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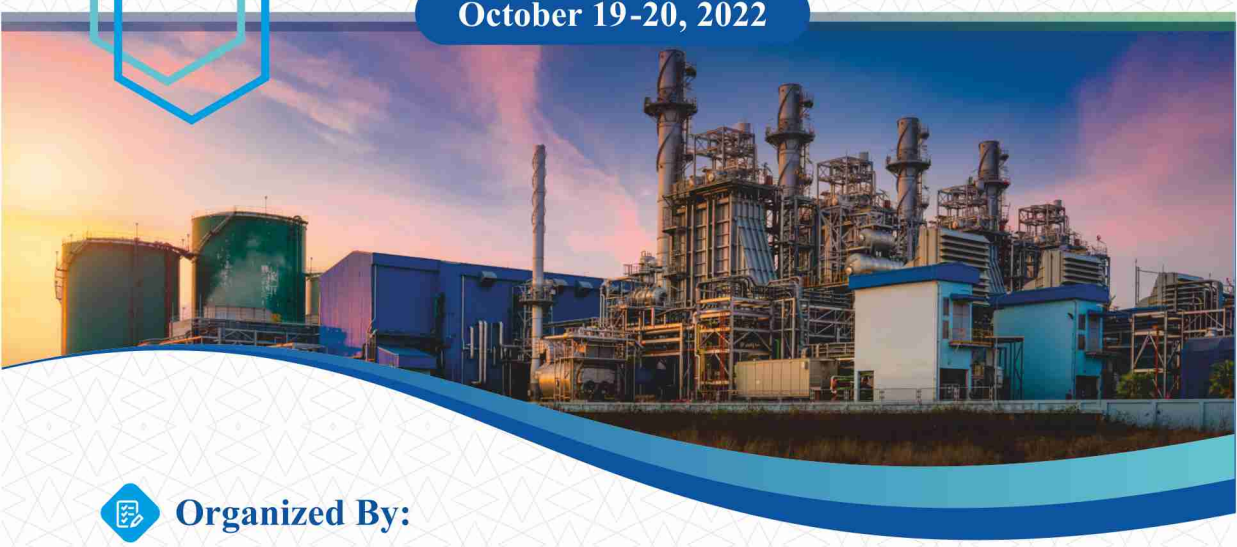
Sixth International Conference on

SUSTAINABILITY IN PROCESS INDUSTRY (SPI-2022)

SPI-2022
SUSTAINABLITY IN PROCESS INDUSTRIES

October 19-20, 2022



Organized By:

DEPARTMENT OF CHEMICAL ENGINEERING
UNIVERSITY OF ENGINEERING & TECHNOLOGY (UET), PESHAWAR
&
DEPARTMENT OF CHEMICAL ENGINEERING
GHULAM ISHAQ KHAN INSTITUTE (GIKI) SWABI

Sixth International Conference on
SUSTAINABILITY IN PROCESS INDUSTRY
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October 19 -20, 2022

Jointly Organized by

Department of Chemical Engineering
University of Engineering & Technology, Peshawar, Pakistan

&

Department of Chemical Engineering
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PREFACE

There has never been a time where the need for sustainability has been felt as profoundly as is evident from the global events of today. The global geo-political situation, emergence of new world players, decline in influence of current super powers, struggle for controlling the worlds resources, emergence of new economic blocks, utilization of resources to their optimum in today's changing world all dictate that our survival lies in a renewed strategy to use our limited resources especially in a sustainable way. Hence the new industrial, social, cultural, and environmental scenarios have to be analyzed and new strategies are to be devised so as to make our living sustainable. This need has been felt and thought after since last two decades and recognized in our Department which plays a vital role in indigenous and global research to contribute towards the sustainable development of Pakistan in the areas of vital importance such as process industries, use of natural resources, recycling, and reuse.

This international event of **"***Sustainability in Process Industry (SPI-2022)***"** (October 19-20, 2022) hosted by the Department of Chemical Engineering, University of Engineering and Technology Peshawar in collaboration with the Department of Chemical Engineering GIKI Swabi, has been a regular bi-annual event attracting the cutting-edge research from the renowned researchers of both national and international repute since its first inception in 2012. The conference has been an on-campus participating event, while in 2020 due to COVID-19, the conference was held online for the first time, and this year we are collaborating with the GIKI Swabi to expand our collaboration with the local universities.

The First conference on "*Sustainability in Process Industry (SPI-2012),* was held at UET, Peshawar on March 28, 2012, second conference on "*Sustainability in Process Industry (SPI-2014)*", on May 22, 2014, in this series third conference on "*Sustainability in Process Industry (SPI 2016)*" was held on October 19-20, 2016 while fourth conference on "*Sustainability in Process Industry (SPI 2018)*" was organized on October 24-25, 2018 with the

support of Higher Education Commission (HEC), Frontier Works Organization (FWO), and in collaboration with PASTIC. The Fifth conference on "*Sustainability in Process Industry (SPI 2020)*", was held online on our Department's Silver Jubilee (1995-2020), utilizing indigenous resources. This year the Sixth conference on "*Sustainability in Process Industry (SPI 2022)*", is going to be arranged in GIKI Swabi with collaboration of the Department of Chemical Engineering, GIKI.

Prof. Dr. Muddasar Habib
Conference Chair (UET)

Prof. Dr. Javaid Rabbani Khan
Conference Chair (GIKI)

ACKNOWLEDGEMENT

It is our great pleasure to welcome you to the SPI-2022 6th international conference of the series, "*Sustainability in Process Industry (SPI-2022)*". Putting together SPI-2022 was a team effort. We greatly appreciate all the authors/researchers for providing the content of the program in the form of oral presentations and the other participants. We are also grateful to the keynote speakers from academia and various industries. These valuable talks can and will guide us to a better understanding of "Sustainability in Process Industry".

We also thank the host organization, UET, Peshawar, GIKI Swabi and our generous sponsors PASTIC, FES and LOT without their support it would have not been possible to hold this conference.
We are grateful to all organizers, who worked hard in order to make the conference successful.

ABOUT PASTIC (CO-SPONSOR)

Pakistan Scientific & Technological Information Centre (PASTIC) is a subsidiary organization of Pakistan Science Foundation (PSF), under the umbrella of Ministry of Science and Technology (MoST). PASTIC is a specialized premier organization in the field of S&T information handling and dissemination responsible for catering to information needs of R&D and industrial community across the country. The PASTIC National Centre is housed at Quaid-e-Azam University Campus, Islamabad having a network of 6 Sub-Centres at Karachi, Lahore, Peshawar, Quetta, Faisalabad and Muzaffarabad.

To begin with PASTIC supported research community across the country when S&T research infrastructure in Pakistan was at a nascent stage and provided facilities including supply of scientific and technical documents, abstracts and indexes, bibliographies, translations, patent information and patent indexes, science reference library service, technological information transfer service, dissemination of computer-based information services, reprographic and publication services.

OBJECTIVES

- National S&T/R&D Information Repository of indigenous information resources (databases).
- S&T/R&D information dissemination through contemporary reference information tools.
- Strengthen National Science Reference Library through resource sharing.
- Promotion of R&D based industrial development.
- Facilitate printing of S&T/R&D Publications.
- Capacity Building of researchers, entrepreneurs & librarians.
- Develop collaborations with local & gloabl information networks.

ACTIVITIES/FUNCTIONS

PASTIC Online databases

- *Pakistan Science Abstracts (PSA):* National research published in Pakistani S & T Journals & Conference Proceedings etc.

— *PakCat:* Union online Public Access Catalogue (OPAC) of Books available in Science and technology Libraries of Pakistan.
— DSpace full text digital repository of indigenous S&T literature.
— *Database of R & D Projects* executed in Pakistan.
— *National Scientists Directory* (NSD)
— *Directory of Scientific Periodicals of Pakistan* (DSPP)
— Industry related databases.

S &T Publications

— *Technology Roundup:* Bi-monthly bulletin provides repackaging of latest global Trade and Technology information.
— *Union Catalogue:* Provide information on research materials (books/journals/conference proceedings/reports, etc) available in different S&T libraries of Pakistan.
— *Abstract Books of National Conferences:* PASTIC supports publication/printing of Abstract Books organized by various S&T universities (on request).

Promotion of Commercializable Technologies & Industrial Products

Organize STEM and IT Expo to promote local Research and Development, SMEs, technologies/products/services/industrial R&D challenges/issues as well as empowering youth and general public on new and faster ways of delivering and accessing information.

National Science Reference Library Facility

A state-of-the-art Traditional Library facilitating the researcher through following services: Reference & Referral Services; Reader Service; Internet Service, Journal Listings; Photocopying & Scanning Services.

Human Resource Development (Capacity Building)

Organize Seminars/Workshops /Trainings/ for capacity building of:

— Young Researchers on Data Analysis, Reference Management Tools (SPSS, EndNote, Mendeley) etc.
— Women Entrepreneurs on e-marketing and e business skills
— Library Professionals on Library Information Management Tools & techniques (Koha, D-space etc.)
— Researchers and entrepreneurs on Intellectual Property Rights, Media Information Literacy
— Scientific Community on latest health issues e.g., Breast cancer, COVID, Hepatitis etc.

CO-SPONSORS

FES Higher Education Consultants is a leading consultancy firm providing quality education services all over Pakistan to students wishing to study abroad. FES Study Abroad Consultants was established in 2003 to provide reliable and value-added education consultancy services to students who wish to pursue further education in foreign universities with the help of our foreign study specialists.

Incorporated in 2011, LOT is a leading developing Supplier of a range of Products and Services specifically designed for the Upstream Oil and Gas Industry. Our Team of Oilfield Professionals endows us with the knowledge and ability to provide our clients with the customized Technical Solutions, along with the added benefit of strong Industry Networking all across the Middle East and North Africa Regions.

