Aspen. A large number of data is generated by sensitivity analysis of Aspen Simulation. These data are used to develop an Artificial Neural Networking model to predict product purity from reactor operating and design parameters. Genetic Algorithm is used to optimize reactor dimensions and operating parameters so that reaction conversion is maximized. ANN model is generated because Aspen simulation has limitation for optimizing large number of parameters. This Aspen Plus and ANN model along with GA optimization framework developed in this study is generic and can be used to optimize equipment design and operating parameters in any other process also.

Keywords: simulation, lactic acid, methanol, Artificial Neural Network, Genetic Algorithm, purity, conversion.

SCHEMCON-2020

First principle and ANN modelling and multi-objective optimization of vinyl chloride monomer (VCM) plant

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ID: OP-06-002

Abstract

In this work, an Aspen Plus simulation was done for a full commercial vinyl chloride monomer plant from ethylene dichloride (EDC) which consists of EDC cracking unit, cooler, first multi-component distillation tower (to separate out hydrogen chloride), second distillation tower (to separate pure VCM). Unconverted EDC is recycled back from second tower bottom to the cracking unit. A complete sensitivity analysis is done to find out the impact of temperature and pressure of the cracking reactor, degree of sub-cooling of the cooler, reflux ratio of both distillation towers on product flowrate, heat duty of reboiler and HCl vent flow. Artificial Neural Networking model is also made from the sensitivity data. Multi-objective Genetic Algorithm optimization was done to simultaneously minimize heat duty of reboilers, vent flow of HCl and maximize the product flowrate. The developed methodology can be deployed in the plant for optimization in real time. Pareto optimal solutions are generated to represent the trade-off between three contradictory objectives. The developed modelling and optimization methodology is generic and can be used in any other process also.

Keywords: simulation, vent flow, heat duty, Genetic Algorithm, sensitivity analysis, Pareto.

SCHEMCON-2020

Design optimization of heat exchanger by old and new generations metaheuristic optimization algorithms: Insights and comparisons

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ID: OP-06-003

Abstract

This study compares the performance of 3 old generation algorithms namely Genetic Algorithm, Particle Swarm Optimization and Differential Evolution with two new generation algorithms namely Firefly Algorithm and Symbiotic Organism Search in optimization of heat exchanger.
The optimization procedure involves the selection of the major geometric parameters such as tube diameters, tube length, baffle spacing, number of tube passes, tube layout, head type, baffle cut, etc., as per TEMA standard and minimization of total annual cost is considered as the design target. The methodology takes into account the geometric and operational constraints typically recommended by design codes. Three different case studies are presented to demonstrate the comparative effectiveness and accuracy of proposed five algorithms. From the results of all the three case studies, it is concluded that DE performed the best in terms of capturing the lowest value of total cost and minimum execution time. The new generation algorithm, SOS performed the second-best as it captures the lowest values of total cost every time, honours the constraints every time in reasonably low execution time.
The final optimized heat exchanger comply TEMA standard, having lowest cost and obey all geometry, velocity and service constraints.

Keywords: Heat Transfer; Mathematical Modelling; Heat Exchanger Design; Firefly Algorithm (FA); Symbiotic Organism Search (SOS); Differential Evolution (DE); Constrained Optimization

SCHEMCON-2020

Modelling and multi-objective optimization of commercial ethylene oxide reactor

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ID: OP-06-004

Abstract

In this work, a commercial ethylene oxide reactor was modelled by Artificial Neural Network algorithm with actual plant data as no reliable first principle based phenomenological model is available. In commercial plant, ethylene oxide is produced by reacting ethylene and oxygen at high temperature (225-275°C) and pressure (19-21 bar) with silver catalyst. The function of catalyst is to promote the desired ethylene oxide reaction (Ethylene + oxygen □ ethylene oxide) and suppress the undesired reaction which produces CO_2 (Ethylene + oxygen □ CO_2 + H_2O). A promoter is also added in small quantity (2-10 ppm) to enhance the catalyst selectivity. In commercial plant maintaining the optimum concentration of promoter is very crucial as it has large impact on selectivity. Our developed ANN model finds a relation of catalyst selectivity and catalyst temperature with other reactor operating parameters like promoter concentration, raw material concentration, CO_2 concentration etc. in reactor inlet gas. A multi-objective genetic algorithm (MOGA) is used to find the optimum reactor conditions to simultaneously maximize the catalyst selectivity and minimize the temperature. Pareto optimal solutions are generated to represent the trade-off between two contradictory objectives.Our developed modelling and optimization framework is deployed in running commercial plant for real time optimization of reactor conditions.

SCHEMCON-2020

Exploiting and comparing metaheuristic optimization algorithms for design optimization of Plate and Frame Heat Exchanger

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ID: OP-06-005

Abstract

The area of optimisation has seen a boom of various metaheuristic algorithms with each claiming to be superior to others. This diversity in algorithms added with the intensified industrial requirements lead to a need for a systematic comparative analysis of these algorithms ensuring that an efficient algorithm is put in use in industries.
This paper focuses on evaluating the performance of some of the old generation metaheuristic algorithms which have proven their calibre with some novel metaheuristic algorithms based on the global minimum and their respective execution time. The study involves comparing old generation algorithms like genetic algorithm (GA), particle swarm optimization (PSO), and differential evolution (DE) with new generation algorithms like Firefly algorithm (FA) and symbiotic organism search (SOS).
For evaluation a benchmark problem of optimising the design of plate and frame heat exchanger for a popularly found case is used. The methodology involved using major geometric and operational parameters as optimization variables namely hot and cold flow length, number of hot-side layers, fin frequency, fin thickness, fin height and fin strip length.
It was found that differential evolution (DE) performed best followed by symbiotic organism search (SOS) when analysed based on the global minimum and the execution time.

Keywords: Symbiotic Organisms Search (SOS); Firefly Algorithm (FA); Heat exchanger design; metaheuristic algorithms; mathematical modeling

SCHEMCON-2020

Insights into the optimal design of plate and frame heat exchangers through comparative study of old and new generation meta-heuristics optimization algorithm

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ID: OP-06-006

Abstract

The conventional design of a heat exchanger is a rigorous task including a complex trial and error process where the possibility of results may not be optimum. The diversification and intensification characteristics of meta-heuristics algorithms benchmarked the global optimisation. The novelty of this paper is that it uses Satin Bower Bird (SBO) and Biogeography Based Krill Herd (BBKH) algorithm for design optimization of Plate and Frame Heat Exchanger (PFHE) and simultaneously compares the performance with three well established old generation algorithms: genetic algorithm, particle swarm optimization, and differential evolution by analyzing a case study taken from the literature in order to have a reliable reference.

This procedure involves seven geometric and operational parameters as optimization variables like hot and cold flow length, number of hot-side layers, fin frequency, fin thickness, fin height, and fin strip length. All variables are continuous except the number of hot-side layers. From the result, the comparative study shows that Differential Evolution (DE) predicts a lower annual cost and faster converging rate than other algorithms followed by the new generation algorithm-Satin Bower Bird (SBO). In regard to case study, the comparative study justifies as a beneficial guide for sustainable, efficient and economic method for optimal design of PFHEs.

Keywords: Satin Bower Bird (SBO); Biogeography Based Krill Herd (BBKH); PFHE; optimal design

SCHEMCON-2020

Combining Column Targeting & Exergy Analysis for Energy Efficient Distillation Column Configuration

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Abstract

To achieve better energy efficiency in distillation system, the column targeting tools needs to be complemented by thermodynamic tool like exergy analysis. The strength of both approaches facilitate modifications for energy target improvement of a base-case design of distillation column. This combined approach facilitates to identify process sections that are thermodynamically inefficient. The combination of process options like feed stage location, reflux ratio modification, feed conditioning, side-reboiler and side-condenser etc greatly enhances the separation and reduces exergy loss throughout the column. In this work, the thermodynamic analysis of distillation column was studied for propane-propylene binary system. The converged simulation of distillation column obtained from Aspen Plus were assessed with column targeting tools and exergy loss distribution. The energy efficient column targeting by both CGCC and exergy analysis achieves ~29% and ~15% reduction in reboiler and condenser duties respectively. This resulted in improvement in the distillation column energy efficiency in the range of 33% as compared to base-case design due to reduction in total exergy losses. The combined approach of column targeting and exergy analysis resulted in reduction in thermodynamic imperfections.

Keywords: Column targeting, CGCC, Exergy Analysis, Pinch Point, Distillation, Thermodynamic Efficiency

SCHEMCON-2020

A Comparative study of old and new metaheuristic optimization algorithm for design of Plate and Frame Heat Exchangers

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ID: OP-06-008

Abstract

In this paper**,** we present few results of old meta-heuristic optimization algorithms like genetic algorithm (GA)**,** differential evolution (DE)**,** particles swarm optimization (PSO) and new generation algorithms like migrating bird's optimization (MBO) and intelligent water drops optimization (IWD) algorithm for design of plate and frame heat exchanger(PFHEs). Optimization was solely done to reduce the total cost. The optimization procedure involves the selection of the major geometric parameters such as hot and cold flow length, numbers of hot-side layers, fin frequency, fin thickness etc.

MBO is based on V-shaped flight formation of migrating birds. It starts with a number of initial solutions corresponding to the leader bird in a V-shape formation. Whereas intelligent water drops algorithm (IWD) works on new swarm-based optimization algorithm. It is inspired from observing the water droplet flowing in the river. The results of these algorithms revealed that old generation algorithm**,** namely**,** Genetic algorithm (GA)**,** differential evolution (DE) gave the best results among all five algorithms in term of execution time and lowest cost. Whereas the new generation algorithms namely MBO and IWD performed third best every time.

Keywords: meta-heuristic algorithms**;** plate and frame heat exchanger (PFHE)**;** migrating bird's algorithm (MBO)**;** intelligent water drops algorithm (IWD)

SCHEMCON-2020

Application of metaheuristic technique to design the lowest cost Plate and Frame Heat Exchanger

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Abstract

ID: OP-06-009

In this study a methodology to design the lowest cost plate and frame heat exchanger was carried out. The procedure involves major geometric and operational parameters of heat exchangers including hot side flow length, cold side flow length, fin height, fin thickness, fin frequency, fin offset length, number of hot side layers, etc. are considered as the optimization variables and the minimization of total cost of the PFHE is taken as design target. This study applies three old generation metaheuristic algorithms, namely genetic algorithm, particle swarm optimization and differential evolution along-with two promising new generation algorithms, Intelligent Water Drop (IWD) and Big Bang Big Crunch (BBBC) for optimization of heat exchanger. The effectiveness and validity of the proposed five algorithms for optimization is investigated by analyzing a case study taken from the literature. Optimization of plate and frame heat exchangers considering the minimization of total annual cost under specified constraints has been conducted. From the results, it is concluded that particle swarm optimization (PSO) performed the best among all algorithms in terms of achieving the lowest total cost. Among the new generation algorithm, Big Bang Big Crunch able to achieve the third-best low values of total cost but its execution time is considerably low.

Keywords: Intelligent Water Drop (IWD); Big Bang Big Crunch (BBBC)); Metaheuristic algorithm; Heat exchanger design; Constrained optimization; Mathematical modelling.

SCHEMCON-2020

Application of AI-based Genetic Programming (GP) to develop a Melt Flow Index (MFI) model for commercial High-density polyethylene (HDPE) plant

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ID: OP-06-0010

Abstract

In commercial HDPE plant, Melt Flow Index (MFI) is the most important quality parameter of the final polymer product. Usually, inside a plant, MFI is measured by lab analysis which takes 4 - 6 hours before the results are available to plant operation engineers. Based on the results, production engineers change the operating parameters like polymer reactor temp, pressure, ethylene to hydrogen ratio, etc, to improve the MFI. Due to this time lag, when the product goes off-spec tons of undesired MFI polymer is produced and industry incurs huge losses. In the present work, a data-driven Genetic Programming (GP) model is developed which can predict the MFI on a real-time basis. GP is an AI- based modeling methodology and the GP algorithm has been improvised to make it effective for accommodating plant data. Commercial plant data and plant operating experience is utilized to identify the input parameters and train the model. The developed model is very accurate as evident from very high R^2 value and very low prediction error percentage, on unseen data. This model can be deployed in plant PCS to indicate MFI. The developed soft sensor helps the production engineer to avoid huge losses from the off-spec polymer product.

Keywords: Soft Sensor; Melt Flow Index; Genetic Programming; High-density polyethylene

SCHEMCON-2020

Soft Sensor to Predict Melt Flow Index (MFI) In Commercial HDPE Polymer Plant Using Artificial Neural Network (ANN)

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ID: OP-06-012

Abstract

In commercial HDPE plants, MFI is the most important quality parameter of the final polymer product. Usually, MFI is measured by lab analysis which takes 4 - 6 hours before the results are available to plant operation engineers. Based on the results, production engineers change the operating parameters like polymer reactor temperature, pressure, ratio of ethylene to hydrogen etc.,to improve the MFI. Due to this time lag, when product goes off-spec, tons of polymer is produced with undesired MFI value and industry incurrs huge losses. In the present work, a data driven ANN model is developed which can predict the mfi on realtime basis. ANN is an AI-based modelling methodology. Commercial plant data and plant operating experience has been utilised to identify the input parameters and train the model. The developed model is very accurate and reliable as evident from very high R2 value and very low prediction error percentage on unseen data (test data). This model can be deployed in plant DCS to indicate MFI of HDPE product in realtime basis. The developed soft sensor helps the production engineer to take easy corrective and preventive action and avoid huge losses from off-spec polymer product.