CONFERENCE PROGRAM

Time	1st Day (October 19, 2022) Auditorium GIKI, Swabi
09:00- 10:00	**Registration**
Inauguration Ceremony	
10:00- 10:10	Recitation from the Holy Quran
10:10- 10:20	Welcome address by Prof. Dr. Javaid Rabbani Khan (*Conference Chairman, GIKI*)
10:20- 10:30	Welcome address by Prof. Dr. Muddasar Habib (*Conference Chairman, UET*)
10:30- 10:40	Opening Remarks by Prof. Dr. Sahar Noor (*Dean, Faculty of Mechanical, Chemical and Industrial Engineering*)
10:40- 10:50	Opening Remarks by Prof. Dr. Fahd Nawaz Khan (*Dean, Faculty of Materials and Chemical Engineering, GIKI Swabi*)
10:50- 11:05	Address by Prof. Dr. Iftikhar Hussain (*VC, University of Engineering and Technology, Peshawar*)
11:05- 11:20	Address by Prof. Dr. Fazal Ahmad Khalid (*Rector, GIKI Swabi*)
11:20- 11:35	Address by Chief Guest: Prof. Dr. M. Akram Shaikh (*DG, PASTIC*)
11:35- 11:55	Plenary Lecture-01 by Guest of Honor: Mr. Jehangir Piracha (*Engro Chemicals*)
11:55- 12:15	Plenary Lecture-02 by Prof. Dr. Najma Memon *(National Centre of Excellence in Analytical Chemistry, University of Sindh)* Black Phosphorus and its Nano-composite materials for high performance super capacitor
12:15- 01:15	**Tea and Prayer Break**

1st Day (October 19, 2022) **Technical Session 1 (Room 1)** **Theme: Material Engineering-1**			
Session Chair: **Prof. Dr. Abdul Shakoor** Session Co-Chair: **Dr. Hayat Khan**			
1:20-1:40	KN-01	Prof. Dr. Abdul Shakoor	Advanced Materials
1:40-1:55	ME-01	Muhammad Amir Hamza (*UET, Peshawar*)	Use of Organic and Inorganic Phase Change Materials for Personalized Cooling Systems
1:55-2:10	ME-02	Farhan (*UET, Peshawar*)	Processing of Reduced Graphene Oxide Reinforced Ultra High Molecular Weight Polyethylene for Orthopedic Implants
2:10-2:25	ME-03	Mudassir Jalal Shah (*UET, Peshawar*)	Use of Nano indentation to determine Surface Mechanical Properties of Modified Ultra-High Molecular Weight Polyethylene
2:25-2:40	ME-04	Muhammad Umar (*GIKI, Topi*)	Adsorption of dye onto superabsorbent hydrogel: Synthesis, characterization, and isotherm analysis
1st Day-(October 19, 2022) **Technical Session 2 (Room 2)** **Theme: Material Engineering-2**			
Session Chair: **Dr. Muhammad Yasir Khan** Session Co-Chair: **Dr. Jamil Ahmad**			
1:20-1:40	KN-02	Dr. M. Yasir Khan	Current Advancements in Nanomaterials for Underground Drinking Water and Industrial Wastewater Treatment
1:40-1:55	ME-05	F. S. Hussain (*NCEAC, Jamshoro*)	Hydrophobic, nano-scaled metallic coated fabric for defense against viral spreading
1:55-2:10	ME-06	Sidra Khan (*NCEAC, Jamshoro*)	Preparation and Modification of Ni-Al layered double hydroxide (LDH) in Decontamination of 4-nitrophenol
2:10-2:25	ME-07	M. Irfan Khan (*CECOS, Peshawar*)	Effects of Variation in Indentation Load & Dwell Time on the Vickers Microhardness of Ti 6Al 7Nb

2:25-2:40	ME-08	Muhammad Saqib Ali (*University of Karachi*)	The development of a nanomaterial-based electrode of chemical sensor for the detection of heavy metals in underground drinking water
1st Day (October 19, 2022) Technical Session 3 (Room 3) Theme: Material Engineering-3			
Session Chair: **Prof. Dr. Tanveer Iqbal** Session Co-Chair: **Dr. Nehar Ullah**			
1:20-1:40	KN-03	Dr. Tanveer Iqbal	Advanced Materials
1:40-1:55	ME-09	Asfand Shahab (*MUET, Jamshoro*)	Corrosion Inhibition of Methionine as a Green Corrosion Inhibitor for Carbon Steel in the Presence of Methanol and Monoethanolamine
1:55-2:10	ME-10	M. Hayat (*UET, Taxila*)	Po Polyester based heat resistant tiles
2:10-2:25	ME-11	Haseeb Ullah (*UET, Taxila*)	Coating Copper Substrate with Polyester Coating and Its Corrosion Analysis for Heat Exchanger Based Applications
2:25-2:40	ME-12	Asad Meer (*UET, Taxila*)	Thermal Characterization and Performance Analysis of Epoxy-based Composite and its Application on Steam Pipes
2:40-3:40	**Lunch Break**		
1st Day-(October 19, 2022) Technical Session 4 (Room 1) Theme: Membrane Separation & Water Treatment			
Session Chair: **Dr. Khurram Shahzad Baig** Session Co-Chair: **Prof. Dr. Saeed Gul**			
3:40-4:00	KN-06	Dr. Khurram Shahzad Baig	Sustainable Technologies
4:00-4:15	MS-21	M. Danish Javed (*GIKI, Topi*)	Surface modification and overall performance enhancement of hybrid biocompatible hemodialysis (HD) membrane
4:15-4:30	MS-22	Hikmat ullah (*UET, Peshawar*)	Filtration of selected dyes using Ti3AlC2 based composite membrane

4:30-4:45	MS-23	Maryam-Munir (*UET, Peshawar*)	Usage of Nano-Filtration Membrane for The Large-Scale Production of Sustainable Water Supply in Rural Areas
4:45-5:00	MS-33	Muhammad Idrees (*MUET, Peshawar*)	Comparative study of CO_2 absorption performance of different frothing agents by process simulation
1st Day-(October 19, 2022) Technical Session 5- Room 2 Theme: Future challenges and Sustainability			
Session Chair: **Prof. Dr. Tauseef Salma (Online)** Session Co-Chair: **Dr. Hammad Khan**			
3:40-4:00	KN-05	Dr. Tauseef Salma	Future challenges, opportunities and mitigation pathways to achieve sustainability
4:00-4:15	WWM-17	Muhammad Ilyas (*UET, Peshawar*)	Performance evaluation of MXenes Used for Removal of Heavy Metals from Aqueous Stream
4:15-4:30	WWM-18	Azfar Zaman Khattak (*UET, Peshawar*)	Use of Ionic Liquid to Eliminate Heavy metal from aqueous solution
4:30-4:45	WWM-19	Hina Sarwar (*UET, Peshawar*)	Studying the effects of utilizing Pet Coke and Carbon Powder as an Alternative Fuel in Cement Kiln
4:45-5:00	WWM-20	Khalid Afridi (*UET, Peshawar*)	Enhancing efficiency and stability of non-toxic Pb-free $MASnBr_3$ PSC with $CuAlO_2$ as inorganic p-type semiconductor by using 1D-SCAPS
1st Day-(October 19, 2022) Technical Session 6 (Room 3) Poster Session			
3:40-5:00	P-1	Syed Mubashir Shah (*University of Karachi*)	Physical & Biological Treatment of Drinking Water using graphene based Nanomaterials/Nanostructures
	P-2	Ghulam Qamber (*University of Karachi*)	Hybrid n-ZnO nanorods/p-polymer Blue Light Emitting Diodes Based on Low Temperature Solution Processed Nanostructure

	P-3	Muhammad Usama (*University of Karachi*)	Fabrication of nanomaterial adsorbents for color removal and enhancement of the physical and biological properties of sugar distillery wastewater
	P-4	Sumbal (*University of Peshawar*)	Efficient Photodegredation of Methl Violet Dye Using N/S Codoped Graphene Hydrogel Photocatalyst for Wastewater Treatment
	P-5	Kiran Fouzia (*University of Peshawar*)	Polyaniline- (PAni-Rare earth metal oxide) coated graphene oxide as counter electrodes for dye-sensitized solar cells
	P-6	Aminah Bibi (*GIKI, Swabi*)	Synthesis of ecofriendly geopolymer for the removal of an AZO dye from textile wastewater
	P-7	Himayat Khalil (*University of Peshawar*)	Binary and ternary composites prepared from reduced graphene oxide coupled with zinc and nickel oxide nanoparticles as room temperature ammonia sensor
2nd Day (October20, 2022) **Technical Session 7 (Room 1)** **Theme: Waste management and Water Treatment Technologies**			
Session Chair: **Dr. Imran Ahmad (Online)** Session Co-Chair: **Dr. Mansoor ul Hassan**			
9:30-09:50	KN-04	Dr. Imran Ahmad (*Online*)	Vanadium based materials for electrochemical energy storage in multivalent ion batteries
9:50-10:05	WMT-13	Sundus Khushnood (*GIKI, Swabi*)	Utilization of Potato and Wheat Waste for Starch Synthesis along with Kinetic Study
10:05-10:20	WMT-14	Saeed ur Rahman (*UET, Peshawar*)	Effective separation of dye from wastewater using Ionic liquid
10:20-10:35	WMT-15	Muhammad Qasim Gul (*UET, Peshawar*)	Heavy metals accumulation in soil via wastewater irrigation: analysis and possible solution
10:35-10:50	WMT-16	Abdul Ahad Khan (*NUST, Islamabad*)	Removal of Chromium (VI) from textile industry

			wastewater by developing algal-derived biochar adsorbent using slow pyrolysis process
2nd Day-(October20, 2022) Technical Session 8-Room 2 Theme: Waste Management and Utilization			
Session Chair: **Dr. Sajjad Ullah** Session Co-Chair: **Dr. Usman Farooq**			
09:30-09:50	KN-07	Dr. Sajjad Ullah	Analytical Chemistry
09:50-10:05	WMU-25	M.A. Sarwar, A. Ullah (*UET, Peshawar*)	The influence of interfacial tension on separation for oil/water system
10:05-10:20	WMU-26	Hira Amin (*PIEAS, Islamabad*)	Finding optimal processing pathway for the conversion of MSW into energy and valuable products in Pakistan
10:20-10:35	WMU-27	Abdul Wahab Khan (*UET, Peshawar*)	Utilization of the dairy farms waste for biogas production; a source of free energy, fertilizer, & saving gallons of water otherwise needed for cow dung disposal
10:35-10:50	WMU-28	Hamza Ahmad (*UET, Peshawar*)	Unplasticized polyvinyl chloride (UPVC) pipe industry of Pakistan: few suggestions to improve the finishing and the strength of the pipes while reducing the production cost
2nd Day (October20, 2022) Technical Session 9 (Room 3) Theme: Petrochemicals			
Session Chair: **Dr. Salman Naqvi** Session Co-Chair: **Dr. Muazzam Arshad**			
09:30-09:50	KN-08	Dr. Salman Naqvi	Carbon dioxide capturing
9:50-10:05	PET-29	M. Hamza Naeem (*UET, Peshawar*)	Current practice for handling the waste lubricating oil in Pakistan, is there any improvement possible in the treatment processes, and a proposed procedure for the disposal of produced sludge.