Keywords: Soft Sensor; Melt Flow Index; Artificial Neural Network; High Density Poly Ethylene

SCHEMCON-2020

Process Development for the Production of 1000 TPD of Ethylbenzene

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ID: OP-06-013

Abstract

Ethylbenzene is a colourless and flammable liquid. Ethylbenzene is used primarily inthe production of styrene and synthetic polymers. Production of ethylbenzene can be accomplished by different routes such as, from mixed xylenes by isomer separation and catalytic is omerization, 1,3-butadiene in a two-step process, the zeolite-based process using vapor/liquid/mixed phase alkylation, etc. To begin with, literature study was done to document all the routes for the production of ethylbenzene. Based on raw material, product price, thermodynamic feasibility, safety, and selectivity considerations, and many other criteria, an appropriate process for the production of ethylbenzene was adopted in the work. Material balance calculations was performed in a spreadsheet for the chosen route. The entire process flow sheet for once-through process and recycle was simulated in DWSIM (v5.8). Stream-wise comparison of results with spreadsheet and DWSIM (v5.8) was done to check the correctness. Major equipment such as heat exchanger, reboiler and distillation column were designed. The economics of the process was determined based on the available data to ascertain the viability of the process. Furthermore, appropriate effluent treatment was done. E-Factor was determined in order to quantify the environmental friendliness of the process. Safety and hazard assessment for the process was done in order to analyze the risks involved in the process. The work demonstrate use of free & open source simulation tool for process development of a key petrochemical derivative.

Keywords: Ethylbenzene; Alkylation; Process Development; DWSIM

SCHEMCON-2020

Process development for the production of liquid carbon dioxide from 2 TPH of raw gas

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Abstract

ID: OP-06-014

Liquid carbon dioxide is used in softening drinks, refrigeration and freezing in food processing, shield gas in welding, fire suppression systems, enhanced oil recovery of oil and gas wells, etc. Liquefaction is the major route used for large scale production of liquid carbon dioxide. It is a process in which gas is compressed and cooled to produce liquid. The present work focuses on development of flow sheet for production of liquid carbon dioxide from 2 TPH of raw gas. In this process, raw gas composition is taken from available industrial data. Operating conditions for the equipment are obtained by simulation in DWSIM (v5.8). Thermodynamic analysis is performed to know the feasibility of sequencing equipment in the flow sheet. Various types of heat exchanger are designed and results are compared with available data. The entire flow sheet is simulated in DWSIM (v5.8). A case study is done to determine the effect of increase in moisture content in the raw gas in the overall liquefaction efficiency. Economic analysis and safety analysis are also documented as a part of the work.

Keywords: Liquid carbon dioxide; Liquefaction; Simulation; DWSIM

SCHEMCON-2020

Extraction of oil from Cadamba seed using modified Soxhlet apparatus: characterization and optimization study

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ID: OP-06-015

Abstract

Neolamarckia cadamba is one of the important medicinal plant belongs to the family Rubiaceae. Various parts of Cadamba tree has got Antivenom, Antioxidant, Antifungal, Antifilarial, Antimalarial, Antidiabetic,Antitumor activity. The motivation behind this project lies to extract oil by standard solvent extraction method using a modified Soxhlet apparatus. The effects of the various operating parameters such as temperature, solvent ratio and solvent type on the extraction yield of the oil have been investigated. The maximum extraction yield was obtained in water and ethanol. The maximum yield of the product (after processing) turned up to a feasible value of 33.2 percent. Effects of different process parameters are Optimized using Response Surface Methodology(RSM) through the central composite design(CCD). Three parameters (Extraction Time, Seed to solvent ratio and Separation Speed) are used to obtain the response surface.

This study definitively provides a thorough procedure to obtain the valuable extraction from the seeds of Cadamba to get maximum yield considering time and cost of the process and Optimization of the results. It gives an idea about how to optimally surpass the loopholes in the methodology working behind this objective.

Keywords: Soxhlet Extracti;,Cadamba seed; yield; Solvent to seed ratio; Oil; RSM

SCHEMCON-2020

Simulation Studies for Production of Levulinate Esters by Reactive Distillation

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Abstract

With the diminishing fossil fuel resources and the trepidation of them exhausting in a few decades has led to escalating studies in the field of renewable energy, especially biofuels. Levulinic acid is produced abundantly from biomass processing; it serves as an eminent precursor for the synthesis of a variety of levulinate esters as fuel additives. The excellent fuel blending properties of levulinates has led to research in this field. Various catalysts have already been studied for manufacturing levulinate based value added products, experiments have also been carried out in this area to optimize the operating conditions. Conventional esterification reactions are seriously affected by equilibrium limitations thereby reducing their efficiency. Reactive distillation (RD) has shown to achieve almost qualitative conversion for most equilibrium reactions. Simulation of the production of levulinic acid derived compounds using RD column are studied for their yield. Also, the optimization of the RD column design is done for economic feasibility. The increased conversions will mark a great step in the production of fuel additives.

Keywords: renewable energy; biofuels; fuel additive; levulinic acid; reactive distillation

SCHEMCON-2020

Process Development for the Production of 150 TPD 1,4-Butanediol

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ID: OP-06-017

Abstract

1,4-Butanediol (BDO) is a primary bi-functional organic compound used as an intermediate for the production of tetrahydrofuran (THF) and polybutylene terephthalate(PBT). THF and PBT form the key ingredients for producing spandex fibers, resins (THF), plastics and elastomers (PBT). The first commercial production of BDO was based on Reppe process that involves the reaction of formaldehyde with acetylene and subsequent stages of hydrogenation to produce BDO. Other processes use maleic anhydride (Davy process) and allyl alcohol (Dairen process) and 1,3-Butadiene (Mitsuibishi process) as raw material. Based on factors such as capacity, thermodynamic feasibility, cost and availability of raw materials and product purity, Reppe process for the production of 150 TPD BDO was chosen and process flowsheet was developed. Material balance based on first principles was developed and the flowsheet was simulated in DWSIM (v-5.8). Major equipment (Distillation column and Heat exchanger) is designed as part of the work. Economic analysis for the process was done as part of the work. Effluent treatment guidelines for the given process were established as part of the work. This work focuses on the process development for the production of BDO using key chemical engineering principles and demonstrates the use of free & open source simulation tool.

Keywords: Butanediol; Reppe process; DWSIM

SCHEMCON-2020

Study of Blast Furnace in Simplified Model: Experimental & CFD Study

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ID: OP-06-018

Abstract

The blast furnace is highly efficient but energy-intensive chemical reactor for iron production. Typical temperature in the blast furnace is around 1300-1400℃. Experimental and live operation measurements can be extremely difficult to perform on blast furnace due to extremely harsh environment generated by the operational process. In this project experiment will carried out in simplified model of Blast furnace (2D system). Computational Fluid Dynamics (CFD) modelling has been applied to simulate and validate for all experimental data, simulation.

Keywords: Blast furnace; CFD;

SCHEMCON-2020

Rating of Shell and U-tube Heat Exchanger Using PRO/II Simulation Software

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ID: OP-06-019

Abstract

Rating of the heat exchanger is done when it is desired to know whether the Heat Exchanger sent by the vendor fulfils the required load or not. Sometimes, periodically there is a need to check the performance of the existing heat exchanger for a given operation. The current work is aimed at the determination of the rating parameters such as heat transfer and pressure drop for a Shell and U-tube heat exchanger. In this work, the extent to which the existing heat exchanger can be utilized for preheating the toluene using hot water as utility is assessed. To perform rating calculations, the steady-state process simulator PRO/II was used. Parametric studies were also performed using PRO/II case study feature to understand the dependence of heat transfer coefficient and the toluene outlet temperature on flow rates. Manual calculations were also performed using certain empirical convective heat transfer correlations. The results calculated, using PRO/II, are in excellent agreement with the manual calculations with an absolute error of less than 5%.

Keywords: PRO/II simulator, Heat Exchanger, Rating

SCHEMCON-2020

Modelling and Multi-Objective optimization of commercial Ethylene Oxide reactor

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ID: OP-06-020

Abstract

In this work, a commercial ethylene oxide reactor was modelled by Artificial Neural Network algorithm with actual plant data as no reliable first principle based phenomenological model is available. In commercial plant, ethylene oxide is produced by reacting ethylene and oxygen at high temperature (225-275°C) and pressure (19-21 bar) with silver catalyst. The function of catalyst is to promote the desired ethylene oxide reaction (Ethylene + oxygen □ ethylene oxide) and suppress the undesired reaction which produces CO2 (Ethylene + oxygen □ CO2 + H2O). A promoter is also added in small quantity (2-10 ppm) to enhance the catalyst selectivity. In commercial plant maintaining the optimum concentration of promoter is very crucial as it has large impact on selectivity. Our developed ANN model finds a relation of catalyst selectivity and catalyst temperature with other reactor operating parameters like promoter concentration, raw material concentration, CO2 concentration etc. in reactor inlet gas. A multi-objective genetic algorithm (MOGA) is used to find the optimum reactor conditions to simultaneously maximize the catalyst selectivity and minimize the temperature. Pareto optimal solutions are generated to represent the trade-off between two contradictory objectives. Our developed modelling and optimization framework is deployed in running commercial plant for real time optimization of reactor conditions.

SCHEMCON-2020

"Model predictions of SARS-CoV-2 infection using chemical kinetics in batch reactor dynamics"

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ID: OP-06-021

Abstract

Nowadays, the pandemic infection of SARS-CoV-2 has been spreading in a huge number. Therefore, future prediction of this spreading behavior by using chemical reaction is often demanded in straightforward model. This will give the importance of the disease spreading and its behavior. In the present work, we considered one series parallel irreversible chemical reaction which is carried out in a hypothetical reactor (batch type reactor). A healthy population (A), active infected population (B), recovered population (C) and, deceased people (D), are to be assumed as molecules of chemical compounds and its dynamics seem well in accordance with those of composition and conversions in chemical syntheses. Due to these analogies, we are able to generate predictive pandemic model taking into consideration its chemical and physical properties and retrograde their kinetic parameters in order to anticipate peak time, entity and end of the infection with some credibility. Ordinary differential equation is adopted to analyze the infection data by given source. These predictions can surely help in emergency plans decision making.

Keywords: SARS-CoV-2; Infection dynamics; Chemical kinetics; Batch Chemical Reactor; Predictive model; Regression; Pandemic Mathematical Model.

SCHEMCON-2020

Study of Heat Transfer through Rectangular Fins in Circular Conduit

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ID: OP-06-022

Abstract

Heat dissipation is a main challenge in process industries, electronic equipment, powerplants,etc. There have been numerous investigations to improve the heat dissipation by incorporating fins on the external surface of a body. The current study is focus on the use of rectangular fins in a circular conduit and the CFD analysis of various factors that affect the performance of these fins. In the current work, the effect of thickness of the fins, length of the fins and the number of fins on a given circular conduit is studied. A 3D steady state computational mode is built on ANSYS (Student version, Ansys Inc., USA). Simulations are performed with water as test fluid. The inlet mass flowrate was varied over the range from 2kg/s to 6kg/s. The study shows that increasing the thickness of the fins result in increased heat flux to a threshold value and beyond which the heat flux remained constant. Also, with the increasing length of the fins, thermal resistance of the material increases, thereby decreasing the heat flux. Further simulation studies are in process. This study demonstrates the use of computational models for better understanding of concepts of heat transfer.
Keywords: heat dissipation; computational fluid dynamics; thermal resistance Abstract ID (For office use):

SCHEMCON-2020

Extraction of Acetic Acid Using Green Solvents

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ID: OP-06-023

Abstract

Acetic acid being widely used in food and pharmaceutical industries is also used for the synthesis of organic compounds.After synthesizing acetic acid need to be separated from aqueous phase and from the literature it is found that various solvents such as benzene, tri octyl amine were used for extraction.These are harmful and cannot be used in food and pharmacy industry where acid produced (ex.,vinegar, drugs) which is directly related to human consumption. Looking at the alternative, to choose green solvents, which are inert in nature and considers SHE(Safety Health And Environment) factors.Selected seven of these solvents namely MIBK, MEK, t-butanol, n-butanol, n-butyl acetate, iso-butyl acetate, ethyl acetate for further studies.

Ternary data was generated for Acetic acid water and with each of above solvent using titration method by **comparing the solubility curve area** suitable solvent was selected and found to be n-butyl acetate which has highest 2-phase area. **Also generated tie line data using simulation software PRO 2 and calculated the distribution coefficients along with separation factors.** And also studied temperature effects on solubility curve (26 ^{O}C, 30 ^{O}C, 35^{O}C) and found out that lower temperatures (26 ^{O}C) are favorable. Similarly, generated distribution coefficient and separation factor for a particular concentration for all the solvents and found that n-butyl acetate has highest value of separation factor.Recovery of acetic acid from solvents using equilibrium data for **flash calculations of P-X-Y and T-X-Y studied using Pro 2 software and is found** that ethyl acetate and MEK, both are good for recovery.

SCHEMCON-2020

Analysis of Two-Stage Membrane-Based Carbon Dioxide Capture Process Using Pro/Ii Steady State Simulator

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Abstract

Coal supplies over one-third of the global electricity generation and the flue gas from coal-fired power plants is a major source of CO_2 emissions. Membrane-based carbon capture technology has the following merits - the absence of moving parts and corrosive chemicals, absence of phase, and temperature change phenomena, leading to lower energy requirements, easy scale-up because of a modular design. Recent improvements in the permeability and selectivity of membrane materials have made the separation process more viable. Membrane process design involves the determination of the membrane unit size i.e., membrane area requirements. In this simulation study, a two-stage membrane separation and liquefaction assembly for a 600 MW coal-fired power plant is analyzed. The capture process was designed to meet the following specifications: 90% CO_2 recovery and 99% CO_2 purity in the CO_2 rich stream. The compression pressure for captured CO_2 is specified to 110 bar at a temperature of 25^{o}C. The variation of the total membrane area and net energy consumption as a result of changes in permeation pressure and feed pressure have been studied.