10:05-10:20	PET-30	Nadeem Shah (*UET, Peshawar*)	Carbon dioxide absorption for gaseous fuel up-gradation application
10:20-10:35	PET-31	Muhammad Usman (*UET, Peshawar*)	Effects of Different Medium on the Corrosion of Crude Oil Storage Tank Bottom Plate and Remedial Actions for its Life Enhancement
10:35-10:50	PET-32	Abdul Waheed (*NUST, Islamabad*)	Impact of co-torrefaction on the fuel characteristics of rice husk, coffee bean ground and their blends
2nd Day (October20, 2022) Technical Session 10 (Room 1) Theme: Numerical Modelling			
Session Chair: **Dr. Atta Ullah** Session Co-Chair: **Dr. Irshad Ali**			
11:00-11:20	KN-09	Dr. Atta Ullah	Modelling and simulations
11:20-11:35	NM-34	Muhammad Ismail (*USPCAS, UET Peshawar*)	Numerical Modelling of Formamidinium tin iodide perovskite solar cell using Scaps-1D
11:35-11:50	NM-35	Asfand Yar Ali Khan (*USPCAS, UET Peshawar*)	Numerical Modeling and Analysis of Inorganic Germanium Perovskite Solar Cell with ZnSe and CMTS Charge Transport Layer
11:50-12:05	NM-36	Rabia Khaliq (*SBBWU, Peshawar*)	Radial basis function method for the fractional magnetohydrodynamics flow of prandtl fluid
12:05-12:20	NM-51	Muhammad Asim (*MUET, Jamshoro*)	Isolated Bubble Ascent in a non-Newtonian media inside an Infinite Bubble Column: A CFD Study
12:20-12:30	NM-40	Hassan Nawaz (*UET, Peshawar*)	Simulation of CO_2 Absorption for Biogas application using Aspen Plus

2nd Day (October20, 2022) **Technical Session 11 (Room 2)** **Theme: Modelling and Simulations**			
Session Chair: **Dr. Iftikhar Ahmad** Session Co-Chair: **Dr. Shozab Mehdi**			
11:00-11:20	KN-10	Dr. Iftikhar Ahmad	CFD simulations applications and Exergy
11:20-11:35	M&S-37	Javeriya Gul (*SBBWU, Peshawar*)	Impact of fractional Magneto-hydrodynamic and Hall current on Ree-Eyering fluid flow by using radial basis function method
11:35-11:50	M&S-38	Khalid Saif Ullah (*PIEAS, Islamabad*)	CFD analysis of hydrogen production in a membrane steam methane reformer for an on-site hydrogen refueling station (HRS)
11:50-12:05	M&S-39	Haroon (*LUMS, Lahore*)	Process development for cost-effective dehydration of macroalga-derived bioethanol via techno-economic assessments
12:05-12:20	M&S-41	Kaleem Ullah *(NUST, Islamabad)*	Comparative analysis of chemical process simulation using open source and commercial software
2nd Day (October20, 2022) **Technical Session 12 (Room 3)** **Theme: Sustainable Processes**			
Session Chair: **Dr. Erum Pervaiz** Session Co-Chair: **Dr. Naseer Ahmed Khan**			
11:00-11:20	KN-11	Dr. Erum Pervaiz	Sustainable processes
11:20-11:35	SP-42	Shafiq Uz Zaman *(GIKI, Swabi)*	Synthesis of Ammonium Persulfate/Glycerol based Novel Deep Eutectic Solvent under controlled conditions; Characterization, Physical Properties
11:35-11:50	SP-43	Zeeshan Khan *(USPCAS, UET Peshawar)*	Investigating the optical and electrical properties of non-toxic MASnI3 solar cell with kesterite and zinc-based charge transport layers

11:50-12:05	SP-44	Muhammad Shaheer *(UET, Peshawar)*	Comparative analysis of Hydrogen production through different ionic liquids
12:05-12:20	SP-45	Iatizaz Hassan *(UET, Peshawar)*	Emissions of black plumes from chimneys of indigenous brick kilns; a plain analysis of the blackish part of the smoke
12:20-12:35	SP-50	Faiz Ahmad Abro *(MUET, Jamshoro)*	Experimental Study of Physicochemical Properties of Aqueous Salt of Threonine blended with Mono-ethanolamine Used as a Solvent for CO_2 Capture
2nd Day (October 20, 2022) **Technical Session 12 (Room 1)** **Theme: Sustainable Processes for reducing Carbon footprints**			
Session Chair: **Dr. Masroor Abro** Session Co-Chair: **Dr. Asmat Ullah**			
12:30-12:50	KN-12	Dr. Masroor Abro	Investigation of hydrodynamic parameters and bubble characteristics in CO_2 absorption column
12:50-1:05	SPC-46	Muhammad Muqaddam Javaid *(PIEAS, Islamabad)*	Economic optimization of dual effect absorption refrigeration system using correlations for heat transfer coefficient
1:05-1:20	SPC-47	Waqar Ahmad *(USPCAS, UET Peshawar)*	Investigating the effect of Charge Transport Layers on Germanium based Perovskite Solar Cell
1:20-1:35	SPC-48	Muhammad Aneeq *(USPCAS, UET Peshawar)*	Performance Enhancement of FAPbI3 perovskite solar cell with kesterite and ZnO charge transport layer
1:35-1:50	SPC-49	Muhammad Noman *(UET, Peshawar)*	Indigenous Development of Low-Cost Electroluminescence Imaging Setup for Reliability Analysis of Photovoltaic Modules

2nd Day (October20, 2022) Technical Session 13 (Video Conference Hall) Theme: Chemical Engineering Science			
Session Chair: **Dr. Guichao Wang (China)** Session Co-Chair: **Dr. Saira Bano**			
12:30-12:50	KN-12	Dr. Guichao Wang	Modelling and Simulations
12:50-1:05	CS-58	Dr. Imran Rind *(University of Sind, Jamshoro & Turkey)*	Comparative study of Pb(II) and Cd(II) sorption onto thermally activated mango peels hydrochar
1:05-1:20	CS-59	Bianca Mortari *(São Paulo State University, Brazil)*	Development of an optical sensor based on QD@MIP for the detection of sulfadiazine in samples of animal products.
1:20-1:35	CS-60	Sohail *(USA)*	Simulation of a continuous fluidized bed separator for mono-component species
1:35-1:50	CS-61	Hasna Abeer *(UET Peshawar)*	A short review on enhancing the heat transfer coefficient in concentric tube heat exchanger
1:50-2:00	CS-62	Zakria *(UET Peshawar)*	Iron ore beneficiation using gravity separation techniques
2:00 - 3:00	**Lunch Break**		
3:00-3:20	Plenary Lecture - 3 by Engr. Fazli Ameen (*GM, Fauji Cement Wah*)		
3:25-3:45	Plenary Lecture - 4 By Prof. Dr. Asif Ali Qaiser (*Chairman, Polymer Engineering Dept., UET Lahore*)		
Closing Ceremony			
3:50-3:55	Recitation from Holy Quran		
3:55-4:10	Wrap-up by Prof. Dr. Muddasar Habib		
4:10-4:25	Award Distribution		
4:25-4:35	Vote of thanks by Prof. Javed Rabbani		
4:35-4:45	Closing Remarks		
4:45-4:55	Group Photos		
5:00-5:30	**High Tea**		

ABSTRACTS

(Plenary, Keynote, and Invited Talks)

Black Phosphorus and its nano-composite materials for high performance supercapacitor

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Black phosphorus (BP) in its 2D form shows high hole mobility (≅1000 cm2/V.s) which is comparable to other p-type semiconductors. BP is reported as efficient material in developing transistors and capacitors for modern electronics. However, instability of black phosphorus in aqueous solutions renders its utilization for real world. Herein, we report bulk black phosphorus and black phosphorus quantum dots/nitrogen deficient graphitic carbon nitride (BPQD's/ ND-g-C3N4) nanocomposites blended with polyaniline. Black phosphorus (BP) was synthesized by liquid exfoliation method from red phosphorus using ultra-sonication process followed by dialysis to obtain black phosphorus quantum dots. ND-g-C3N4 was then added into ethanolic solution of BPQD to develop composite of the two. Resulting materials was characterized for structural/surface morphology. To evaluate the capacitive performance, polyaniline binder was used for the fabrication of electrode with the composition of 85% BPQD's/ ND-g-C3N4 10% PANI and 5% activated carbon. Electrochemical characterization of material was done by cyclic voltammetry and electrochemical impendence spectroscopy using three electrode system using NaOH (1M). Prepared electrode showed maximum and minimum specific capacitance obtained 541.34 F g-1 at the scan rate 0.4V and 431.68 F g-1 at 1V respectively and stability of BPQD's/ ND-g-C3N4 electrode is achieved as 1000 cycles per single electrode.Composting of BPQDs with ND-g-C3N4 and PANI resulted in good specific capacitance and remarkable cyclic stability in alkaline aqueous solution.

Keywords: Black phosphorus composite, BPQDs composite, electrochemistry BP, Stable capacitive electrode, ND-g-C3N4.

Vanadium based materials for electrochemical energy storage in multivalent ion batteries

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We can imagine the disastrous consequences of climate change triggered by fossil-fuel based economy and our every increasing desire for a luxurious life style demanding exponential growth in energy supply and consumption. Recent shift towards renewable energy technologies, to mitigate the environmental impacts of carbon based energy supply chain, may be sustained with energy storage technologies such as electrochemical energy storage. Lithium ion batteries despite being the premium electrochemical energy storage devices may not be able to fulfil the future demands of energy storage due to limited resources. Therefore, post-lithium batteries such as multivalent aluminum, calcium, magnesium, sodium, and zinc ion batteries are being explored and commercialized. This work explores vanadium based cathode materials for zinc ion batteries as low cost and environmentally more benign electrochemical energy storage systems. Our focus is to relate material properties obtained from simple synthesis methods such as molten salt and sol gel method with electrochemical performance in multivalent ion batteries.

Keywords: Vanadium; vanadium based materials; cathode materials; multivalent batteries; zinc ion batteries.

Current Advancements in Nanomaterials for Underground Drinking Water and Industrial Wastewater Treatment

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In recent decades, the development of new and innovative technologies has resulted in a very high amount of effluent and major impurities in underground drinking water. Industrial waste, which contains a wide range of industries, is the main source of drinking water pollution. Organic and inorganic pollutants, heavy metals, and non-dissolving materials are some of the pollutants found in wastewater and drinking water. This pollution is dangerous for the environment. As a consequence, novel and innovative methods and technologies must be introduced to eliminate

them. Nanomaterials have increasingly been suggested as a promising pollutant-removal solution.A range of low-cost nanomaterials with unique properties is now available. Nano-absorbents are excellent material in this context. In both underground and surface streams, heavy metal contamination is common. Numerous research has recently focused on the removal of heavy metals, the focus of the present landmark study is on the use of nanomaterials to remove pollutants in drinking water and industrial effluents.

Keywords: Drinking water, Impurities, heavy metals, pollution

Investigation of hydrodynamic parameters and bubble characteristics in CO_2 absorption column

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For first time, bubble size distribution, bubble shape, bubble orientation, mean bubble size (d_{32}), gas holdup and interfacial area in pure IL [BMIM][BF4] were compared with those in its binary mixtures with MEA and MeOH. Experiments were performed in small-scale cylindrical bubble column with a porous sparger using a high-speed image capture system. Further, to investigate effects of sparger pore size, column diameter, temperature and gas flow rate, experiments were performed employing gas-pure IL system. Compared with pure IL, d_{32} in binary mixtures was smaller, which decreased with increasing MEA or MeOH concentration, whereas, gas holdup and interfacial area were increased. MeOH exhibited profound effect as compared to MEA. In gas-pure IL, sparger pore size and temperature significantly influenced on aforementioned parameters. Correlations were proposed for predicting d_{32} and gas holdup in pure IL for two different column sizes, which demonstrated their applicability in higher column dimensions and scaling-up.

Keywords: Bubble column, Binary Mixtures, Bubble size, CO_2 capture system, Ionic Liquid, Hydrodynamics.

Indigenous Development of Low-Cost Electroluminescence Imaging Setup for Reliability Analysis of Photovoltaic Modules

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With increasing use of photovoltaic (PV) modules, their reliability is a matter of keen interest for the research community as well as the manufacturers. Different techniques have been utilized for the reliability analysis of the PV module such as the use of IV/PV curve tests, electroluminescence (EL), photoluminescence (PL), and infra-red (IR) imaging. Amongst them, EL imaging, which can effectively determine defective regions (inactive areas) in the modules, is a commonly used tool on the commercial level. This paper presents the development of a low-cost EL imaging setup for PV modules. A commercially available DSLR camera was modified into a specialized EL camera by using an IR filter. EL imaging was performed in a dark environment to avoid stray light from entering the testing area. The pre and post-processing of the images obtained by means of the setup were performed using MATLAB software. The development of the setup followed the use of standard operating conditions and international standard IEC 60904-13. The images obtained by the indigenously built setup were compared with those obtained by commercially available EL setup. The available EL setups in Pakistan are imported from abroad at high cost while this setup was developed using commercially available inexpensive components to make it economical, Furthermore, image analysis technique was applied on the EL images obtained through this setup. Cracks were detected manually as well as through image analysis in MATLAB.

Keywords: Electroluminescence Imaging, EL camera, Reliability Analysis, Low-cost EL Setup, Image Analysis.

CFD analysis of hydrogen production in a membrane steam methane reformer for an on-site hydrogen refueling station (HRS)

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Steam methane reforming is one of the most used methods for hydrogen generation. The use of a perm-selective membrane in the conventional steam methane reformer (SMR) is a promising technology to produce ultra-pure hydrogen under moderate operating conditions. The challenge in designing and scaling up the membrane SMR lies in the suitable selection of operating conditions. The objective of this research was to perform a detailed computational fluid dynamic (CFD) analysis of a membrane SMR unit for an on-site hydrogen refueling station (HRS) to get the optimum operating conditions. In this work, the global kinetic model of reforming reactions and the sievert's law for hydrogen permeation were coupled with CFD by writing user-defined functions (UDF) in C language. The developed model was validated with the experimental results and then a comprehensive analysis was performed to study the effects of gas hourly space velocity (GHSV), process gas inlet temperature, operating pressure, and sweep gas flow configurations. The obtained results predicted that the high process gas inlet temperature, the high operating pressure, and the low GHSV were advantageous, however, these factors must be carefully adjusted to achieve optimal efficiency. Furthermore, the simulation with a counter-current sweep gas flow configuration gave better results as compared to a co-current operation. The study's major observations and optimal operating parameters were explored to give insight into the aspects controlling overall performance.

Keywords: Alternate fuels, computational fluid dynamics, modelling.

Use of Organic and Inorganic Phase Change Materials for Personalized Cooling Systems

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Human body need comfort in every situation whether to work inside or out. Heat has a huge impact on human health. In Pakistan, during hot weather, the ambient air temperature rises due to which body of human feels tired and exhausted. People working outdoor in this severe environment like policemen, students, labourers which suffers badly from this heat related issues. This problem needs serious attention and a solution to overcome this issue because environment like in summer's scorching heat issues are very often to be seen in normal day life. There are many advanced options for interior thermal comfort and they all perform well. However, there has not been much progress in terms of outdoor thermal comfort. Phase Change materials (PCM) can solve this problem because it can change its phase from solid to liquid and liquid to solid with in restricted temperature range.

The wide use of PCM against heat stress for personal protection device is cooling hat and vest. PCM has the ability to store and release energy when outside temperature falls in it range. PCMs are also employed in many other industries like food, medicine, textile and also in solar energy cell. The cooling device which has PCM as a coolant is much cost effective, environment friendly and easy to use and can provide cooling for 2-3 hours with a less recharge time. If the PCM has high Latent heat and can absorb more heat than it can be used for prolong period. In this study different PCMs are explored and finally two PCMs are selected Polyethylene Glycol (PEG 600) and Glauber salt for cooling vest and cap. Their melting points comes in the range of human thermal comfort zone. Latent heat of fusion of PEG 600 and Glauber salt is 148 and 240 KJ / Kg respectively.

Keywords: Glauber salt, Phase change materials, Polyethylene Glycol 600.

Process development for cost-effective dehydration of macroalga-derived bioethanol via techno-economic assessments

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This paper investigates the economic potential of a macroalgal biorefinery considering three separation techniques for bioethanol dehydration, including, pressure swing distillation (PSD), extractive distillation (ED), and membranes (MEM). Rigorous process simulation models were developed in Aspen Plus for each of the aforementioned pathways to estimate mass and energy balances at a plant scale of 50 million gallons per year of bioethanol. In addition, wastewater and solid waste (fermentation residue) treatment were also considered to maximize circular economy and environmental sustainability. Regarding techno-economic assessment, a discounted cash flow rate of return analysis model was developed to calculate key economic indicators, such as net present value (NPV) and minimum ethanol selling price (MESP). Results showed that bioethanol dehydration via membranes is the most promising strategy, leading to an NPV of 145 million dollars while PSD is found to be the second to the best strategy for bioethanol dehydration with an NPV of 36 million dollars considering a project life of 20 years. Extractive distillation was found to be the worst pathway for bioethanol dehydration, leading to a negative NPV of -102 million dollars. Furthermore, MESP for PSD, ED, and MEM was calculated to be 2.35 $/gal, 3.08 $/gal, and 1.76 $/gal, respectively. Furthermore, our results show that biofuels are a sustainable energy source that can be employed at large scales reducing the negative environmental impact of fossil fuels.

Keywords: Macroalgae; Bioethanol dehydration; Process simulation; Techno-economic analysis

The influence of interfacial tension on separation for oil/water system

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The influence of interfacial tension between oil and water on permeation and rejection of oil drops during produced water treatment using a slotted pore metallic membrane has been evaluated. It was found that the rejection and permeation of oil drops through the membrane had a direct link with the interfacial tension experimentally and analytically. Oil/water emulsion with a range of interfacial tension (4 and 30 mN/m) were tested experimentally and analytically and a comprehensive set of data is presented. The higher interfacial tension between oil and water phases provided better rejection and lower permeation through the slots. The oil drops were assumed to be passing through slots by the drag force generated by the flow of the fluid passing around the drops. While the other force referred to as the static force tried to restore the spherical shape of the drops and plays an important role in the rejection of drops. The static force had a direct association with the interfacial tension. The drag force and the static force counter each other at every stage. The higher the drag force than the static force cause permeation of the drops, while, in the case of a higher static force than the drag force, rejection of drops was dominant.

Keywords: Interfacial Tension; Oil; Slotted Pore Membrane

Processing of Reduced Graphene Oxide Reinforced Ultra High Molecular Weight Polyethylene for Orthopedic Implants

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Ultra-high molecular weight polyethylene (UHMWPE) has been used as a bearing material in total joint replacements due to its relevant properties and biocompatibility since 1962. Acetabular cup in total hip replacement and tibial component in total knee replacement are generally fabricated from UHMWPE. The use of UHMWPE in joint replacements is well established and its demand is increasing in young and active patients. The life span of the artificial joint can be

increased by enhancing the mechanical properties of UHMWPE. Although this procedure is widely practiced in Pakistan, it lacks indigenous manufacturing capabilities of artificial joints. In this study, relevant properties of UHMWPE were enhanced, and UHMWPE component was indigenously fabricated. The addition of filler material in UHMWPE is an effective way to enhance its relevant properties. Reduced Graphene Oxide (rGO) was selected as a filler material as it will lead to better wear resistance, toughness, and thermal stability. Graphene oxide (GO) was synthesized by Modified Hummer's Method, and it was thermally reduced to obtain rGO. GO and rGO were characterized by Fourier Transform Infrared spectroscopy (FTIR) which confirmed their synthesis. The rGO/UHMWPE mixture was prepared by adding 0.7 wt% of rGO employing dry mixing method. Standard samples of the nanocomposite were manufactured by compression molding. Various mechanical tests were performed on the sample which shows tensile strength increased by 19.3% while impact strength decreased by 31%. Machining operations were performed on the sample to achieve the required dimensions of a tibial component. The fabricated tibial component with improved properties provides an effective and economical approach to meet the requirements of the indigenous market.
Keywords: Biocompatibility; Graphene oxide; FTIR

Use of Nano indentation to determine Surface Mechanical Properties of Modified Ultra-High Molecular Weight Polyethylene

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Nano-indentation, is a latest developed technique used for the measuring of the surface mechanical properties of materials, especially polymers. Ultra-high molecular weight polyethylene has been used as a biomaterial in total joint replacements due to its desirable properties. It has high toughness, high abrasion resistance and low coefficient of friction as compared to other polymeric materials used for the same purpose. Several studies have been conducted to improve the mechanical properties of UHMWPE material for use in joint arthroplasty. The problem that widely encounter is the debris, which forms from the wear of UHMWPE material, reacts with the bone tissue causing osteolysis and early damage of the implant. Different methods of crosslinking have been explored to enhance wear properties of UHMWPE which include radiation crosslinking. However, this

method has negative impact on the mechanical properties since the doses of radiation produces free radicals which causes oxidation. This problem is addressed by achieving crosslinking in the presence of antioxidants. Vitamin E has proved to be a best candidate for this cause. Studies further showed that during cross linking, vitamin E reacts with the radicals, which reduces the crosslink density. Crosslinking using peroxides in the presence of tea polyphenols is recently explored in search for more competitive anti-oxidants which results in improved wear resistance and high crosslink density as compared to vitamin E. Knowledge of surface mechanical properties are important parameters of interest for material in applications involving tribological contacts, ultimately leading us to the understanding of the wear behavior of the material. Surface mechanical properties cannot be precisely measured by conventional mechanical testing. This study, explored the use of Nano indentation to determine the surface mechanical properties of both, a peroxide cross-linked UHMWPE samples and uncross linked UHMWPE sample. The indentation results showed improvement in the surface mechanical properties of the cross-linked UHMWPE samples.