Keywords: Membrane separation; CO_2 capture; Process simulation

SCHEMCON-2020

Thermodynamic Analysis of the Carbon Dioxide Based Vapour Compression Refrigeration Cycle Using Pro/Ii Steady State Simulation Software

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ID: OP-06-025

Abstract

The use of certain chlorofluorocarbon-based refrigerants in the conventional vapor compression refrigeration cycle has been causing ozone layer depletion and global warming. Due to this, there has been an increased interest in the refrigerants with zero ODP (ozone depletion potential) such as carbon dioxide, ammonia, and hydrocarbons. The refrigerant currently being used in cold storage for the storage of frozen products is R404a. Efforts are being made to upgrade to carbon dioxide. It is well known that for the conventional subcritical system the coefficient of performance (COP) increases with the decrease of the heat rejection (condensation) pressure. For the transcritical carbon dioxide cycle, however, the variation of the COP with the heat rejection pressure exhibits a non-monotonic change since the heat rejection temperature is independent of the heat rejection pressure in the supercritical region. This work is aimed at understanding, how the gas cooler exit temperature, the degree of superheat in the evaporator will affect the COP, and to determine the optimum compressor outlet pressure which maximizes the coefficient of performance. PRO/II steady state process simulator has been used along with manual calculations and a comparative study for various thermodynamic methods have been presented.

Keywords: Refrigeration; transcritical cycle; process simulation.

SCHEMCON-2020

Reaction Model for Predicting Oxidative Degradation of Ortho – Xylene

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Abstract

Understanding degradation behaviour of chemical products is important not only for finding suitable stabilizers and predicting their shelf-life while stored in inventories, but also for safety and economic concerns. In this work, an oxidative degradation mechanism for ortho-xylene is studied. Long term degradation of liquid phase ortho-xylene is complex and can be initiated by generation of oxygen radicals caused by UV radiations followed by a set of liquid phase radical reactions. The oxygen radicals can react with o-xylene molecules to give benzene and toluene. Hydrogen donation and beta-scission of o-xylene produce o-xylylene which can rearrange to give styrene. Hydrogen donation of o-xylene followed by oxidation can give tolyl-methoxyl radical which can react further generating tolualdehyde. Termination reaction can occur between any two free-radicals in proximity to each other. Mass balance on various reacting species is performed to obtain the model equations required for predicting their concentration evolution. The rate constants of different reactions are either obtained from literature or estimated. Rates of reactions are compared in order to study the rate determining step. A parametric study is also utilized to find the key parameters governing the overall degradation.

Keywords: - Oxidation, Xylene, Parametric Research. Degradation, Reaction Mode

SCHEMCON-2020

Multi-Objective Optimal Control of Otto-William Reactor

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Abstract

Optimization is essential for reducing material and energy requirements as well as the harmful environmental impact of chemical processes. Model-based process optimization has garnered particular interest and one such process is the Otto William plant which act as a test bed for various non-linear programming (NLP) algorithms and their relative efficacy. Generating optimal policies for this reactor is a challenging task, so a systematic and computationally tractable approach is developed for generating optimal operating policies for production of the desired product using Otto William reactor. Considering the issues in the field of optimization, this work develops a comprehensive and computationally tractable framework to maximize profits and minimize energy requirements using a multi objective optimization approach i.e., Non dominated sorting Genetic Algorithm II(NSGA-II). Further, the results generated are shown to give a set of trade off solutions to satisfy both the objectives. The optimization results indicate that NSGA-II is able to generate the global optimal solutions within reasonable number of cycles.

Key words: Model-based optimization; Williams- Otto Reactor; Genetic Algorithm II

SCHEMCON-2020

Modelling and Simulation of Gas Engines Using Aspen HYSYS

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ID: OP-06-028

Abstract

In this paper gas engine model was developed in Aspen HYSYS . The rising cost of energy and emissions has necessitated the interest in an alternative economical, cost effective and least polluting means of power production .Fuel flexibility, fuel types and part load performance of the gas engine were investigated. The design variability revealed that the gas engine can operate on poor fuel with low lower heating value (LHV) such as landfill gas, sewage gas and biogas with biogas offering potential integration with bottoming cycles when compared to natural gas. The efficiency and power output were calculated.

Keywords: Gas engine, Aspen HYSYS , lower heating value

SCHEMCON-2020

Modeling and Simulation of Microfluidic channels

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Abstract

In today's world, major developments are happening in the field of optimization. Microfluidics is the concept that is highly used to optimise the expense in the field of research. Microfluidics considers treatment of fluid with volumes commonly in the scope of nano-to microliters (10^{-9} to 10^{-6} L) or smaller. Hence, the cost of raw materials, lab, operation, fabrication etc. is relatively less when working with them to establish the mechanism. Also, there are properties (for ex. surface tension, viscosity and diffusivity) which have more effect at micro level (can be known from scaling analysis). To study these properties and to understand the working of various processes in living beings and its applicability in industrial processes, research in the microfluidics area is required. As a part of the project, photocatalytic dye and bacterial degradation were simulated on different types of microchannels using finite element methods (FEM). Further, diffusion limitations of photocatalysis and reaction kinetics within the boundary layer of a catalyst surface are investigated. The insights obtained from this study would elaborate the understanding of the surface mechanisms of miniature devices and sensors.

Keywords: Microfluidics, FEM, Tubular Reactor, Photocatalytic Degradation.

SCHEMCON-2020

Handling Styrene Effectively Through LG Polymers Ltd. Case Study

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ABSTRACT

In this growing age of industrialization, safety and design are the most important aspects to be considered during construction and commissioning of any industry. Any mishap in a chemical plant has two-fold effects - the immediate effect of the blast and the after effects of the chemical that spreads throughout the surroundings. There have been numerous accidents in industries reported till date owing to human errors and faulty designs leading to heavy toll of the human race both personally and financially.

One such incident reported during COVID-19 pandemic happened to occur at L.G. Polymers Ltd. in Visakhapatnam due to leakage of styrene gas. This study discusses in detail about the major reasons causing the incident with special emphasis on the safety and design aspect. The operational and maintenance errors which led to the accident have been enlisted. The study also includes an effective design of storage tank for styrene monomer that eliminates polymerization of styrene, excessive temperatures, contamination of polymer residue left in infrequently used pumps and pipes. Additional features like inhibitor addition, tank content sampling, tank breathing etc are also discussed as well in the preventive standpoint of such incidents.

Keywords: Styrene Gas Leak; Faulty Storage Tank; Polymerisation;Excessive Temperature; Tank Design.

SCHEMCON-2020

Mathematical modelling approach for nodes selection in HAZOP

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ID: OP-06-032

Abstract

A Typical chemical process plant is best studied by the information such as process flow diagram's (PFD) and piping & instrumentation diagram(P&ID). HAZOP study for a chemical process is very critical to operate the process to the desired level and safely. P&ID's are the necessary diagrams for this study arbitrary selection of nodes by the HAZOP team. This is highly challenging to the team as this might consume lot of time in selection and study of the nodes. The primary focus of this study is to present a mathematical modelling approach for effective study. Many researchers Dunjo et al (2011, 2012), Khan and Abbasi (1997) have given models for node selection as a function of P&ID diagrams and number of Major Equipment (ME) and time for node selection. The reported model for node selection is in the form of:

Nd = a(P&ID's) +b(ME)

This mathematical modelling approach if applied for chemical plants can ease the efforts of team.

Keywords:P&ID; HAZOP team; Mathematical Model; Nodes selection; Time of node selection

SCHEMCON-2020

Zero Liquid Discharge Strategy And Related Energetics: A Study Of Thermal Desalination Integrated With Crystallization

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Abstract

Presently, desalination is carried out throughout the world with State of Art technology. The present study is focussed on the MLD (Minimum Liquid Discharge) or ZLD (Zero Liquid Discharge) by integrating Crystallizer with MSF-OT (Multi-Stage Flash Once-Through) consisting of 15 stages. The author has considered different combinations of crystallizer with MSF-OT to observe the maximum percentage of water recovery and thermal efficiency of the system. Additionally, the thermal efficiency of seawater was calculated for different salinities with MSF-OT. The simulation was carried out using Aspen Plus, ELECNRTL property method to recover potable water and precious salts (NaCl, KCl, $MgCl_2$) that would add benefits to the plant. The simulations revealed that with an increase in salinity, thermal energy increased while water recovery decreased. The thermal energy of seawater (35000 ppm) turned out to be 69.763 kWh/m^3 with 47.92% of water recovered while for 2,15000 ppm, the water recovered and thermal energy of the plant was 38.984% and 72.355 kWh/m^3 respectively. Also, when crystallizer was integrated with MSF-OT, the best possible case revealed the solid fraction of precious minerals to be 1 with 57.25% of the recovery of water. Yet, the thermal energy requirement turned out to be extremely high (349.264kWh/m^3).

Keywords: Desalination; Multi-stage flash; Zero Liquid Discharge; Minimal Liquid Discharge

Other Areas of Chemical Engineering (OCE)

SCHEMCON-2020

Estimation of solubility of NH3 in Deep Eutectic Solvents using Artificial Neural Network

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Abstract

After the discovery of deep eutectic solvents (DES's) with its unbelievable chemical and thermodynamic properties, research on green solvents paced up. Recent studies highlighted the use of deep eutectic solvents in the absorption of harmful gases released in the industries. In this work solubility of NH3 in nine deep eutectic solvents is studied using artificial neural network. A neural network is trained using Bayesian-Regularization algorithm. The resultant solubility is then compared with the solubility data available in literatures. The overall absolute deviation was found around 5.13%. Henry's constant for each isothermal dataset is also calculated using estimated solubility and the average absolute deviation was found around 3.51% which indicates that our neural network is trained properly.

Keywords: Ammonia; Deep eutectic solvents; solubility; artificial neural network; Henry's constant

SCHEMCON-2020

Effect of green additive in cold finger apparatus to measure the performance in wax deposition studies

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ID: OP-07-003

Abstract

Chemical inhibition method is one of the most economic method to mitigate the wax deposition in pipelines. Before going into field study, it was recommended to check the efficiency of additives in laboratory scale. Cold finger apparatus is one of the most common wax deposition measurement apparatus in which probes are fitted into sample carrying glass bottle. In this experiment, 1h, 2h and 3h time interval wax deposition thickness was measured in between 30 - 50℃ temperature range.

The green additives were synthesized with Sesame oil. Transesterification reaction was performed between Sesame oil and Pentanol. Sesame oil contains triglycerides which turned into sesame oil pentyl ester after transesterification reaction. The functional groups were characterized by FTIR instrument and physical properties like wax, water, pour point and SARA analysis of crude oil was measured by ASTM procedure. Pour point measurement were done after treating with 0-2000 ppm additives with crude oil. Maximum 11℃ pour point reduction was observed after crude oil terated with 1500ppm additives.

After addition of 2000 ppm green additives, the wax deposition thickness was reduced 47% with Indian crude oil. The result suggested that hydroxyl (-OH) and Carbonyl (-CO) are responsible for interaction with asphaltene and resin to reduce the van der waals interaction force between the molecules.

Keywords: Wax deposition; Green additives; Transesterification ; Pour point

SCHEMCON-2020

Permeability Study of dye wastewater using Nanofiltration membrane

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Abstract

Accumulation of hazardous species in aquatic environment becomes a threat to water supply for human, agriculture and recreational purposes. Because of low biodegradability of most dyes and chemicals used in dye industry, biological treatment does not always meet with expected success. Membrane separation technologies are reported to be a practical and competitive alternative for removal of a variety of dyes from aqueous solutions. In this work, wastewater from a dye manufacturing unit was treated by NF membrane using a flat sheet membrane module. Variation of permeate flux (PF) and dye retention with time were analyzed for different transmembrane pressure (TMP). Extent of dye retention, COD, conductivity and total dissolved salts (TDS) were determined to monitor membrane's separation efficiency.

Keywords: COD, Concentration polarization, Permeability, Pressure drop, Retention

SCHEMCON-2020

Online Course on Advanced Process Control with Industrial Exposure

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ID: OP-07-005

Abstract

Reduced profit margin and nerve-racking global competition has forced the process industries to switch focus upon yield and profit maximization, energy efficiency, waste minimization. Over two decades, implementation of Advanced Process Control (APC) in chemical companies, refineries, and petrochemicals industries, proved as an efficient controlling and optimizing tool to achieve above targets in real time. However, profit increasing opportunities, energy reduction and raw material consumption vary from plant to plant. Identifying those opportunities and exploiting them to enhance plant efficiency and capacity is an art; contemplated during functional design of APC.

Present work studied and gathered knowledge on different aspects like preliminary cost-benefit analysis, functional design, step testing, offline simulation and deployment of robust APC application, based on large refineries and petrochemicals plants. The practical knowledge of building APC applications are poles apart compared to theoretical/textbooks details of APC to date. This exposure is presented in an Online Course covering implementation steps, successful evaluation techniques and monitoring performance, once installed. Additionally, APC application failure along with its root cause and safeguards and corrective measures are incorporated too. This Course primarily bridges the gap between academic knowledge and industrial practice, beneficial to practicing chemical engineers, control engineers and process control students.

Keywords: online course; advance process control; cost-benefit analysis; monitoring performance

SCHEMCON-2020

Long Term Structure Evolution in Electrorheological Fluids under Shear Flow

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ID: OP-07-006

Abstract

A two-phase flow continuum model is employed to obtain the long-time evolution of the structures in electro-rheological fluids under constant shear and electric field. To this end, a temporal study of the ER fluid structures is performed using the continuum model. While columns get formed in the absence of shear flow, stripe formation takes place when a shear flow is imposed in the presence of an electric field. Our temporal study shows that stripes evolve and thicken after a sufficiently long-time for high shear rates. The results from our simulations are in line with the experimentally observed phenomena of thickening of stripes with time.