Keywords: Antioxidant, Crosslinking, Nano-indentation, Ultra-high molecular weight Polyethylene, Wear behavior.

Thermal Characterization and Performance Analysis of Epoxy-based Composite and its Application on Steam Pipes

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Currently process industries are facing excessive problem of corrosion, wear and tear, toughness, and strength degradation in various metal/alloy-based pipes. In this work, an alternative approach has been adopted in effort to fix the issue with two phase composite pipes i.e., glass fiber and epoxy resin. Two phased composite was synthesized after mixing epoxy & hardener (Amine) in a ratio of 2:1. Curing of these samples were conducted at 60°C, 80°C, 100°C, 120°C,140°C, 160°C. In this synchronized thermal and mechanical study, Thermal conductivity (K), specific heat capacity (C_p), Thermal Gravimetric Analysis (TGA) and Fourier Transfer Infrared Spectroscopy (FTIR), Hoop strength tests were performed. FTIR manifested the presence of (O-H) group, Amine (N-H) and epoxied. Optimal

degradation, hoop strength and burst pressure was recorded for a sample cured at 140 °C.

Keywords: Curing, epoxy resin, glass fiber, two phased composite

Studying the effects of utilizing Pet Coke and Carbon Powder as an Alternative Fuel in Cement Kiln

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The development of construction industry has certainly increased the demand of cement production and usage. On the other hand, cement manufacturing is considered as an energy intensive process in which the fuel demand is very high. Furthermore, the fuel crisis and fuel prices hike at national and international level is an alarming situation for the sustainable future of these industries. Therefore, researchers and industrialists are trying to find alternative fuel for cement industry which should be economically viable and cleaner solution. The main objective of this research work is to utilize Pet Coke and Carbon Black as an alternate fuel in kiln of a cement industry and determine their effects on the product cost. In this study, up to 20% Pet coke and carbon powder are burnt in the cement kiln along with the imported coal. The results showed that both alternative fuels increased carbon monoxide (CO) formation due to low volatile matters. Moreover, the particulate matters (PM) increased while using pet coke in comparison to the imported coal. It was found that the fuel cost reduced by using pet coke and carbon powder, however, the environmental pollution was increased.

Keywords: Cement industry, Fuel economy, Environment, Pet Coke, Carbon Powder

Filtration of selected dyes using Ti_3AlC_2 based composite membrane

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MXene is a new type of highly hydrophilic and negatively charged two-dimensional (2D) nanosheets material for the reasons especially its supernatant has good dispersibility and stability. The MXene supernatant containing several layers was

treated as aqueous solvent for interfacial polymerization, consequently the prepared MXene nanocomposite membrane could maintain high perm selectivity even under low pressures required for low carbon footprint. MXene nanocomposite membrane had better hydrophilicity and higher negative charge. Na_2SO_4 rejection and the pure water flux was improved as compared with the pristine membrane. The MXene nanocomposite membrane also showed the better antifouling property and good stability. Hydrophilic and negatively charged MXene supernatant had better dispersibility and stability. Substituting MXene supernatants of different concentrations for deionized water in aqueous phase, MXene nanocomposite membranes are generally prepared by interfacial polymerization. It was observed that few-layers Ti_3C_2Tx acted a crucial role in membrane surface modification, so that it improved the hydrophilicity and negative charge of membranes surface and increased surface roughness. Few-layers of MXene nanosheets with excellent hydrophilicity, negative charge and mechanical properties provided an academic basis for the preparation of low-carbon and durable NF membranes with outstanding performance.Two-dimensional titanium carbides can be used to remove toxic dyes like acid blue and methylene blue, for their good adsorption contrast to other two-dimensional materials. In compared to typical adsorbents, the removal efficiencies of the use of MXene in methylene blue, methyl orange, methyl red, congo red, and Evans blue was unusually high.

Keywords: MXene, Nano filtration (NF) membranes, dyes,

Unplasticized polyvinyl chloride (UPVC) pipe industry of Pakistan: Few suggestions to improve the finishing and the strength of the pipes while reducing the production cost

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Polyvinyl chloride (PVC) resin is polymerized to produce a variety of plastic materials. Worldwide about 40 million tons of different PVC products are produced annually. Unplasticized Polyvinyl chloride (UPVC) are rigid plastics prepared from the polymerization of the same PVC resin. In Pakistan, UPVC pipes are very commonly used as sewer and water pipes. Our industries use calcium carbonate ($CaCO_3$) mineral as a filler during the polymerization of the resin. Filler replaces some part of the expensive PVC resin and thus decreases the cost. On the other hand, if the concentration of calcium carbonate ($CaCO_3$) increases from 10 PHR the net weight (specific gravity) of the pipes increases. Moreover, if added than a certain concentration the produce pipes may not retain the required mechanical strength. The handling of the viscous polymerized mixture is difficult and creates difficulties

in processing. In short, the addition of calcium carbonate reduces the overall cost but it adversely affects the specific gravity and other mechanical properties.Our study was about the possible fillers having less effect on the specific gravity and can improve the smoothness of UPVC pipes at a minimum cost. We propose a mix of organic (corn starch) and inorganic (aluminum trihydride) fillers. Organic fillers have less weight (specific gravity) and are usually cheap. Polyethylene wax (lubricant) will improve the smoothness and overall finishing quality of the pipe. The use of these types of lubricants facilitates in flowing processing and increases the chances of uniformity in the polymerized chains.

Keywords: Calcium carbonate; Unplasticized Polyvinyl chloride, ($CaCO_3$); Parts per hundred rubber (PHR).

Utilization of Potato and Wheat Waste for Starch Synthesis along with Kinetic Study

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Mankind has explored the natural resources of earth without limits, including extraction of raw material for industry. The planet's capacity to absorb and convert the waste, resulting from modern life, seems to be inexhaustible. Situation has become a matter of great concern with the exponential increase in the population of planet. Consequently, waste production will increase by many folds. To counter this, alternatives such as substitution of conventional plastics for biodegradables are being studied. So, the main focus during the present work was the utilization of solid potato and wheat waste into biodegradable product such as starch, having various applications. For extraction of starch from waste potato and wheat, hydrothermal pretreatment was performed due to its high conversion efficiency and then compared it with the synthetic starch. Furthermore, kinetics of different starch were also carried out indicating that potato starch was the most suitable candidate and it follows the first order kinetics.

Key Words: Biodegradable, Hydrothermal Pretreatment, Kinetics, Starch,

Performance evaluation of MXenes Used for Removal of Heavy Metals from Aqueous Stream

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The use of 2D metal carbides, nitrides and carbonitrides (MXenes) in the treatment of heavy metals is becoming more and more widespread. MXenes have strong chemical compatibility, greater thermal stability, outstanding surface adjustable chemical compatibility, hydrophilicity, ease of functionalization, large surface area and biodegradable features. The oxidizing functional groups and accessible active binding sites of MXene nanoparticles make them a special adsorbent for eliminating heavy metals from waste-water because of their distinctive layered structure. Batch-mode investigations were carried out to ascertain the impact of several factors such as contact duration, adsorbent dosage, sample pH, temperature and initial concentration of polluted water on the adsorption of Cadmium (II). MXene was subjected to FTIR, XRD, BET, EDS, and SEM analysis both before and after the adsorption procedure in order to understand the surface properties and validate the adsorption of Cadmium (II) over MXene. Using batch adsorption with optimum conditions, including pH is 6.0, adsorbent dosage is 0.015 g/ 50mL, contaminated water concentration is 250 mgL^{-1}, temperature is 30ºC, agitation, and contact duration of 30 minutes, MXene was able to remove Cadmium (II) with a maximum removal rate of 95.43%. Data fitting with the Langmuir isotherm and good correlation with the pseudo-second order were explained by the performed adsorption kinetics studies and adsorption isotherms. Therefore, it can be said that MXene is a suitable adsorbent for remediation of Cadmium (II) metal ions from waste-water.

Keywords: 2D materials, MXene, Heavy Metals, Water Purification, Adsorption

Surface modification and overall performance enhancement of hybrid biocompatible hemodialysis (HD) membrane

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The latest trend for modification of overall performance of hemodialysis membrane (HD) is the use of biocompatible nanomaterial. For improving performance of hemodialysis therapy, novel biocompatible membranes are in great demand. The main purpose of this study is to increase the protein fouling resistance, biocompatibility, hydrophilicity and to reduce the challenges during the hemodialysis therapy. In this work amine functionalized Titanium dioxide TiO2 is treated with polyvinylpyrrolidone (PVP) in N-Methyl-2-pyrrolidone (NMP) to form Nano composites and then mixed with polysulfone (PSF). Phase inversion process is used for the formation of these hybrid membranes. Characterization of membranes will be done and their overall performance will be evaluated with water

permeation rates (PWP) and rejection of urea, creatinine, Iysozyme. It is expected that PSF nano hybrid membranes will show better overall performance and improved hydrophilicity as compared to pristine PSF membranes. So these membranes will show better clearance of the waste like urea, creatinine and iysozyme respectively. These hybrid membranes indeed modified the overall performance of the PSF hemodialysis membranes.

Keywords: Hemodialysis (HD) membranes; Biocompatible; Dialysis; Phase Inversion Process; Kidney

Polyester based heat resistant tiles

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Polyesters are used in several applications regarding manufacturing of electrical and mechanical parts of different machineries. Due to its low thermal conductivity, polyester was used to make heat insulation tiles. Curing process was used to increase hardness of polyester. In the curing process, Methyl Ethyl Ketone Peroxide was used as a hardener and Cobalt as an accelerator. Different temperatures (Range 40 C -160 C) were applied during curing of polyester and curing kinetics was observed. After testing, optimum temperature for curing of polyester was found to be 110 C.

Keywords: Composite; Curing kinetics; Polyester; Heat insulation tiles.

Synthesis of Ammonium Persulfate/Glycerol based Novel Deep Eutectic Solvent under controlled conditions; Characterization, Physical Properties

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Solvents with deep eutectic properties are characterized by decreased melting points compared to their parent components. The physicochemical properties of these materials can be tailored, which makes them ideal to be utilized for different industrial applications. They are prepared by the combination of salt with hydrogen bond donor moiety to some definite ratio. In the current study, a novel deep eutectic solvent (DES) was synthesized by the combination of ammonium persulfate and glycerol in 2:1 wt. % ratio using ramp input temperature response which otherwise resulted in uncontrolled reaction with the emission of smoke that could result in burst. The bonding behavior of synthesized novel DES was determined by FTIR spectroscopic analysis, which confirms a physiochemical combination of the constituents and leads towards the prospered synthesis of DES by the significant shifting of characteristic peaks. The physical properties such as electrical conductivity, density, viscosity, surface tension, and freezing point of the immaculate DES were also reported. The variation in physical characteristics allowed the synthesized DES to be appropriate for miscellaneous applications.
Keywords: DES; Eutectic solvents; Physical properties

Economic optimization of dual effect absorption refrigeration system using correlations for heat transfer coefficient

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The world is going through a fuel crisis, and a lot of resources are spent on it to produce electricity and hence refrigeration. Therefore, it has become necessary to adopt energy-efficient technologies, such as absorption refrigeration system (ARS), that uses a low-grade form of energy and hence not only saves fuel but also stops the wastage of heat that could go to the atmosphere and pollute it. During optimization of ARS, researchers have previously used constant values of heat transfer coefficient, but as decision variables change during optimization, values of heat transfer coefficient don't remain constant as they depend on fluid properties like density, temperature & pressure, etc., flow properties like Reynold number and geometric properties. So, a constant value will give inaccurate results during optimization when the optimizer constantly changes decision variables to go towards a global minima. The objective of this work was to optimize operating conditions and areas, by using empirical correlations found in the literature to minimize Total Annual Cost (TAC). For this purpose, a 50-kW evaporator is

considered for both series and parallel configurations of a double effect ARS system. A thermo-economic model is developed in MATLAB and optimization is done using a Genetic Algorithm (GA). Results show that TAC is reduced in both cases after the integration of correlations, which implies that although constant values give a good initial guess, correlations affect the process variables a lot.
Keywords: Absorption; Correlation; Optimization

Coating Copper Substrate with Polyester Coating and Its Corrosion Analysis for Heat Exchanger Based Applications

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Copper is provided a uniform coating of polyester using the dip-coating method to increase its ability to resist corrosion in the presence of sodium chloride solution. One substantial difference between the two substrates would be through Fourier Transform infrared spectroscopy (FTIR), which discovered a uniform and crack-free Polyester coating on a Copper substrate whereas an electrochemical corrosion test on the uncoated sample clarified a cracked texture covered in thick corrosion layers. However, by covering the corrosive pits, a higher concentration of sea water (NaCl Solution) significantly impacted the surface morphology. The electrochemical corrosion test was used to examine the homogeneous coating's resistance to corrosion on a copper substrate that had been coated with polyester. When the corrosion rate of the coated sample was slightly shifted towards the anodic direction, it resulted in a better protection efficiency (PE) when compared to the corrosion performance of a polyester coated copper substrate in a NaCl medium.
Keywords: Polyester; Copper; corrosion performance

Finding optimal processing pathway for the conversion of MSW into energy and valuable products in Pakistan

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As a developing country, Pakistan is constantly confronted with several roadblocks on its way to advancement. Municipal solid waste (MSW) management is one of those arduous challenges. This research project investigates the most sustainable approach to convert municipal solid waste into energy out of the several methods available for conversion. This study proposed the most optimal pathway by developing a systematic methodology by considering all the possible technological conversion alternatives for municipal solid waste. This methodology leads to superstructure-based optimization of MSW processing pathways. Thermochemical, biochemical, physicochemical, recycling, and landfill-based electricity generation are all potential technological alternatives for producing valuable products from MSW that are incorporated in the superstructure. A mixed integer nonlinear programming (MINLP) model is constructed based on the proposed superstructure to discover the optimal MSW processing paths considering two alternative MSW handling scenarios. The optimal approach for synthesizing valuable products from MSW under the economic objective function is provided by the solution to the optimization problem. The established methodology is applied to 15 cities of Pakistan as a case study to determine the best processing pathway for managing and processing Municipal solid waste into energy and valuable products. Optimization demonstrates that combined recycling and composting of MSW is the most economically beneficial route for processing MSW.

Keywords: Municipal solid waste, Waste to Energy, mixed integer nonlinear programming, superstructure

Carbon dioxide absorption for gaseous fuel up-gradation application

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Renewable energy is currently the world's leading interest area. Biogas is being given significant attention regarding its production, purification and upgradation for it to be used as a renewable fuel supplement for the generation of energy. Biogas is a rich source, due to the presence of high contents of methane. The composition of biogas is methane (50-70%) and impurities like carbon dioxide (30-50%), sulphur oxide, water and other trace components (1%). The presence of these impurities make it difficult to use biogas directly, as it reduces the gas heating value, cause operational problems for equipment and restrict its applications. It is necessary to upgrade biogas by removing carbon dioxide content to be used for required purposes. Different methods are used for biogas upgrading, such as cryogenic separation, membrane separation, adsorption and absorption. The method used for

upgrading biogas in this work is the chemical absorption using a novel solvent for small-scale applications. This utilizes a solvent that has the ability to effectively remove carbon dioxide from the biogas mixture. Several previous researches studied different types of solvents such as amine-based solvents, organic solvents, solvent blends and ionic liquids. Amine solvents such as MEA have been long used for carbon dioxide removal from natural gas but due to certain limitations are not applicable for small scale applications. The solvent used in this work aims to achieve effective carbon dioxide absorption, a high absorption rate, greater absorption capacity and the possibilities for improvement by providing a more environmentally friendly operation.

Keywords: Biogas, biogas upgradation, CO_2 absorption, solvent blend**.**

Simulation of CO_2 Absorption for Biogas application using Aspen Plus

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As the fossil fuels diminish and the prices soar, the world is turning its attention to renewable fuels as an alternative to reduce its dependence on fossil fuels. Biogas is one of the renewable source of energy. However, to be used as a fuel, it needs to be purified and upgraded to meet the standards of the fuels set worldwide. This includes removal of impurities like Sox, Nox and Cox. Carbon dioxide removal is done to increase the methane content in biogas and bring it at par with other fossil fuels such as natural gas. There are several methods of removal of carbon dioxide such as membrane separation, adsorption, absorption etc. Pressure swing absorption and membrane separation have their limitations due to cost issues. Absorption is one of the best ways for carbon dioxide removal with high carbon dioxide removal as well as due to the reason that solvent can be recovered. This paper presents a description of Carbon dioxide removal process that has been simulated with the process simulation tool Aspen Plus. To achieve high CO_2 removal, different parameters and other operating conditions were varied and simulated on Aspen Plus model. The effect of concentration on absorption and CO_2 removal are studied. The absorption rate, absorption capacity, and loading of CO_2 absorption are investigated.

Keywords: Aspen Plus, process simulation, CO_2 absorption, biogas.

Utilization of the dairy farms waste for biogas production: A source of free energy, fertilizer, and saving gallons of water otherwise needed for cow dung disposal

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Pakistan can increase the present domestic milk production capacity by modernizing the indigenous dairy farm industry. One aspect of upgrading the industry is simply to increase the number of healthy animals and thus will have to dispose the generated bovine wastes in a proper manner. Dairy waste is produced on a daily basis, whereas our domestic biogas production technology is successful enough to produce gas which can be used as a heating fuel for a number of applications. Our study evaluates the potential of different types of biogas production reactors. Fixed dome biogas plant is more common in Pakistan, with a payback period of only a few months. In addition, the slurry produced by the biogas reactor is a highly valuable agricultural bio-fertilizer. Less amount of water is needed for keeping cattle farms clean because most part of the faeces are picked and then utilized for gas production.

Keywords: Dairy farms, biogas reactors, and fertilizer.

Investigating the effect of Charge Transport Layers on Germanium based Perovskite Solar Cell

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Perovskite material have brought revolution in the field of photovoltaics. Perovskite based solar cells have high efficiencies, low cost and good optical properties. With these properties perovskite have also some challenges like of large area fabrication, toxicity, long term stability and humidity. The toxicity of the device is because of lead. To solve the issue to toxicity, in the present study lead is replaced by germanium. Germanium also belong to the group of lead with band gap close to the lead. Cesium Germanium Tri-Iodide ($CsGeI_3$) based perovskite solar cell is simulated with electron transport layer (ETL) based on C_{60} and hole transport layer (HTL) based on CuI using SCAPS-1D simulation software. The effect of thickness and on the parameters of the solar cell are study in depth. The maximum efficiency of 15.02% is achieved with the fill factor of 85.88%. Moreover, the Voc of 0.883V and the Jsc of 19.79 $mACm^{-3}$ is obtained for the designed solar cell.

Keywords: Perovskite; Photovoltaics, SCAPS, Non-Toxic

Performance Enhancement of $FAPbI_3$ perovskite solar cell with kesterite and ZnO charge transport layer

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Recently, methyl ammonium lead triiodide ($MAPbI_3$) perovskite solar cell (PSC) has surpassed the power conversion efficiency (PCE) of most of the established photo voltaic technologies, with PCE of 25.7%. But achieving long term structural stability still remains a hurdle in its large-scale commercialization. The methyl ammonium (MA) in perovskite material has low thermal conductivity and degrades with the built up of heat in it. This causes the leakage of the toxic lead into the environment. Research is being focused on replacing the MA with alternate thermal stable material. One such material is formamadium (FA). Formamadium lead triiodide ($FAPbI_3$) is more thermally and structurally stable than $MAPbI_3$ but has lower efficiency. The performance of the FA-PSC can be enhanced by identifying the optimized design parameters of each layer in the PSC structure. In this work the $FAPbI_3$ is numerically modelled with CBTS and ZnO as charge transport layers in SCAPS-1D. A systematic approach is adopted to identify the optimized design parameters of each layer (hole transport layer, absorber and electron transport layer). After optimization the PCE of 24 % was achieved with Jsc of 24.271454 mA/cm2, Voc of 1.140949 V and fill factor of 86.65 %. Moreover, the effect of varying layer thickness, doping concentration, defect density and working temperature on the performance of $FAPbI_3$ is analyzed in detail.

Keywords: Perovskite solar cell; $FAPbI_3$; SCAPS-1D

Investigating the optical and electrical properties of non-toxic $MASnI_3$ solar cell with kesterite and zinc-based charge transport layers

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In recent years, the perovskite-based solar cell has emerged as a fast-growing photovoltaic (PV) technology owing to improved performance, cost-effectiveness, and ease to use in unconventional places. The lead (Pb) based perovskite solar cells (PSC) have achieved the best results so far due to their favorable chemical and optoelectronic properties. However, the toxicity of Pb hindered the development of

such PSCs. In this work tin (Sn) based, eco-friendly n-i-p PSC device with methyl ammonium tin triiodide (MASnI3) as an absorber layer has been proposed because of its non-toxic nature and similarity in optoelectronic properties to Pb. The proposed PSC has been designed by a solar cell capacitance simulator (SCAPS) based on continuity and Poisson equations. Owing to the large band gap and low absorptivity, ZnSe has been chosen as ETL. While kesterite CZTSe has been selected as HTL due to its non-toxicity, cost-effectiveness, tunable band gap, and electron affinity. The effect of charge transport layers (CTLs) on the quantum efficiency (QE), band alignment diagram, electric potential, recombination, IV curve, and power conversion efficiency (PCE) of the proposed structure have been analyzed. Furthermore, the influence of defect density on the optimized thickness of the absorber layer and PCE of PSC has been analyzed in detail. Based on the results the optimized thickness of the perovskite layer for defect density of E13 was found to be 1.1 µm with PCE of 30.45%, for E14 0.9 µm with 29.21%, and E15 0.7 µm with 26.21%. The results achieved in this work showed a lot of promise for further implementation of non-toxic Sn-based perovskite solar cells.