Keywords: electrorheological; shear; field; fluid; columns; stripes;

SCHEMCON-2020

Fault distillation with Neo4j in Food Industry

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ID: OP-07-007

Abstract:

Customers are key stakeholders of a product of any company. Customer satisfaction is directly proportional to the progress of the company. For a company, it is not possible to deliver every product undamaged. It is crucial for any company to solve every complaint and improve its standards to satisfy their customers. When it comes to food products, every food product has its flavour, texture, and feel which attracts the consumer to have it repeatedly. An unpalatable product leaves an unsatisfied customer, when the customer raises a complaint to the respective company, it might take few weeks or months to get response. Every day, number of batches are produced in a factory. Even though sample checks are done, it's not possible to check each and every product's compatibility. To increase the complaint solving efficiency, the model called Fault Distillation with Neo4j(graph database platform) is developed wherein with a batch number, the data of the quality parameters, time of delivery of ingredients, and any other parameters that have observed on the day of processing can be acquired within a few minutes. Tracing the problem becomes uncomplicated with this method. This helps to improve the company's products and provide a better profitable atmosphere too.

Keywords: Tracing data; quality parameters; complaint solving.

SCHEMCON-2020

Challenges and Prospective for Carbon dioxide Removal

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ID: OP-07-008

Abstract

In the present scenario of climate change, greenhouse gases including carbon dioxide as one of the largest contributors, play a major role to intensify it. Major sources for carbon dioxide include burning of fossil fuels like coal, oil and natural gas. With the fast developing world, the need for energy is increasing day by day and so is the use of fossil fuels which might eventually lead to increase in global warming. Thus, there is a dire need to remove carbon dioxide from gaseous mixtures like natural gas, biogas etc. There are various technologies being employed for the removal of carbon dioxide out of which membrane-based technology is efficient, cost effective and environmentally friendly. Polymeric and inorganic membranes are the most studied having their own pros and cons. But now a days, a new class of mixed matrix membranes with metal organic frameworks (MOFs) as fillers offer combined advantages of the other classes of membranes. In this review, our key focus is highlighting the recent advances in metal organic frameworks based membranes with a detailed study of the permeability and selectivity data for different membrane bases and fillers. We will also draw a comparison between metal organic frameworks (MOFs) and polymeric membranes, thus providing a clear insight for the best possible kinds of membranes for different applications.

Keywords: Metal Organic Frameworks (MOFs); Mixed Matrix Membranes; Gas Separation.

Ionic Liquid Supported Membranes Form CO2 Separation

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Abstract

Separation of gaseous mixtures, involving carbon dioxide (CO2), is not only of scientific interest but also a social issue for environmental protection, due to its implications on global warming. Carbon dioxide is constantly being exchanged among the atmosphere, ocean, and land surface as it is produced and absorbed by many microorganisms, plants, and animals. Ionic liquids (ILs) have been proposed as potentially good solvents for CO2 capture and separation. They are formed by a combination of organic cations and organic or inorganic anions. ILs have attracted extensive attention in recent years due to their appealing properties: excellent thermal and electrochemical stability, very low vapor pressure, relatively high ionic conductivity. In this review we focus on the applications of ILs in separation processes. Thus, an extensive study is presented of various ionic liquids impregnated into the polymeric membrane to test the separation performance with pure as well as mixture of gases containing carbon dioxide.

Keywords: Ionic Liquids [ILs], Polymeric membrane, Membrane separation

SCHEMCON-2020

Impact of lockdown and the trends after unlock on air quality of Delhi, Chennai and Mumbai during COVID-19

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ID: OP-07-010

Abstract

COVID-19 lead to a nationwide lockdown in India starting from 25th March, 2020 after a Public Curfew held on 22nd March, 2020. COVID-19 outbreak showed some positive impact on the natural environment. In the present work, the effect of lockdown on air quality of three major Indian metropolitan cities namely Delhi, Chennai and Mumbai is evaluated using MATLAB. The variations in concentration of key air pollutants including $PM_{2.5}$, NO_2, SO_2, CO and O_3 during three phases- pre-lockdown, during lockdown and post-lockdown phases, was analyzed. There was a reduction in concentrations of $PM_{2.5}$, CO and NO_2 of 70%, 66% and 54%, and 55%, 29% and 41%, and 56%, 65% and 80% for Delhi, Chennai and Mumbai respectively. However the improvement in the air quality was only a temporary lockdown benefit and the air quality is already degrading post lockdown as a result of revitalizing the economy which is evident on comparing the data during the same period in the years 2018 and 2019. Overall, this study gives confidence to the regulatory bodies that a significant improvement in air quality could be expected provided strict execution of air quality control plans is implemented.

Keywords: COVID-19; India; Air Quality; Lockdown; Air Pollution; Environment

SCHEMCON-2020

Study and analysis of physical and thermal properties of biopolymeric composites and the effects of composition change on the properties of the biopolymeric composites.

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Abstract

Composites are the macroscopic scaled mixture of two different types of materials which produces materials with enhanced properties. Composites constituting of polysaccharide, polypeptide and plasticiser have shown significant improvement in the thermal, chemical and physical properties closely or equally matching plastics. Introduction of the biopolymers (polysaccharides, polypeptides) into the composite synthesis have shown a great potential of reducing the utilisation of synthetic plastics, from the existing procedure of composite manufacturing. This has also shown potential in reducing the existing solid waste management problems by recovering the biopolymeric matrices from the municipal and agricultural wastes. Due to the inclusion of various biopolymers, the properties of composites can be modulated according to the need by changing the composition (starch/cellulose/keratin presence) of the matrix which is not possible in the case of synthetic plastics. Furthermore, the composites unlike synthetic plastics are exceptionally biodegradable which is one of the main problems while dealing plastics. This paper focuses on the study of the effects on the physical properties of the biopolymeric composites due to composition changes and noting down the factors which induces the changes. Furthermore, producing the characterisation results obtained from FTIR, SEM, TEM etc to cement the study with proofs.

Keywords: Composite; biopolymer; biodegradable; synthetic; polymers

SCHEMCON-2020

Effect of particle size and concentration of fly ash on the properties of polymer composite matrix.

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Abstract

ID: OP-07-012

Particulate filled polymer composite is growing by the years because of its wide application and low cost. Numerous particulates also known as fillers such as Mica, Rice straw, Calcium Carbonate, fly ash and so on has been used to enhance the various properties of polymer composites. Fly ash is a fine-grained powder, which is mainly composed of spherical glassy particles, produced during the combustion of coal at thermal power stations. It has been used in various industry due to its low density, strong filling ability, smooth spherical surface and it is easily available at low cost. It is a waste by product material that must be recycled or disposed properly otherwise it may give rise to several environmental issues such as atmosphere contamination and huge area for dumping. Utilizing fly-ash as a filler material in polymer composites is considered important in improving the properties of composites and also in reducing the production cost. The main aim of this work is to determine the effects of particle size and concentration of fly-ash on polymer matrix and its properties. The concentration of fly-ash and its particle size plays an important role in the enhancement of physical and mechanical properties of polymer matrix. The mechanical properties of polymer filled composites are strongly dependent on size, shape and distribution of filler particles in the polymer matrix. Scanning electron microscopy (SEM) is used to characterize the morphology of the polymer/fly-ash composite. Mechanical properties such as tensile strength, elongation of break, impact strength is analyzed as per the ASTM standards.

Keywords: Polymer Composite, Fly ash, Particle Size, Concentration.

SCHEMCON-2020

Influence of Temperature on the Reactive Crystallisation of Oxalic Acid

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ABSTRACT

Reactive separation is a chemical process in which the synthesis of a substance (reaction) and the separation of-products proceed simultaneously in one unit. It involves the reaction between the reactants to form a solute which crystallizes into a product. When chemical reaction is the reason for supersaturation of a crystallizing compound, the operation is known as reactive crystallization. In reactive crystallization, because of high local supersaturation reactions can be very fast compared to the mass transfer rates and growth rates to the crystals. The high level of supersaturation results in high nucleation rates and small size crystal in micron range. Production the small sized crystals in the pharmaceutical compounds manufacturing is important to improve properties such as dissolution rate, bioavailability, and tableting of the drugs, and to avoid additional downstream operations such as milling to reduce the particle size.

In this work oxalic acid was prepared by oxidizing sucrose using nitric acid and obtained the product in one step without further steps of purification. Influence of temperature on reactive crystallisation of oxalic acid was investigated. It was observed that in the sample which was cooled to 7 °C the nucleation has been just initiated but the crystal growth did not happened. Whereas the sample which was heated to 85 °C it was observed that white colour oxalic acid crystals were formed. So in reactive crystallization by lowering the temperature there was no considerable crystal growth. Hence evaporative crystallization shall be preferred for this process.

KEYWORDS:Reactive Crystallization; Oxalic acid; Super- saturation.

SCHEMCON-2020

Application of extreme learning machine (ELM) method for recently developed process intensification (PI) techniques for biodiesel production

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Abstract

The fast depletion of fossil fuels and environmental pollution are the main concerns for mankind. Being a biodegradable and sustainable biofuels, biodiesel has potential to substitute gasoline diesel due to its similar phyco-chemical properties. Biodiesel produced through convention mechanical stirring has several drawbacks, such as higher oil to alcohol ration and catalyst loading, energy intensive, lower yield and excess time consumption. Recent studies suggest that process intensification techniques have potential to replace convention mechanical stirring method with favorable process parameters. The developed techniques reported in the literature included microwave (MW), ultrasound (US), sequential or hybrid MW+US, hydrodynamic cavitation (HC), shock wave power reactor (SWPR) etc. The main process parameters of these techniques are: molar ratio, catalyst (%), reaction time, and reaction temperature and system specific geometric/ operating parameters. Till recently, RSM based tools have been popularly used by researchers to optimize the process parameters to maximize the yield. The RSM based BB design, Taguchi and CCD methods are widely used to save time, effort, material and cost. Recent optimization studies related to biodiesel production reported that ELM method is superior modeling method as compared to RSM based method due to its unique features. The present study summarizes the feature of various PI techniques for biodiesel production process and the application of ELM method for optimization of process parameters.

Keywords: Biofuels; production techniques; optimization and analysis:

SCHEMCON-2020

Process Intensification for Production of Bioethanol using Extractive Fermentationin Sugar Industry-A Review

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Abstract

Conventional fuels have a deleterious impact on our environment and the need of the hour is to promote the use of biofuels and Bioethanol is one such green fuel. India, the second largest producer of sugarcane can economically convert sugarcane wastes like bagasse and molasses into bioethanol. Fermentation is the key process which needs to be intensified in order to attain energy efficiency, higher yield of bioethanol and economy while considering the impact on the environment. Extractive fermentation is a strategy which involves product recovery by introducing a biocompatible organic solvent in the fermenter to selectively extract ethanol in a single step. The solvent is effectively recycled in a closed loop back to the fermenter. This process is characterized by high productivity, continuous operation, significantly reduced water consumption and lower product recovery costs. This paper has reviewed the process intensification in the system and analysed it in terms of cost of production, eco-friendliness, flexibility, consumption of energy and material, profitability, efficiency and overall sustainability.

Keywords: Bioethanol; Process Intensification; Extractive Fermentation; Sugarcane wastes; Sugar Industry

SCHEMCON-2020

Dimethyl Ether from Syngas – Standpoint on Catalyst and Reactor Configurations

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Abstract

Dimethyl Ether (DME), additive to diesel, a clean fuel with high octane number makes it favourable to use it as a substitute for diesel and also for LPG as a cooking fuel. Catalytic synthesis of dimethyl ether is performed by two methods, direct method, a route wherein syngas is converted to DME in one step & indirect method, wherein first syngas to methanol synthesis takes place which is followed by dehydration of methanol to DME. DME synthesis if influenced by the the nature of the catalyst and also on the types of reactors and separators and their configuration dictating the process economics. This paper presents a review on the innovative strategies which have been reported for the production of DME from standpoint of catalysts and influence of operational parameters on DME selectivity, conversion and yield. Coupled and dual type reactors are industrial employed in the direct method, one such reactor is reactive distillation column with dividing wall column (R-DWC). The dual type reactor applies exothermic reactions as heat source and works on counter current configuration with increase the rate of production at low cost. Different reactors and configurations in practice are also compared here and a critical analysis is presented to provide future prospects in the field.

Keywords: Dimethyl Ether (DME), Syngas, Methanol, Bi Functional Catalysts, Dual Type Reactors.

SCHEMCON-2020

Energy Saving Opportunity by suitable Variable Speed Drive to a Pump

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ABSTRACT

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Energy plays an integral role in industrial development process. In Chemical Industry, Pumping system accounts for nearly 25% to 50% of total energy usage and as much as 75% of Pump's total cost of ownership. Many pumping systems require a variation of flow or pressure. When a single pump is installed for multiple range of duties, it should be sized to fulfil the greatest output demand, therefore it will usually be oversized, and will be operating inefficiently for other duties. Hence, there is always an opportunity to achieve an energy cost saving in pumping systems. There are various flow control methods for pumps such as throttle, bypass, on/off and VSD control. Out of which flow control by speed regu1ation of pumps, is one of today's best methods of varying the output. It serves advantages like energy cost savings, Simplified pipe systems by elimination of control valves & by-pass lines, Soft start & stop and reduced maintenance. This Paper compares the energy consumption for all flow control schemes, discusses various aspects of system curves for different process scenarios and also sets some process guidelines or rules of thumb for the installation of VSD for a new or existing pump.

Keywords:
Energy consumption, pump & system curves, comparison of energy cost savings.

SCHEMCON-2020

Nutraceuticals: Efficacy, Current Trends and Challenges

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Abstract

Nutraceuticals is a word which has been derived from 'nutrients' and 'pharmaceuticals' thatare available in the form of isolated nutrients, herbal products, processed foods and dietary supplements in various different forms such as capsules, tablets, etc .Nowadays, nutraceuticals have received considerable interest due to potential nutritional, safety and therapeutic effects . An analysis of its development, efficacy, current trends and challenges forms the basis of this paper. Recent studies have shown promising results for these compounds in various complications with increasing potential in its efficacy pertaining to target and using apt pathways. The explosive growth of health consciousness , research developments, burgeoning trends and satisfactory standards make it a high demand product along with its myriad benefits and minimal side effects. The nutraceutical industry has grown alongside the expansion and exploration of modern technology and is advancing at a paced rate with new processes, namely ,various nano systems and advanced biotechnology systems which have been introduced to improve the therapeutic efficacy of products with varied applications which in turn promotes new researches for new prospects and trials to strive each day to enhance its activity and safety. Alongside of this booming success, the incipient industry faces various challenges such as developing a viable product with a background in scientific evidence and regulation in market without altering the nutritional supplement it provides.