Keywords: Perovskite solar cell, MASnI3, Optimization, SCAPS, Charge transport layer, Defect density

Use of Ionic Liquid to Eliminate Heavy metal from aqueous solution

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Heavy metals in wastewater possess a serious threat to the environment and its removal from water required significant consideration. In this regard several techniques were employed for its remediation however, the low efficiency and high toxicity of the existing adsorbents compel the researcher to investigate/develop sustainable adsorbents. Therefore, in this study the hydrophobic ionic liquid, trihexyltetradecylphosphonium dicyanamide ($[PC_6C_6C_6C_{14}][-N(CN)^{2-}]$) is used for the removal of heavy metal, Thallium (Tl) from aqueous solution. The results showed that $[PC_6C_6C_6C_{14}][-N(CN)^{2-}]$ have the potential to adsorbed Thallium from aqueous solution with adsorption capacity of (180 mg/g). Moreover, the removal efficiency of the $[PC_6C_6C_6C_{14}][-N(CN)^{2-}]$ was also investigated and it was noticed that $[PC_6C_6C_6C_{14}][-N(CN)^{2-}]$ have the ability to remove more than 85% Thallium from aqueous solution. Hence, the result presented in current study showed that ILs have the potential to effectively replace the conventional toxic adsorbents.

Keywords: Ionic Liquids, Heavy metal, Water treatment, Thallium (Tl)

Numerical Modelling of Formamidinium tin iodide perovskite solar cell using Scaps-1D

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Perovskite solar cells (PSCs) have emerged as one of the most promising Photovoltaics Technologies in recent years. Methyl Ammonium Lead Tri-Iodide ($MAPbI_3$) based PSCs gained attention because of their impressive Power Conversion efficiencies (PCE). However, the presence of thermally unstable Methyl Ammonium (MA) Cation and toxicity of lead (Pb) limits its progress towards future commercialization. FA (Formamidinium) and Sn (Tin) have emerged as good alternatives for MA and Pb. $FASnI_3$ has been found to be more thermally stable and nontoxic but lower in PCE than MAPbI3. In this work, FASnI3 is numerically modeled in SCAPS-1D software. To enhance the performance of FA-PSC, copper and carbon charge transport layers are used. To improve electric conduction CuI is used as HTL (Hole Transport Layer) while to improve thermal conduction PCBM (phenyl-C61-butyric acid methyl ester) is used as ETL (electron Transport Layer). For further performance improvement, the optimized thickness for each active layer (Absorber, PCBM, and CuI) is identified and the effect of thickness on parameters like Voc, Jsc, FF, and PCE is observed. Thickness optimization showed phenomenal results in terms of an increase in PCE from 17.37% to 20.5 %. Moreover, the effect of the charge transport layer (CuI and PCBM) on the absorption bandgap alignment electric field intensity are also been analyzed and studied in detail in this paper.

Keywords: Perovskite, Nontoxic, $FASnI_3$, SCAPS, Optimization

Adsorption of dye onto superabsorbent hydrogel: Synthesis, characterization, and isotherm analysis

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Polysaccharide-based hydrogels offer a great overlook for environmental applications and help in the elimination of various noxious pollutants from the water system. Novel superadsorbent hydrogel having appreciable swelling properties and

adsorption capacity towards Methylene blue (MB) was synthesized by suspension polymerization technique. The hydrogel grafting conditions were optimized by studying the effects of different parameters (temperature, stirring rate, initiator concentration, monomer to polysaccharide ratio). For ascertaining the maximum adsorption capacity, various influential parameters such as contact time, adsorbent dose, dye concentration, and temperature were systematically studied. Maximum adsorption capacity as calculated from the Langmuir isotherm was 3300 mg/g for MB dye. Kinetics studies revealed that the adsorption process follows pseudo-second order reaction kinetics. Overall, the present study reveals that the synthesized superadsorbent hydrogel can be used as an efficient adsorbent for the removal of dyes from an aqueous solution.
Keywords: Polysaccharide, superadsorbent, Methylene blue

Effective separation of dye from wastewater using Ionic liquid

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Disposal of dye-containing wastewater which is mainly derived from textile industries is more disastrous and need significant attention. Therefore, environmental benign treatment process needs to be develop for elimination of such pollutants from wastewater. This work aimed to evaluate the application of the hydrophobic ionic liquid, trihexyltetradecylphosphoniumchloride ([PC6C6C6C14][Cl] used for the removal of tartrazine dye from aqueous solution. The results revealed that [PC6C6C6C14][Cl] have the potential to adsorbed tartrazine dye from aqueous solution with adsorption capacity of (150 mg/g). Furthermore, the removal efficiency of the [PC6C6C6C14][Cl] was also evaluated and it was observed that [PC6C6C6C14][Cl] have the capability to remove more than 90% tartrazine dye from aqueous solution. Overall, the result presented in this study depicted that ILs have the potential to replace the conventional toxic adsorbents used for the removal of toxic dyes.
Keywords: Adsorption capacity, Hydrophobic IL, tartrazine dye, toxic dyes,

Comparative analysis of chemical process simulation using open source and commercial software

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Different process simulation softwares are used by researchers for process design and simulation in both academia and industry. In market, we have the availability of both open source and commercial softwares. The commercial softwares are expensive and require an annual license renewal, which may impose a financial strain on institutions or colleges with restricted budgets. In this paper, some of case studies have been simulated using both DWSIM (an open-source chemical process simulator) and Aspen HYSYS (Proprietary software). Three case studies of steady state processes which are mixer & separator, shortcut distillation column and shell & tube heat exchanger, have been simulated in both DWSIM and Aspen HYSYS using same input data. Simulation results of both softwares are presented and compared for analysis. The simulation results show that both softwares gave us nearly precise results with each other with less than 5% difference. Also DWSIM is easy to use, easy to report, and convergence times are good. This work suggests that open-source software like DWSIM without any investment for license can be used as a process simulation tool for the systems studied in this work in academia and industries for hands on experience.

Keywords: Aspen HYSYS, DWSIM Process Simulator, Simulation software.

Comparative analysis of Hydrogen production through different ionic liquids

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Hydrogen as an energy source having high potential for enhanced energy storage capacity has drawn interest of researchers as an environmental promising fuel. Hydrogen used in industrial applications is currently produced by catalytic reforming reactions. Various other methods of hydrogen production have been developed, including the water electrolysis. Hydrogen is a highly promising energy source due to its extremely high energy density and light weight. Around 95% of the hydrogen production in the world has been estimated to originate from fossil fuels, underlining the reliability and importance of fossil fuels as a hydrogen source. Ionic liquids (ILs) are salts comprising cations and anions, and usually liquids at or below 100°C. The salts that are liquids at room temperature are generally called as

room-temperature ionic liquids (RTILs). Ionic liquids are also employed as auxiliaries and catalysts in chemical synthesis. Ionic liquids are non-volatile in nature having low vapor pressure. They are generally stable and heat resistant up to 300℃. The electrical conductivity is very high, that is not the case in fluids composed of neutral particles potential. Imidiazolium ionic liquids are more preferably used for hydrogen production. Low pH (2.5) and high temperature (338 K) were discovered to be the better conditions for hydrogen production. The 1-ethyl-3-methylpyridinium ethyl sulfate (EMP-ES) ionic liquid is used to regulate the rate of hydrogen generation for the first time The comparative analysis of different ionic liquids is done by using a simulation software ASPEN Plus. Different ionic liquids being considered are analyzed using sensitivity analysis.

Keywords: High potential, Electrolysis, Ionic liquids, ASPEN, 1-ethyl-3-methylpyridinium ethyl sulfate (EMP-ES)

Corrosion Inhibition of Methionine as a Green Corrosion Inhibitor for Carbon Steel in the Presence of Methanol and Monoethanolamine

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The study of carbon steel corrosion is paramount in many industries as corrosion of metal surfaces incurs massive losses to the industries. Numerous authors worked on corrosion inhibitors but the results shown by the amino acids are promising. Due to this fact, the corrosion rate of aqueous methionine solvents against carbon steel with weight-loss method was studied in this work. In this weight-loss method, three carbon steel strip coupons were used. Preparation of coupons was a major step, as they are cleaned thoroughly with sandpapers as per the standards of ASTM G-1-90. The metal specimens were dipped in aqueous methionine solvents for specified period. Once the corrosion time was completed, metal specimens were washed, cleaned, weighed and put into the formula for calculation of results. The results showed that without using the methionine, the corrosion of carbon steel was 2.41 mm/year. For a lower concentration solution (2%MTH, 8%Methanol, 20%MEA), the corrosion against carbon steel dropped to 0.96 mm/year with a protection efficiency of 60.166%. For medium concentration solution (5%MTH, 5%Methanol, 20%MEA), the corrosion reached 0.92 mm/year with a protection efficiency of 61.826%. But as the concentration of methionine was increased, it was found that the corrosion also increased greatly, because at a higher concentration of methionine (8%MTH, 2%Methanol, 20%MEA), corrosion became 0.84 mm/year with a protection efficiency of about 65.145%. The presence of methionine lowers the

corrosion rate even much better than other amino acids. The inhibition efficiencies of methionine are augmented with improved methionine concentration. Methionine was able to give 65.145% inhibition efficiencies for carbon steel. The new solvent mix can be employed as an efficient corrosion inhibitor.

Keywords: Corrosion, Carbon Steel, MTH(Methionine), Amino Acids, Methanol, MEA(Monoethanolamine), Weight loss method.