Keywords : Nutraceuticals; Novel formulations; Efficacy; Regulation

SCHEMCON-2020

Recent Advancements in Functionalized Polymeric Membrane: A Review

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Abstract

Water scarcity, insufficient freshwater resourcesto meet the human and environmental demands of a given area and increase in water pollution would be the major threat to the human society, nature and this planet in near future. As a solution to this problem, Membrane technology is widely accepted as a means of producing various qualities of water from surface water, well water, brackish water and seawater. In the present age, polymers and plastics dominate our rapidly developing daily needs and show enormous potential for the development of new technologies as they are the important building materials in the making of membrane. It is therefore obvious that the future of polymer chemistry will be influenced by the elaboration of new functional polymers. They are also widely used for membranes and in the solid phase synthesis of peptides and oligonucleotides. Membrane-based processes, with their inherent advantages, emerges as a highly competitive candidate for reclamation and reuse of water, owing to its efficiency, ease of implementation, cost, and low environmental impact. A major problem in membrane technology for applications such as waste water treatment or desalination is often the loss of membrane performance due to organic and bio-fouling. This review provides a comprehensive overview on the development of polymeric membranes having advanced or novel functions in the various membrane separation processes for liquid mixtures.

SCHEMCON-2020

Photocatalytic Process for CO2 Emission Reduction in Chemical Industries

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Abstract

Reducing the impact of greenhouse gases (CO_2) on climate change in an attempt to tackle global warming issues is a challenge many companies and businesses are trying to undertake. Businesses across the globe need to take a leadership role in reducing their carbon footprint. This paper proposes carbon sustainability framework that provides a comprehensive strategy to reduce the emission of greenhouse gases (CO_2) from data centers in order to reduce the effects of global warming. This contribution describes a novel process systems engineering framework that couples advanced control with sustainability evaluation for the optimization of process operations to minimize environmental impacts associated with products, materials and energy. The sustainability assessment of process operating points is carried out by using the U.S. EPA's Gauging Reaction Effectiveness for the Environmental be Sustainability of Chemistries with a multi-Objective Process Evaluator (GREENSCOPE) tool that provides scores for the selected indicators in the economic, material efficiency, environmental and energy areas. At present, carbon dioxide (CO_2) is the largest contributor among greenhouse gases. This article addresses the potential application of photo catalysis to the reduction of CO_2 emissions from industrial flue gas streams. Not only does this process remove CO_2, but it can also convert CO_2into other chemical commodities such as methane, methanol, and ethanol. In addition, the photo catalytic process can consume less energy than conventional methods by harnessing solar energy. Given these advantages, photo catalysis is an attractive alternative for CO_2 capture. This article reviews the principle of photo catalysis; existing literature related to photo catalytic CO_2 reduction; and the effects of important parameters on process performance, including light wavelength and intensity, type of reductant, metal-modified surface, temperature, and pressure. Finally, we discuss various system configurations for UV and solar photo catalytic reactors. The advances in photo catalysis technology indicate a promising application potential for significant reductions of CO_2 emissions and a positive impact on climate change effects.

Keywords: Sustainability, Process control, Reduction of co_2, Process performance, GREENSCOPE

SCHEMCON-2020

Performance analysis of pulsating-gas-jet mixer based on volumetric mass transfer coefficient

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Abstract

Mixing is one of the important industrial treatments in order to attain and maintain the concentration homogeneity of the process streams. Care must be taken to achieve effective mixing at an industrial scale as the process is more energy intensive in nature. Literature reveals that research works have been carried out in order to improve the mixing index and to reduce the energy requirement. Jet mixing has been reported as one of the alternative methods for mixing of gas-liquid and liquid-liquid systems. Literature shows that jet mixing has its own merits and demerits. In order to improve the performance of mixer and to minimize the energy requirement for mixing, a novel method called 'pulsating-gas-jet' mixing was developed. This project deals with the performance analysis of pulsating-gas-jet-mixer based on volumetric mass transfer coefficient by passing the compressed air through the nozzles and recording the dissolved oxygen content of the working fluid (water). From the results of the study, it was observed that the mixing time was reduced on the usage of pulsating input on comparison with conventional mixers and it was also noticed that the pulsating gas jet mixer found to give good results in both mixing and mass transfer.

Keywords: Gas jet mixer; Pulsating input; mixing time; dissolved oxygen transfer.

SCHEMCON-2020

Study of Ionic Liquid Membranes for Gas Separation

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Abstract

The amount of greenhouse gases in the atmosphere are continuously increasing and as the demand for energy increases in the coming years the amount is going to rise further. There are various methods to separate and reduce the amount of greenhouse gases which are pressure swing adsorption, water adsorption and cryogenic distillation which are well established. Nowadays, membrane technology is a promising and widely studied field. It is being widely used in selective separation of various gases which can be further utilized. It is also an economic and energy efficient process as it doesn't require much energy to carry out the separation processes. Another promising technology is the ionic liquids (IL) which are also efficient in the gas separation processes. The conventional membrane technology is not effective in separation of various gases and has some drawbacks. For effective separation of the gases an efficient membrane is required. In this review, we are going to mainly focus on the effectiveness of membrane when combined with ionic liquid whose intrinsic property will help in effective separation of various gases. Moreover, future prospects and commercial viability of the supported ionic liquid membranes will also be evaluated.

Keywords: adsorption**;** cryogenic;membranes; ionic liquid

SCHEMCON-2020

Modification of Polymeric Membrane using Graphene Oxide for Water Treatment

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Abstract

Water is getting highly contaminated from the effluents of industries, domestic sewage and other polluting agents. Treatment of such polluted water is a very challenging task. Various practically enhanced technologies are there for water/wastewater treatment in a very effective and efficient way. Among all those methods, membrane technology is a very novel, efficient, cost-effective and easy-to-go process. Unmodified membranes are not that much helpful in treating the water, so addition of some materials such as silica nanomaterials and carbon-based inorganic materials to the membrane coating enhances its permeability, mechanical strength, flux and rejection as well. Graphene oxide (GO) and functionalized GO intercalated with any type of membrane (PES, PVDF etc.) shows very promising results due to its extraordinary properties such as high specific surface area, thermal and mechanical stabilities, easy functionalization of surface, 2D nanostructures can also be prepared. GO's abundant functional groups, including epoxy, carboxyl, carbonyl and hydroxyl provide functional reactive sites and hydrophilic properties and increase the membrane performance. In this paper, functionalization of GO with various amines, polyamines, porous oxide materials such as Al_2O_3, alkylation with PEG and so more which helps in better permeance and selectivity of the membrane. It describes the methodology of preparation of GO layered hybrid membrane along with its characterization and removal of various pollutants from wastewater. At last, the mechanism behind the separation has been discussed in detail to get an insight into the process and future scopes in this area.

Keywords: Wastewater Treatment; Membrane Technology; Graphene Oxide; Functionalised GO

SCHEMCON-2020

Highly stable M/NiO-MgO (M = Co, Cu and Fe) catalysts towards CO2 methanation

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Abstract

NiO-MgO nanocomposites are synthesized using solution combustion, sonochemical, and co-precipitation synthesis to understand the catalytic activity of CO_2 methanation. Excellent particle size distribution was noticed with the sonochemical routed synthesis method, and the CO_2 conversions are found to be better with the same synthesis protocol. Surface modifications in NiO-MgO composite were incorporated by doping M (M = Co, Fe, and Cu). The active catalysts are characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) to understand physical, structural properties and surface morphology of the nanocomposites. All catalysts showed excellent catalytic activity for the conversion of CO_2 to methane and selectivity towards methane to be higher than 85%. However, 2%Co/NiO-MgO showed the lowest activation energy of about 43 ± 2 kJ mol^{-1} among other synthesized catalysts. The mechanism of CO_2 methanation was investigated with the inputs from temperature programming reduction with H_2 (H_2-TPR), and temperature programming desorption with CO_2 (CO_2-TPD) studies. Detailed reaction mechanism and kinetics are investigated for all doped catalysts. M/NiO-MgO offered excellent stability up to 50 h reaction time with high CO_2 conversions and CH_4selectivities.

Keywords: NiO-MgO nanocomposites; Sonochemical synthesis; Reaction mechanism; CO_2 methanation; Co, Fe, and Cu doping

Sterically hindered C-2 Substituted Benzimidazolium cation containing adamantane group as highly stable anion exchange membrane: Theoretical and experimental approach.

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Abstract

A Fuel Cell is a device that converts chemical potential energy (energy stored in molecular bonds) to electrical energy. Among various types of fuel cells that have been developed, the Alkaline Exchange Membrane Fuel Cell (AEMFC) is considered to be one of the most promising energy conversion devices for stationary and mobile applications due to enhanced oxygen reduction and fuel oxidation kinetics. In AEMFC, Anion Exchange Membrane (AEM) i.e. OH^-, should possess high ionic conductivity, low degree of swelling and high chemical stability. Over the years, AEM's suffers from poor alkaline stability, largely due to nucleophilic attack on the fixed cation species. Hence, in the present study covers synthesis of poly (arylene ether sulfone) copolymers containing benzimidazolium cations, determination of the effects of the C-2 substitution on alkaline stability of benzimidazolium salt by ^{1}H-NMR spectroscopic analysis. Further, results indicate C-2 substituted benzimidazolium salt displayed enhanced stability at elevated temperatures in comparison to C-2 unsubstituted benzimidazolium salt, which may be due to the steric hindrance of the substituent. Further, details about the synthetic route, spectral analysis, and thermomechanical, physical and electrochemical properties have been discussed in detail.

Keywords: Benzimidazolium; Anion exchange membrane; Alkaline fuel cell

SCHEMCON-2020

Study of Hydrodynamic Cavitation based hybrid advanced oxidation technology: A case study for degradation of Sodium dodecyl sulphate

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ID: OP-07-033

Abstract

dodecyl sulphate (SDS) is an anionic surfactant commonly used in detergents for laundry, personal care products and has potential application in industrial cleaning applications. However, removal of surfactant from wastewater is a challenging problem due to its low biodegradability. Hence in this work, the authors have reported the possibility of treating SDS laden wastewater using hydrodynamic cavitation (HC) technology for the first time. The authors have carried out a systematic study by optimizing the geometry of the cavitating device followed by studying the effect of process parameters like pH, inlet pressure, treatment time on the degradation rate of SDS.

Under optimized conditions of pH 2 and 5 bar of inlet pressure, % degradation of SDS was found to be 64.93 % in 120 min by HC process alone. Coupling HC with oxidizing agents such as H_2O_2 and Fenton's reagent further accelerated the rate of degradation and improved the performance of the process and the maximum degradation was observed to be 99.96%. Additionally, the degradation mechanism of SDS at optimized conditions were evaluated using liquid chromatography–mass spectra (LC–MS) study. Further studies were carried out based on the energetics and economics for standalone technologies as well as hybrid process for implementation of the technology from lab scale to industrial scale.

Keywords: Surfactant degradation; Hydrodynamic Cavitation; Advanced Oxidation Process; Synergisti Co-efficient.

SCHEMCON-2020

Functionalization of PVA-CA membranes with nanoparticles for surface enhancement

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Abstract

In the current study, Polyvinyl Alcohol (PVA) and Cellulose Acetate (CA) composite membrane is doped with nanoparticles for surface enhancement. PVA hydrogel was prepared using the solvent Dimethyl sulfoxide (DMSO) with varied compositions of CA added in known quantities to get a homogeneous polymeric solution. The PCD-Ti, PCD-Zr, PCD-Cd flat sheet composite membranes were prepared using phase inversion method combined with gentle doping of nanoparticles like ZrO, TiO_2 and CdO. The synthesised PVA-CA membranes were examined using SEM, TGA, FTIR and XRD. The basic characteristics like pure water flux, membrane porosity, langelier saturation index, contact angle, dye rejection rate, and water uptake capacity were tabulated. The effects of different type of solvents involved during the preparation of PVA-CA membranes were also studied. The high-resolution SEM image analysis showed the homogeneous dispersion of ZrO, TiO_2 and CdO nanoparticles over PVA, and TGA analysis showed improved thermal stability of the membrane. The nanoparticle doped PVA-CA membranes showed improved mechanical strength and good chemical oxidation stability during Fenton test. PCD-Ti (6.4% wt) showed high thermal stability and oxidation stability at elevated temperatures of 290^{o}C compared to PCD-Zr, PCD-Cd.

Keywords: surface enhancement; PVA-CA; composites; nanoparticles; membrane stability

SCHEMCON-2020

Rpa in Manufacturing Industries

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Abstract

Imagine if your company is able to reduce the number of mundane, repetitive tasks that are completed manually by staff. Tasks that can often hold up sales, delay delivery, frustrate customers or, even worse, be completed incorrectly. This can be done by RPA. Robotic Process Automation (RPA) is transforming the way organizations across different industries do business. It allows organizations to automate work processes to reduce the time spent on costly manual tasks and increase efforts to deliver mission critical work. In the past few years, RPA has grown rapidly in many sectors. Manufacturers can get up to 40% cost savings using RPA. It can even increase employee productivity. Teams can provide quicker resolution to customer queries with RPA, automating searches across system into a single action by users bringing necessary data to resultant queries. RPA enables order placement with suppliers tracking shipped and delivered orders main inventory stock level. To stay competitive and to optimize manual process, RPA streamlines operational processes. If any error happens, this could lead to a massive loss in the industry. RPA allows the companies to create the product better because of data accuracy.

SCHEMCON-2020

Advances in Steam Cracking

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Abstract

Petrochemical sector in India is a key pillar of the economy and one of the fastest growing, at a CAGR of about 10%. Despite the healthy growth, the per capita consumption stands at 10kg compared to the global average of 30kg, indicating significant headroom for growth. The steam naphtha cracking is the cornerstone of the petrochemical industry for the production of lower olefins. But, the present thermal process requires high energy, with significant down time for coke removal moreover, we have a little control over product selectivity, producing mainly ethylene. But, the demand for C3&C4 olefins is increasing at higher rate than the production levels. The capacity of on-purpose production technologies are still at very low levels and have a major concern on feed availability. The recent advances in the steam cracking involves a catalytic approach by which the reaction temperature can be decreased significantly and can also obtain higher yields of C3&C4 olefins apart from the ethylene. Here, we explore the catalytic steam naphtha cracking in terms of advantages over conventional steam cracking and also study the effect of various operating conditions on the product yields and the process kinetics.

Keywords: Catalytic steam cracking; Kinetics; Catalysts; Petroleum

SCHEMCON-2020

Leak Detection in Heat Exchangers and Underground Pipelines Using Radiotracer

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ID: OP-07-037

ABSTRACT

In a larged scaled industry , it is very common to have a little amount of leaks. But these small malfunctions can become threat to whole plants in real soon if undetected. This leaks are suspected if there is any abnormal behavior of a system, such as loss of pressure contamination of product or loss of process efficiency. Leaks create serious problems in process plants or in pipelines, spoiling the quality of the final product or reducing the transportation capacity of the water, oil and gas pipelines. A pipeline section leaking few liters of oil per hour to the environment has the potential to contaminate tens of thousands of cubic meters of groundwater per day. Sothe basic functions of leak detection are the location and size measurement of leaks in sealed systems. Radiotracer techniques are very sensitive, effective and competitive for on line leak detection, especially in heat exchangers and underground pipelines. Radiotracers allow an early detection of small leakages before these develop into major pollution incidents. Radiotracer can achieve the detection limits up to 0.1% of stream flow by emitting radiations.

KEYWORDS: LEAKS, HEAT EXCHANGER, PIPELINES, RADIOTRACERS.

SCHEMCON-2020

Emission control by catalytic convertor: Present scenario

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Abstract

The increasing number of mode of transportation resulted in uncontrolled emissions to pollute air. Emissions from diesel vehicles are the main concern of air pollution related deaths worldwide. Its impacts are growing in most of the developing nations especially India, inspite of the regulatory limits. In 2016, the Indian government declared that the nation would skip the Bharat Stage(BS) V norms completely and adopt progressively stringent BS VI norms by 2020 in which the level of nitrogen oxide(NOx) and particulate matter (PM) emissions will be reduced by 89% and 50%, respectively, from BS-IV norms. The major pollutants emitted through vehicular sources are carbon monoxide (CO), hydrocarbons (HC), oxides of nitrogen (NOx), particulate matter (PM) and lead (Pb) which can be reduced by improving fuel quality and by improving the catalytic converter design or catalyst used in the convertor. In present study we have reported the various types of catalytic convertors used and the new research going on in Indian automotive industry.

Key words: Air emissions; Catalyst; Catalytic convertor

SCHEMCON-2020

An Investigation into Phenomenal Characteristics of Rotating Packed Bed Reactor

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Abstract

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Rotating Packed Bed reactor (RPB) is a novel equipment which holds a packed bed fixed within a hollow tubular casing. It uses centrifugal force in addition to other conventional principles of packed bed reactor to increase mass transfer and heat transfer. RPB reactor has been in research for its efficient usage /application in several industries. RPB is ideal for process intensification which aims to integrate multiple process/operations to enhance internal mass, heat transfer and kinetics at micro-level and thereby improve mixing. Rotating Packed Bed reactors significantly reduce the equipment volume and improves selectivity. These merits can effect intense micro mixing and internal mass, heat transfer. It can also provide more contact between reactant and catalyst and thus resulting in more product formation. Desired products can also be produced by adjusting the variable speed of rotation. RBP reactors also have come up with some disadvantages like channeling of inlet stream, side reactions, tedious heat transfer to/from the reactor and control of temperature gradient.

Keywords: Packed bed reactor; Rotating Packed Bed reactor; Mass and Heat transfer; Process intensification; Mixing

SCHEMCON-2020

The Food Industry's Role in Sustainable Development

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ID: OP-07-040

Abstract

The world is moving towards sustainable development with focus on attaining the Sustainable Development Goals in the coming years. In this context the role of food industry is extremely important to attain the sustainability.

Sustainable development is the development that meets the needs of the present, without compromising the ability of future generations to meet their own needs. Making sustainability strategies operational is itself a big task, feeding a planet of 7.7 billion people is no easy matter. Every person on the planet needs, expects, and has the right to a healthy diet, every farmer needs, expects, and has the right to a decent livelihood.

A 'food system' involves the infrastructure and processes that go into feeding the population, such as growing, harvesting and transportation.
Despite the increase in food production, the Food Sustainability Index ranks India 33rd among 67 countries in 2018. Many foods related conditions and diseases, including poor diet, under-nutrition, over-weight and obesity as well as general food safety risks are all interlinked. This study focuses on sustainable food production and policies that comply with international food safety standards and promote good health from the farmer's field to the dinner plate.

Keywords: Sustainable development; Food safety; Health and Nutrition

SCHEMCON-2020

Recent developments in printing technologies for electrochemical energy storage devices

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ID: OP-07-041

Abstract

Electrical energy storage (EES) devices play an important part in the development of sustainable energy technologies. Electrical energy generated from renewable resources such as solar radiation or wind have proven to be sustainable if not continuous in the quest for energy .Thus, these renewable energy technologies which generate electricity intermittently require efficient and reliable electrical energy storage methods. Ever since the development of Electrochemical Energy storage devices, scope for advancements in the fabrication methods and materials of these devices has been increasing. Massive research interest has been sparked among scientists in this field. Conventional methods like spray coating and vapour deposition, to name a few, have not been as flexible and low cost as one expects them to be. Recently developed printing technologies like 2D and 3D printing are well equipped to become more promising fabrication methods. This review provides an insight into some of the more commonly used printing technologies for the fabrication of EES devices emphasizing mainly on the 2D and 3D printing techniques employing graphene and graphene – based materials. The fabrication and performance of current graphene based batteries and supercapacitors have been reviewed. Challenges faced in the field of 2D and 3D printing have also been discussed.

Keywords : Printing techniques ; Graphene ; Electrochemical Energy storage devices

SCHEMCON-2020

Effect of inorganic salt on the structure and dynamics of stereoregular isomers of poly (methacrylaic) acid (PMA) in dilute aqueous solutions-A molecular dynamics simulations study

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Abstract

The effect of monovalent salt i.e. NaCl on the structure and dynamic properties of stereoregular water soluble polymer polyelectrolyte poly(methacrylic acid) (PMA) was studied by atomistic molecular dynamics (MD) simulations with explicit solvent description. The stereoisomers studied in this work are *isotactic*-PMA (*i*-PMA) and *syndiotactic*-PMA (*s*-PMA). Results pertaining to salt concentration dependence on structural properties viz. radius of gyration, conformations, end-to-end-distance, h-bonds, intermolecular structure and scattering structure factor and, dynamic properties viz. chain relaxation, h-bond dynamics and self-diffusion coefficient of *i*-PMA and *s*-PMA and counterions will be presented. The PMA radius of gyration decreases with increase in NaCl concentration in corroboration with experimental and simulation works reported in the literature. The number of intermolecular h-bonds between PMA-water decreases with salt concentration for both isomers (*i*-PMA and *s*-PMA). The intermolecular structure and counterion condensation are studied via. radial distribution functions and quantified by computing coordination number values.

Keywords: poly(methacrylic acid); molecular dynamics; stereoisomers; intermolecular structure; counterion; radial distribution functions

SCHEMCON-2020

Developing Hydrophobic - Oleophilic absorbent material by synthesizing composites of Ceiba pentandra (Kapok) for Oil Spill Clean-up

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ID: OP-07-044

Abstract

Oil spill clean-up is an expensive and complicated process harming marine life and further damaging the environment. Recently used methodologies include in-situ burning of oil, using chemical dispersants to breakdown oil into very small droplets, skimming oil floating on top of the water, and/or absorbing it with expensive, unrecyclable sorbents. Oleophilic and hydrophobic absorbent materials have received growing attention in recent years for promising applications in accidental oil spills. The porous structure and high lumen content enable Ceiba pentandra having excellent oil absorbency and retention capacity. The proposed model is a sandwich-like structure that has an innermost oleophilic layer of reinforced Ceiba pentandra and similar materials which is bounded by the hydrophilic sponge layer. The whole structure provides rigidity using a coated metal net. The hydrophobic sponge layer is obtained by a metal-ion-induced hydrophobic melamine sponge (MII-HMS) prepared by a one-step solution immersion process. The sponge is immersed in an aqueous solution of transition metal ions (e.g., FeCl3) for a short period, followed by drying. This simple process renders the transition of the super hydrophilic melamine sponge to become highly hydrophobic. Ocean surface is simulated using surface wave generating device. Spinning the wheel of time and technology has led us to dive deep into the future possibilities of the advanced engineering and material science techniques for mitigating with oil spill clean-up.

Keywords: Oleophilic; Hydrophobic; Ceiba pentandra; Absorption

SCHEMCON-2020

Non-conventional desulfurization of petroleum oils

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The increasing worldwide demand for energy is pushing oil and gas industries to look for heavy and inferior fuel resources as low sulfur-containing crudes are rapidly being depleted. Sulfur has deleterious impacts on the environment as well as human health.Removal of sulfur, especially below 10 ppm, from various types of fuels is an important area of research and countries worldwide mandate these low sulfur levels and the norms have become increasingly stricter in recent years. India also poses strict standard for fuel quality and vehicle emissions standards. Liquid petroleum fuels contain verities of sulfur compounds such as, thiols, sulfides, disulfides and thiophenes which cause severe environmental pollution by generating SO_x and airborne particulate emissions during combustion, poison the catalysts of downstream processes as well as cause corrosion in refinery equipment.

Hydrodesulfurization (HDS) is the most widely used industrial process for removing sulfur compounds from petroleum fuel. But the severe operating conditions and the use of costly hydrogen make the process expensive. Hence, research is underway to develop alternative desulfurization processes. Alternative or non-conventional desulfurization processes such as oxidative desulfurization, adsorptive desulfuristion, extractive desulfurization etc are the upcoming techniques to take the position of HDS. Mild operating conditions such as requirement of temperatures less than 100˚C and atmospheric pressure make these processes more appealing over hydrotreatment. The oxidative desulfurisation takes place in the presence of oxidising agents such as hydrogen peroxide, tert-butyl hydrogen peroxide or in some instances, in the presence of molecular oxygen and ozone as well and the oxidised products are removed from the oil by adsorption or extraction with polar solvents. Adsorptive and extractive desulfurizations are non-catalytic, low-severity process, which need a suitable adsorbent and solvent respectively to remove sulfur compounds from petroleum fuels economically without changing the chemical nature of the fuel cut.

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SCHEMCON-2020

Esterification of Acrylic Acid with Ethanol

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ID: OP-07-047

Abstract

Esterification of acrylic acid with ethanol, Thecatalysed by sulphuric acid has been carried out in stirred batch reactor under atmospheric pressure. Different parameters such as effect of initial molar ratio, effect of catalytic loading, effect of reactant temperature has been studied in the batch reactor. Differed catalyst loading system (1-3%), initial molar ratio (1:1-1:2), reaction temperature(50-70°C) was used in the reaction system. The temperature dependence is exponential and expressed by Arrhenius type of relationship. Kinetics parameter such as equilibrium constant, rate constants, activation energy and reaction enthalpy and entropy were estimated by experimental data. The rate equation has remarkable fit to the data and was able to describe the behavior of the system of various reaction temperature. Sulphuric acid was found to be more efficient catalyst for esterification it induces the maximum conversion pf acrylic acid. ester, which are desired product out of esterification reaction, have varied applications. we want to developed optimum condition for the production of ethyl acrylic.

Keywords: acrylic acid, ethanol, kinetics, esterification.

SCHEMCON-2020

Estimation of Material Accumulation, Temperature, Humidity and Generation Using Iot in Industry

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Abstract

Internet of things (IoT) has bounded itself into our lives and its wide application embedded into almost every gadget which we use. If such technology brought into the chemical industry it brings a huge difference in the work and also creates safe workplace. In industry during a certain reaction a person must completely monitor the reactor for amount of materials present in the equipment, temperature and humidity. We worked out a successful project in which we applied IoT to laboratory chemical apparatus. We had built a device which is used to measure the parameters like height of the materials present inside the equipment, temperature, humidity and generation which will be displayed on the monitor with more accurate values. Three major equipments are employed in the construction of our device includes an ultrasonic sensor, Arduino Uno and a DHT-11 sensor. Arduino Uno is programmed as per reactants and used to do the material balance. This device easily measures the distance and information is displayed on a monitor which runs a GUI (Graphical User Interface) which displays the various conditions in the reactor.

Keywords:Internet of Things; Easy measurement; Safe; Time saving; GUI

SCHEMCON-2020

A Novel Integrated Approach for the Enhancement of Yield of Biogas from Cow Dung

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ID: OP-07-051

Abstract:

Present study deals with an integrated approach for the production of biogas from Cow dung to fulfill the growing demand of Indian market of the gas fuel. The ratio of Cow dung to water was optimized 1.5:1 (w/w) for the dilution. The effect of pre-treatment of cow dung with cavitation is checked and synergic effect of this integrated system is obtained. It was also observed that the glucose concentration in the Cow dung increases after UC treatment which means depolymerisation of polysaccharides of glucose (cellulose) occurs. Effect of ultrasonic cavitation was checked with UV spectroscopic analysis in terms of Total Reducing Sugar (TRS). pH was maintained in between 4.5-5.0 during Anaerobic digestion using buffer solution. The outstanding enhancement in TRS in the pretreated biogas dilution with UC+Acid is obtained up to 34% due to synergetic effects of integrated pretreatment process. It is helpful to reduce the ddigestion time as well as increase in glucose concentration for the Biogas production. This would be breakthrough for the India as well as agricultural based countries to become self-reliance for fuel.

Keywords: Biogas Production, Total Reducing Sugar, Cow Dung, Ultrasonic Cavitation bath.

SCHEMCON-2020

The shape memory polyurethane in chemicalrelease and diffusion

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ID: OP-07-053

Abstract

Shape memory polyurethane are mechanically active and smart materials, which can be formed and fixed in a temporary shape and are able to deform to their original shape when exposed to a suitable circumstances such as the temperature change. In this the mechanism of pH responsiveness of pyridine compound and urethane is used ,which acts as a switch to control shape memory and this functionality only depends on the change in the pH and not with the variation in the temperature. Where this is applied in the controlled release and diffusion mechanisms of engineering equipments as an automatic chemical release in process equipment and also can be used as a control for chemical reaction .

Keywords: shape memory polyurethane ; change in shape; pH responsiveness ; chemical release ; controlling reactions

SCHEMCON-2020

Application of Herbal medicine against SARS-CoV-2 and its Socioeconomical effect: Speculative study

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ID: OP-07-054

Abstract

The present study focuses on medicinal plants which are used for the treatment of Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).Aeglemarmelos (Bael), Colocasia esculenta (Arbi), Curcuma longa (Haldi) and Tinosforia cordifolia (Giloy) is use to check the herbal medicinal activity to see the immunity boost effect against SARS-CoV-2. Extraction studies for given plants has been carried out to investigate& confirm the presence of chemical compounds like alkaloids, coumarins, alkaloids, flavonoids and tannins. It confirms from reported data that Leaf and fruit extract of these plants shows anti-diabetic, antiulcer, anti-oxidant, anti-malarial, anti-inflammatory, anti-cancer,anti-fungal, antib-acterial and anti-viral activities. Survey study to check the Socioeconomical effect of such plants also carried out and it shows that, medicinal plants show comprehensive results along with the traditional reports.

Keywords: Immunity Booster; CoV-2; Soxhlet Extraction; Chemical constituents; Bioactivity; Soxhlet extraction.

SCHEMCON-2020

Development of Ceramic Membranes From Industrial Solid Waste Material and Their Application in Water Recovery from Aqueous Effluents.

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ID: OP-07-055

Abstract

The study proposes to develop ceramic membranes from industrial solid waste. The current industrial method of filtration uses diatomaceous materials as adsorbents, which adsorb impurities, colour, etc. After a certain number of filtration cycles, the filter bed has to be replaced with fresh one. This leads to a solid waste chiefly containing the diatomaceous material. Such industrial spent material is abundant with silica and other metal oxides. This either goes to incineration or land filling. This study proposes to develop ceramic membranes from such industrial spent material, because of their chemical inertness, rigidity, and high temperature stability, as compared to polymeric membranes. Ceramic membranes were been synthesized in-house based on the previously reported methods using fully characterized industrial spent material. Synthesized ceramic membranes were tested for water recovery from industrial aqueous effluents. The overall objective of the project is to develop a technology for the reuse of industrial solid spent material for water recovery and effluent treatment purposes.

Keywords: Membrane; Industrial Spent Material; Ceramic; Filtration; Effluent.

SCHEMCON-2020

Role of PSM Critical Elements in Engineering Control

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Abstract

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The approach to controlling the chemical risk from a process is rarely straightforward as there will always be a choice of control options – some easier to apply than others. The present work emphasizes on the engineering controls, a part of hierarchy of control. This consists of a variety of methods for minimizing hazards, including process control. Well-designed engineering controls can be highly effective in protecting workers from accidents. Accident has become a huge issue in the world which has been recurring in the process industries today though there are a number of safeguarding elements. For example, in the LG Polymers accident elements like MI, PSI, OP, PHA, and PSSR should have been thoroughly considered post lockdown in pandemic situation COVID-19 which could have prevented the release of styrene. Poor maintenance of the storage tank has resulted in polymerisation of styrene due to presence of iron oxide in the tank. As higher temperatures are bound to cause styrene vaporization and subsequent build-up of polymer, maintenance of lower temperature in the tank was preferred in the range of 10–18°C. Well established interlocking system between the tank temperature and refrigeration system could have prevented the onset of reactive hazard. Elements mentioned above of PSM mainly address the safe operation of the process equipment to prevent loss of containment. Present work suggests that these elements are critical.

Keywords: Engineering control, PSM critical elements, Interlocking system,

SCHEMCON-2020

Ameliorating economic sustainability of Enhanced Oil Recovery (EOR) by Polymer flooding method

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ID: OP-07-058

Abstract

With Industrial Revolution 2.0 the energy demand is more than obvious. Among the non - renewable energy solutions ,about 5.1 million barrels of oil was consumed per day only in India (2019). Keeping that in eye we need to rethink the production strategies and expenses of oil production. In this project, we have performed an analytical examination onAmeliorating economic sustainability of Enhanced Oil Recovery (EOR) by Polymer flooding method. Polymer flooding is a non-thermal and only proven chemical enhanced oil recovery (EOR) method in which a non-Newtonian polymer gel like-Polysaccharide derivative and polyacrylamide derivatives are used to decrease the water-oil mobility ratio by increasing the viscosity of displacing water. Polymer flooding has considerably higher oil recovery potentials than waterflooding, which is typically on the order of 6%–12% higher, which gives a 40%–50% recovery factor of initial oil in place (IOIP) after application .So our main objective is to improve the efficiency of oil recovery process in an economical and sustainable way by using an advanced form of polymer flooding method by blending it with alkali and surfactant flood. We have also explored on Fractional flow and diverting injected water from zones for more efficacious recovery.

Keywords: Polymer ratio; Mobility ratio; Recovery factor; Fractional flow

SCHEMCON-2020

Various Aspects of Production of Ethylene Glycol

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Abstract

Ethylene glycol, also called ethane-1,2-diol or monoethylene glycol (MEG), is the simplest member of the glycol family of organic compounds. It is an odourless, colourless, sweet-tasting viscous liquid. It is an important industrial compound used in a large number of commercial applications mainly in manufacture of polyester fibre and for antifreeze and coolant formulations. Owing to its versatile applications, a variety of methodologies have been explored for the synthesis of ethylene glycol.and great efforts have been undertaken in order to improve these processes. The commercial route to ethylene glycol in use today involves hydrolysis of ethylene oxide. Although hydrolysis with both acid and base catalysts are proven methods for ethylene glycol production, neutral non-catalysed hydrolysis has been shown to be equally popular. The descriptive study of these methods has been done and distinction between these processes has been made.

SCHEMCON-2020

Rosemary Essential Oil Extraction and Its Components from Microwave Hydrodistillation Method

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OP-07-060

Abstract

The main focus of this review project is to study the advantages and properties of the rosemary essential oils and to study its components. The major part of this paper also focuses on the impact of the extraction process for the essential oil of rosemary. Microwave Assisted Hydro Distillation (MAHD) process is proven to be one of the finest methods among the already existing one for the isolation of essential oils from rosemary plants. The process is based totally on the principle of classical hydro distillation method. The study of the extraction of essential oil and its components of rosemary oil, is characterized by the Gas Chromatography coupled with mass spectroscopy (GC-MS). The study of the methods (MAHD, HYDRODISTILLATION (HD)) has been done from the available literature on the basis of cost, energy, time and cleanliness or the environmental safety and is effectively compared with each other. The results according to the literature reviewed suggest that the yield of the rosemary essential oil is much likely the same as other methods quantitatively (yield) and qualitatively (aroma). Based on the research and when compared on the basis of mentioned aspects MAHD process stands out to be the most efficient method among the traditional one (HD). Microwave heating appears to be very versatile and safe. For example, the total time of the extraction of essential oil for 100 gm of plant was calculated to be *30 mins* for MAHD and *90 mins* for SD. Moreover, this review also covers the general components of essential oils and their propertiesand other general advantages of essential oils from other plants. In the conclusion, MAHD has more advantages over the traditional methods and therefore it can successfully replace the traditional industrial methods on a pilot and industrial scale for extracting essential oil from rosemary and other aromatic and medicinal plants after comparing.

SCHEMCON-2020

Extraction of Impurities from Water with the Help of Agro-Waste Rice Husk& Rice Husk Ash

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ID: OP-07-061

Abstract

Concern about the environmental pollution increased due to enrichment of civilization, globalization and countless falls down in ecosystem. Among the different kind of environmental pollution, water related pollution has taken the attention of scientists and researcher. Different pollutants, for exampledyes, phenols, heavy metals, organic compounds, etc. can be removed productively by using rice husk(RH) and rice husk ash(RHA) in the form of adsorbent.An attractive adsorbent which need not require any additional pre-treatment and is inexpensive provides alternative for pollutants removal from waste water. The utilization of RH and its RHA due to its different properties such as insoluble in water, upper mechanical strength, chemical stability & granular structure, makes it desired adsorbent substance. This article shows brief reviews on the contribution of RH and RHA in the elimination of several toxins through contaminated water. Studies on the adsorption of different toxins by RH material are looked into & the mechanism of adsorption, appreciative conditions, influencing factors etc, examined in this article. It is noticeable from the review that in the field of adsorption science, the expansion of rice husk and their ash represents a valuable and powerful tool which has led to great improvements in pollution control and environmental protection.

Keywords: Rice husk, Dyes, Inexpensive, Adsorbent, Pollution

Transition and Advancement of Sulphuric Acid Production

SCHEMCON-2020

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ID: OP-07-062

Abstract

Sulphuric acid, also known as the Oil of Vitriol, is a mineral acid composed of the elements sulfur, oxygen and hydrogen. It is a colourless, odourless, and viscous liquid that is soluble in water. It is a basic raw material used in a wide range of industrial processes and manufacturing operations. Due to the continuous expansion and variation in the market and to meet the increase in demand of Sulphuric Acid, the sulphuric acid industry has been adopting new methods and technology for improving plant reliability, operability, environmental and safety services. The paper deals on this aspect of the acid industry and describes the production process which is the contact process along with the transition brought about in the production sector. The paper also describes the recent advancements made in the production process including air pollution control, minimising the emissions using scrubbers and improving efficiency.

Keywords: Sulphuric acid; Oil of Vtriol; Sulphur

Synthesis of Anisole by Vapour Phase Methylation

SCHEMCON-2020

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ID: OP-07-063

Abstract

Anisole synthesis by vapour phase methylation of phenol and methanol is carried out in presence of gama-alumina catalyst in fixed bed reactor. The vapors of phenol and methanol are reacted over gama- Alumina catalyst with mole ratio of 1:5 respectively. Keep the catalyst at 6000 C for 4 hrs for calcination. Silica balls are used for packing with 2 grams catalyst at middle of the reactor and fed the solution with the flowrate of 0.3 ml/min. The Anisole selectivity is maximum at 250 0c and selectivity decreases in between 275 0c – 300 0c therefore 250 0c is optimum temperature hence selectivity inversely proportional to temperature .The reaction follows first order reaction according to kinetics study by plotting graph of concentration vs time .The rate of a first-order reaction is proportional to the concentration of one reactants rate .The purity of anisole is further increased by distillation process.

Keywords: methylation,calcination,kinetics, gama-alumina,selectivity.

M.P Chary Awards 2020

SCHEMCON-2020

Synthesis of 2, 5-Dimethyl Furan (DMF) from Renewable Lignocellulosic Biomass

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ID: OP-08-001

Abstract

Renewable biomass resources could reduce the dependency on the fossil fuels by conversion of itslignocellulose into bio-fuels and other valuable chemicals. Depolymerisation oflignocellulose,hydrolysis of cellulose to monomer glucose and its subsequent dehydration results 5-hydroxymethylfurfural (HMF). HMF is an important platform chemical for fuels and various other applications. Thehydrogenation of HMF results 2, 5-dimethylfuran (DMF), which may be a biofuel with 40 % greaterenergy density than that of ethanol. The homogeneous catalytic method is preferred for lignocellulosicbiomass conversion to cellulose, its hydrolysis and further dehydration to HMF. This review is anattempt to summarise the current research and developments in the field of lignocellulose derived HMFand further conversion to DMF as a potential biofuel using conventional homogeneous andheterogeneous catalyst as well as using deep eutectic solvents as green solvent.

Keywords: Biofuels, Biomass, Chemicals, Dimethyl furan, Lignocellulose.

SCHEMCON-2020

Synthesis and Characterization of Aromatic Polymer Blend Membranes for Fuel Cell Applications

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Abstract

The energy crisis has been one of the globe's foremost concerns because of rapidindustrialization and depletion of fossil fuel resources. Consequently, there is an urgentnecessity to develop energy efficient machinery that is ecologically friendly. Under thesecircumstances, membrane-based fuel cells (FCs) appears to be potential by having membraneis one of the foremost components. Nafion membrane manufactured by Du-Pont, USA, iswidely used, but owing to its high production cost, temperature limitations and high methanolpermeability, restricts its widespread commercialization. Therefore, the present work focuseson the synthesis of more affordable alternatives that overcome the limitations of Nafion. Tocontrol the problem of methanol crossover or hydrogen (H 2) fuel bypass without sacrificing their proton conductivity, chemical crosslinking and physical blending of polymers have beeninvestigated in this work. Different polymeric blend compositions made up of sulfonatedpolyethersulfone (SPES) with polyetherimide (PEI) and polyamide-imide (Torlon) weresynthesized by solution casting and solvent evaporation method to obtain dense (nonporous)membrane. Apart from blending, nanocomposite membranes prepared from polyaniline(PANi) were also studied. The structural and surface modifications of membranes afterblending and doping of nanoparticles were confirmed by FTIR, XRD, TGA, and SEManalysis for comparison with their pristine membrane. Furthermore, the combination of thebiodegradable and synthetic polymeric membrane was also studied. The synthesized blendand nanocomposite membrane exhibit low fuel crossover without sacrificing protonconductivity along with maximum performance of 0.13 W/cm 2 shows that the indigenouslysynthesized membranes exhibit a strong potential for membrane-based FC applications bydemonstrating all the desired properties.

Keywords: Membrane; Fuel cell; Molecular Dynamics; Polarization curve; Protonconductivity

SCHEMCON-2020

Modeling and Simulation of Biodegradation of Scaffolds for Bone Tissue Engineering

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Abstract

Tissue engineering is a promising field of research which offers reconstructionor regeneration of a particular tissue and organs. Scaffold plays an important role intissue engineering and an optimum degradation rate and enough mechanical strength arerequired during the regeneration of tissue. 3D printing technology attracts theresearchers and clinicians to fabricate biodegradable scaffolds. Mathematical modelingand simulation of scaffold degradation, mechanical stimuli and bone regeneration canprovide an optimal design of 3D scaffold using computational methods. The presentwork is to model the degradation of polymeric scaffold which occurs due to diffusion.The reduction in molecular weight over the time is modeled by understanding theconcentration of functional groups remain inside the polymer matrix and Fick's law ofdiffusion using Matlab. Simulation resulted, 80 percentage of polymer gets degraded atthe end of 14 week. Young's modulus calculated using the porosity of scaffold revealsthat, up to 4 week the degradation rate is slower and after which undergoes fasterdegradation and scaffold is capable of withstanding for a minimum period of 14 weeksand ensures regeneration of tissue in the defected bone. Another attempt of 3Dgeometry of scaffold with four layer is developed with the following dimensionsdiameter – 4 mm, Height – 5 cm and spacing – 2 mm in Comsol. Concentration dropduring the degradation process is captured for the entire geometry and it is observed thatfor 10 hours of simulation edges of the scaffold begin to degrade thus ensures thecomplete degradation of entire polymer matrix. Simulation time and step size are to beincreased to predict the complete degradation of polymer matrix.

Keywords: Scaffold; Degradation; Concentration

SCHEMCON-2020

Inkjet-printed nanostructured electrocatalyst for Fuel Cell application

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Abstract

Proton exchange membrane fuel cells (PEMFCs) are an energy-efficient alternative to combustionengines for automotive applications but are on the cusp of mass-adoption, mainly due to highercosts. Significant advances have been made in PEMFC design over the time concerning cost-reduction and structural redesign. The membrane electrode assembly (MEA), especially theelectrocatalyst, is considered as ‘the heart' of a PEMFC and is designed to accommodateconstraints imposed by the cost of platinum used for electrocatalysis, as well as the need forefficient transport of electrons, reactants, and heat. The current design of Pt/C electrocatalyst isprone to carbon support corrosion followed by deactivation under PEMFC working conditions andhas led to renewed interest in carbon-free nanostructured electrodes (NSTFs). Contextually, thePrint-Expose-Develop technique developed in our group was used to fabricate porously andconducting silver nanostructures on the Nafion membrane. Preliminary results confirm successfulelectrodeposition, of Pt on metallic nanostructures via the self-terminating process having < 10μgPt/cm2 loading. The ease of printing silver nanostructures using a simple inkjet printer andthe ability to coat them with atomic layers of Pt via cycling of electrode potential can pavethe way for a cost-effective, additive process for manufacturing of MEAs for PEMFCs.

Keywords: Inkjet printing, Print-Expose-Develop; Self-terminating electrodeposition, Ptatomic layers

SCHEMCON-2020

CLeONs: Contact Lens-based Oxygen Nanosensors for Rapid pO_2 Sensing in the Post Lens-Tear Film

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ID: OP-08-005

Abstract

Contact lens wear affects oxygen tension (pO_2) in the post-lens tear film (PLTF), and thereby,influence oxidative metabolism of the cornea. pO_2 measurement underneath the tear film isimportant to assess corneal health. However, rapid measurement of pO_2 dynamics in the PLTFis still an unmet need. Thus, we propose to employ contact lenses coated with silicananoparticles (NPs) containing O_2 sensitive Ruthenium phenanthroline to measure pO 2dynamics.

Ru-SiO_2 NPs were prepared by microemulsion method. To enhance binding to the contact lens,they were surface functionalized and coated on the posterior surface of contact lenses using dropcoating method. The average size of functionalized Ru-SiO_2 NPs was 190 ± 50 nm.Photoluminescence analysis showed fluorescence at 590 nm confirming the presence of Rucomplex. SEM imaging and AFM confirmed the deposition of nanoparticles on the lens surface.
Furthermore, Ru did not leach out from CLeONs. Fluorescence lifetime of Ru complex was 60100 ns. Fluorescence quenching was observed in the presence of oxygen and significant increasewhen exposed to N_2, demonstrating its oxygen selectivity. Based on these findings, we presumethat CLeONs can be used as a sensor for measuring pO_2 dynamics rapidly and selectively in thePLTF.

Keywords: Oxygen, post lens tear film, Ruthenium silica nanoparticles, fluorescencequenching.

SCHEMCON-2020

Aqueous Calcium Amended - Hydroxyapatite Defluoridation Method: A Step towards Mitigation of Crippling Fluorosis for Rural Areas

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ID: OP-08-006

Abstract

In India, around 11.5 million people are at high risk due to an unappreciated and debilitatingdisease, fluorosis, which is mostly caused by the drinking of fluoride contaminated water.Researchers had made efforts to alleviate fluorosis, which given some relief from thiswidespread disease. However, they fail to provide a permanent solution for this cripplingdisease due to adverse health effects on the consumers. Defluoridation using synthetichydroxyapatite found to be a cost-effective and efficient method due to its propensity touptake fluoride ion. However, hydroxyapatite dissolution during defluoridation was anunattempted problem. Hence, this water was unfit for drinking due to the higher residualvalues of pH and phosphate, and no calcium even hydroxyapatite could effectively removefluoride. A modified method was proposed to overcome this issue which suggested thatamending aqueous calcium to the fluoride water before contact with the hydroxyapatitesuccessfully prevented its dissolution and also enhanced defluoridation capacity. Further, thetreated water was calcium-enriched and alkaline. A field study done using this proposedmethod reported that it was free from hydroxyapatite dissolution and also fluoride-removalwas effective. Further, it reported that there was an improvement in the health of fluorosisaffected patients after drinking this water. In conclusion, “aqueous calcium amended-HAPdefluoridation method” would be a promising method not only for fluorosis prevention butalso it helps in the fluorosis reversal in the already affected population.

Keywords: Drinking water; Fluoride contamination; Fluorosis; Fluoride removal;Hydroxyapatite; Household water filtration.

SCHEMCON-2020

Ultrasound-Assisted Hybrid Techniques for Developing a Sustainable Environment

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ID: OP-08-007

Abstract

The present investigation provides the information to understand the mechanism of sono-hybridtechniques including validation of experimental results with simulations of cavitation bubbledynamics model for identifying the links between the physics and the chemistry of ultrasound andcavitation. The study also reports the ultrasound-assisted green synthesis of alternative fuels,nanomaterials using plant extracts and its application for oxidation processes towards developingsustainable environment. The effects of different process parameters such as intensity, frequency,system temperature and pressure, properties of the solvent, oxidant dosages etc. have also beenextensively investigated. The results of his study have shaded light on the intricacies of theultrasonic processes and have helped to identify the relative contributions of different parameters inthe process to the overall outcome of the process (in terms of either kinetics or yield).

Keywords: Green Synthesis; Advanced Oxidation; Modeling; Cavitation

SCHEMCON-2020

Development of Green and Sustainable Processes for Catalytic Production of Fuels and Chemicals from Biorenewable Resources

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Abstract

Herein, the synthesis of most sought-after chemicals such as 5-ethoxymethylfurfural(EMF), 5-hydroxymethylfurfural (HMF), and ethyl levulinate (EL) from differentfeedstocks is studied. Obtained compounds serve as a precursor to producing a varietyof commodity chemicals as well as fuel both. In this regard, synthesis of EL from HMFin the presence of inexpensive metal salts have been demonstrated. The reactionmechanism illustrated the overall EL synthesis from HMF proceeds via EMF formation.Therefore, another novel process has been developed and patented for the selectivesynthesis of EMF from carbohydrates in the presence of dichalcogenides. Alternatively,EL synthesis from the biomass-derived and commercially available levulinic acid havebeen explored. For this purpose, novel heterogeneous catalysts have been prepared viawet impregnation method using Keggin type silicotungstic acid and zirconium dioxidesupport. Subsequently, synthesized catalyst has been characterized using XRD, FT-IR, Raman spectroscopy, BET surface area analyzer, Ammonia TPD, FESEM, TEM, andHR-TEM. After that, production of ethyl levulinate in a microwave reactor usingsynthesized catalyst have been explored. Eventually, a suitable kinetic model has beendeveloped to calculate the activation barrier for EL formation from the levulinic acid inthe presence of zirconia supported Keggin type silicotungstic acid.

Keywords: Green Catalysis, Biofuel, Biomass Conversion

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Prospect of biopolymer derived hydrogel for controlled environment agriculture

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Abstract

Hydrogel derived from naturally occurring biopolymers (e.g. cellulose,lignin, alginate) can be widely deployed for agriculture applications. The waterabsorbing quality and water retention property of hydrogel makes it a suitablecandidate in arid and semi-arid conditions. The presence of the biopolymerpromotes the plant growth and it can act as a possible growth medium for controlledenvironment agriculture. Biopolymer derived hydrogels can help to regulate thewater content, flow of nutrient according to various other dependent variable likeambient temperature, pH of the soil and presence of nutrients. The effectiveness ofthe hydrogel largely depends upon the porosity, toxicity and other chemicalproperties. Thus hydrogel can act as a proper management tool to develop physic-chemical and biological properties in controlled environment agriculture. Thechoice of the biopolymer as the precursor of hydrogel is also crucial and thoroughexamination should be carried out prior to the application. The optimumconcentration of biopolymer in hydrogel should be analyzed in the plant growth fora particular plant subjected to environmental condition.

Keywords: Biopolymer; Hydrogel; Controlled environment agriculture; Growth medium

SCHEMCON-2020

Integrated Membrane Processes for Radioactive Effluent Treatment in Nuclear Industry

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Abstract

Integrated Membrane Processes (IMP) play a crucial role in implementing processintensification practices in the industry to meet the demand for effective separation with less energy consumption, cost-effective design, and safe practices. Different membraneprocesses with varying configurations serve the multipurpose need in improving quality,quantity, and capacity with effluent treatment and recovery of valuables. In the nuclearindustry, large volumes of medium level (10 kBq/l), and low level (0.1 kBq/l)radioactive waste that consists of alpha (Np, Pu) and beta (I, Zr, Se, Cs, Sr) emittersneeds to be treated and separated before its disposal. Conventional separation methodscan be replaced with IMPs such as, Liquid Membranes (LM), Ultrafiltration (UF),Reverse Osmosis (RO), Membrane Distillation (MD), etc. that requires less chemicals,offer better volume reduction, and with high selectivity. Application of MF+RO was
used for treating radioactive waste with 95% of water recovery. Hybrid processes ofRO+MD, evaporation+RO that use waste heat from the nuclear plant, and are reliablefor small scale operation. IMPs offer improvement in the techno-economical, energeticanalysis of various case studies. This study gives a brief review on the applicability ofIMPs in the nuclear industry with a framework for the futuristic aspect of them.

Keywords: membrane processes; nuclear industry; radioactive effluent treatment

SCHEMCON-2020

Cavitation induced treatment of wastewater: The current state of knowledge

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Abstract

Tremendous stress on water sources has led to a situation where there will be a 55%upsurge of water demand, globally, by 2050. Sustenance of limited water availability canbe addressed by focusing on recycling and reuse of wastewater. In this regard, this is theneed of the hour for a sustainable, cost-effective and safe solution for water management.Thus, the current work explores hydrodynamic cavitation (HC) as a promising treatmenttechnology coupled with other advanced oxidation processes for effective degradation ofemerging water pollutants. The authors have focused on treatment of surfactants, dyes,antibiotics and real life greywater streams discharged from kitchen sinks. A systematicapproach has been adopted for all the treatment schemes whereby the following modusoperandi were taken: (i) selection of a cavitating device for HC treatment (ii) optimizationof operating parameters (iii) influence of oxidizing agents on treatment efficiency (iv)energetics and economics of the treatment scheme. The results indicate that HC inducedadvanced oxidation process is efficient in reduction of more than 75 % organic content,around 60% dye degradation, more than 90% antibiotic degradation and almost 100 %
surfactant degradation. Encouraging results at laboratory scales can help in providingscaled up solutions both for domestic and industrial applications.

Keywords: Hydrodynamic cavitation; Advanced oxidation process; Surfactants;Antibiotics; Dyes; Greywater

SCHEMCON-2020

Development of Capacitive Graphene Oxide Flow Electrode for Salt Recovery

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Abstract

Capacitive Deionization (CDI) is an emerging new technology for removal of ionic aswell as polarizable species from water/wastewater. This CDI is an alternative to flashevaporation for recovery of salts from RO reject with low operational cost and enhancedenergy efficiency. In recent time, Flow Capacitive Deionization, FCDI has beenconsidered one of the emerging and alternative techniques for conventional saltremoval. We have developed a graphene oxide flow electrodes, flow CapacitiveDeionization unit. The FCDI has been tested for salt recovery from domestic RO reject.The results are quite encouraging. The process operating parameters such as initial salt(NaCl) concentrations, effect of permeate flow rate, effect of flow electrode weight havebeen extensively varied to study the efficiency of slat recovery. The efficiency, optimalwt%, optimal flow rate, water recovery for activated carbon and graphene oxide flowelectrodes was found to be 85, 7%, 0.7 ml/min, 73% and 97, 5%, 0.7 ml/min,73%respectively. The result shows the better performance efficiency of graphene oxide flowelectrodes and the further application of desalination in industrial scale.

Keywords: FCDI; Graphene oxide; Desalination

Power of Graphite for Green Chemical Process Industry

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Graphite
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