Current practice for handling the waste lubricating oil in Pakistan, is there any improvement possible in the treatment processes, and a proposed procedure for the disposal of produced sludge

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We all know that the vehicles changes oil after a certain kilometers of travelling. Collected waste oil are valuable and ideally most of it should be regenerated. In Pakistan there are a numbers of oil cleaning businesses but unfortunately almost all are reluctant to disclose their cleaning methodology. The main reason for hiding the cleaning process is because of tough governmental regulations. Usually, after heating the waste oil for few hours sulphuric acid is added slowly to remove oxidized hydrocarbons (darkish part). The sludge generated is the main environmental hazard and because this problem this simple acid cleaning process was banned in European countries. The generated sludge contains heavy metals and many other kinds of hydrogenated viscous species. Few simple experiments were conducted to propose an alternative cleaning methodology. In short, the oil was heated till the knocking sound disappeared. After that at a room temperature the dehydrated oil was treated with the glacial acetic acid (instead of sulphuric acid) and was properly mixed for an hour. A settling time of 24 hours is provided after which reddish brownish (top) and black (bottom) layers are formed. The collected upper layer was then treated with fuller earth (Multani meti) under continuous stirring. Finally, after cooling to a room temperature the oil was filtered to a reasonably clean engine oil. This cleaning process recovers about 53.2% of the engine oil. At least theoretically the collected sludge containing acetic acid is biodegradable. The collected sludge from both types of acid treatment was mixed with cement to prepare concreate roadblocks. The bricks were hard and had sealant property.

Keywords: Used engine oil, acid cleaning, and sludge bricks.

Enhancing efficiency and stability of non-toxic Pb-free $MASnBr_3$ PSC with $CuAlO_2$ as inorganic p-type semiconductor by using 1D-SCAPS.

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Organic-Inorganic metal halide perovskite solar cells device has (PSC) fascinated researcher attention from all over the world. A non-toxic Sn-based PSC has similar photo electronic properties to that of lead based PSC. In this report work the structure consist of C60 as electron transport material (ETM) and CuAlO2 as hole transport material (HTM) with lead free non-toxic MASnBr3 as perovskite active layer. A numerical modeling of MASnBr3 PSC has been investigated by utilizing 1D SCAPS simulation software. Investigation of the most important parameter such as thickness of each layers has been optimized to advance the stability and enhance the power conversion efficiency of the device. The inverted arrangement ITO/CuAlO2/MASnBr3/C60/Al exhibit maximum PCE 16.34%, FF 89.19%, VOC 1.49 V and JSC 12.29 mA/cm2 with 400 nm of absorber thickness. The device has shown a good thermal stability.

Keywords: 1D-SCAPS, fullerene C60, MASnBr3, perovskite solar cell, stability

Effects of Different Medium on the Corrosion of Crude Oil Storage Tank Bottom Plate and Remedial Actions for its Life Enhancement

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Every industry in the world is experiencing a huge problem with corrosion, which is the degradation of materials to their atomic components, but the petrochemical industry is particularly affected. Crude storage tanks play a crucial role in the petrochemical process since they keep everything functioning properly. Storage tanks are extremely vulnerable to corrosion because of the aqueous environment, which could lead the petrochemical industry to significant financial loss. Corrosion in the bottom plates of storage tanks for crude oil and refined products is directly related to water present in the crude that is transported with the products, whether in suspended or condensed form. After processing, crude oil taken from wells and kept in a storage tank for 24 to 72 hours before being transported. Crude extracted from reservoirs contains microorganisms as well as salt, sand, carbonates, and chlorides. Because the nozzle for draining produced water is located above the bottom plate,

produced water accumulates in the tank's bottom all year long. During the settling process, slugs progressively accumulate in the tank's bottom and corrode the bottom plate. This study's objectives were to assess the underlying causes of corrosion in a crude storage tank's bottom plate as well as the rate of corrosion in various corrosive media, including crude, produced water, and solution (crude represented 80% of corrosion and produced water 20%) by using weight loss and linear polarization resistance methods. Additionally, the application and analysis of various corrosion control measures, such as various corrosion inhibitor types (oil base, water base), and fiber reinforcement polymer (FRP) coatings, are the main goals of this study. The findings demonstrated that FRP coating, as opposed to corrosion inhibitors, reduced the specimen's rate of corrosion. By using FRP coating, the bottom plate's corrosion rate was decreased by 93 (%) and the results were compared to those from other methods.

Keywords: Corrosion, crude, produced water, corrosion inhibitor and FRP coating.

Effects of Variation in Indentation Load and Dwell Time on the Vickers Microhardness of Ti 6al 7nb

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Biomedical alloys Ti-6Al 7Nb was taken and its Vickers Micro hardness behavior was investigated at three different loads 300 gm, 500 gm and 1000 gm and four different dwell time i-e 10s, 20s, 25s and 30s. The average VHN number for the alloy was between 350 and 358. These values for the said alloy agreed well with the reported hardness of the enamel of human molar teeth. Further, the two way ANOVA tests revealed that the dwell time had no significant effect over the hardness value therefore a dwell time of 10 seconds is sufficient. However, the hardness values showed variation with the load. Tukey tests revealed that for Ti-6Al 7Nb the difference in hardness values for 300 gm and 500 gm load at various dwell time were not statistically significant, however the hardness values for both the loads differed than that of 1000 gm applied load. The traditional Meyer's law was used to analyze the load dependence of the hardness and it pointed positively towards the indentation size effect for both the alloys.

Keywords: Biomaterials; Vickers micro hardness; dwell time; Indentation size effect

Impact of fractional Magneto-hydrodynamic and Hall current on Ree-Eyering fluid flow by using radial basis function method

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In present work, an analysis has been arranged to study Magneto-hydrodynamic of Ree-Eyering fluid with effect of Hall current between two parallel plates. Initially both plates are at rest. Suddenly both plates move with some velocities. The governing problem is converted to the fractional partial differential equation and then numerically solved by using radial basis functions. The Crank-Nicolson scheme is applied for the discretization of space derivatives. Performance of the method is investigated with the help of tabulated results for radial basis functions by comparing it with the exact solution. Obtained results shows the efficiency of method for different parameters. Present work has an edge over existing models because in this model radial basis function is applied to approximate space derivative. It gain more importance in recent years, due to their practical significance and numerous applications in physiology, biomedicine and engineering.

Keywords: Ree-Eyering fluid; Radial basis function; Crank-Nicolson scheme

Radial basis function method for the fractional magnetohydrodynamics flow of Prandtl fluid

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In this article, magnetohydrodynamics flow of Prandtl fluid in a porous medium between two parallel plates is discussed. Lower plate is held stationary while upper plate is oscillatory. Radial basis function collocation approach is used to find the numerical solution of time fractional partial differential equation correlated with Prandtl fluid flow passing between two parallel plates. In this problem fractional derivative is consider in a Caputo sense and Crack Nicolson scheme is used to approximate the space derivative by using radial basis function. Numerical results are presented to check the accuracy of the method. Solution is plotted for different values of magnetohydrodynamics, Prandtl fluid and porous medium parameters. Numerical solutions are also plotted for different fractional orders to demonstrate the effect of introducing fractionality in the system.

Keywords: Radial basis function, Caputo Derivative, Prandtl fluid.

Preparation and Modification of Ni-Al layered double hydroxide (LDH) in Decontamination of 4-nitrophenol

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The amount of freshwater available in the world is decreasing everyday. Different industries generates a variety of highly toxic organic wastes. Industrial dyes are highly toxic to human health and the phenols are called as carcinogenic even at a low concentration.To remove the pollutants like organic dyes and phenols is the current challenges of wastewater. To meet with such challenge, it is necessary to synthesize a versatile material that can remove different kinds of organic pollutants. Preparing bimetallic layered material with active sites on the surface; therefore, useful for the removal of pollutants from nature. In the present work Ni-Al LDH with the ratio of 3:1 were prepared by co-precipitation method and intercalate with Fe complex Schiff's base. The obtained material was characterized by Fourier transformation infrared spectroscopy (FTIR), X-ray diffraction (XRD), Brunauer-Emmett-Teller (BET), Scanning electron microscopy (SEM) Ultra high performance liquid chromatography (UHPLC) and UV-Vis spectroscopy (UV) for systematically investigated for removal of methyl orange and 4-nitrophenol. Pollutant removal was optimized using various experimental parameters, like pH, concentration, ratio (catalyst to volume of solution): catalyst dose (mg)) and time. Under optimized conditions for MO dye such as; catalyst amount 10.0 mg at pH 8 using dye concentration of 12.5 mg/L (10 mL solution) and contact time of 30 minutes in continuous stirring mode; Schiff base modified Ni-Al LDH can remove 96% of MO dye. For 4-nitrophenol under optimized conditions like; catalyst amount 10.0 mg at pH 2 using 4-nitrophenol concentration of 10 mg/L (5mL solution) and H_2O_2 concentration of 20mM (5mL) and contact time of 5 minutes in continous stirring at 30 °C; Schiff's base modified Ni-Al LDH can remove 99% of 4-nitrophenol. Schiff's base modified Ni-Al LDH in order to active H_2O_2 to degrade 4-nitrophenol under mild conditions. Moreover, LDH structure offered strong synergetic interactions among active species that may be help in minimum leaching. The resueability test for schiff's base modified Ni-Al LDH shows the LDH can be reuse four times; the degradation efficiency of MO dye at 1st run is 91.5% and at 4rth 73.59 while in 4-nitrophenol at 1st run the degradation efficiency is 95.0% and at 4rth run 78.2%

Keywords: Layered double hydroxide (LDH), Schiff's base, Methyl orange dye, 4-nitrophenol.

Heavy metals accumulation in soil via wastewater irrigation: analysis and possible solution

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Industrialization is vital and required for the country's growth and development. Unplanned industrial urbanization adversely affects society and human health. Effluents from widespread industrial sectors containing harmful substances like heavy metals, whose discharge directly affecting human health via food chains. Heavy metal contamination in industrial untreated effluent water transfer to food chain via irrigation of agricultural soil. Rapid and unorganized urban and industrial developments have contributed to the elevated level of heavy metals in the urban environment of the developing countries. The current research work investigates the identification, characterization, and evaluation of specific heavy metals in industrial wastewater (IWW) collected from selected agricultural field irrigating canals of IWW in Haripur Hattar (Pakistan) and an economical purification technique for the IWW has been suggested. Obtained results were compared with the tube well water irrigated samples. Heavy metals accumulation was tested through atomic absorption spectrophotometry (AAS). Analysis of water samples showed that the concentration in mg l^{-1} of heavy metals in Industrial wastewater follows the trend Fe(4.25)> Pb(2.98)> Zn(0.20)> Ni(0.155)> Cr(0.068)> Cu(0.01) while Tube well water has Fe(1.70)> Zn(0.09)> Cr(0.085)> Ni(0.068)> Pb(0.029)> Cu(0.009). Analysis of the soil samples irrigated with IWW followed the order of Fe (67.85) >Cu (12.99) >Pb (9.56) >Zn(8.95) >Ni (3.54) >Cr (1.736) and Fe (40.37) >Zn (0.712) >Pb (0.529) >Cr (0.323) >Cu (0.15)>Ni (0.068) irrigated with TWW. Heavy metals concentration values found in soil irrigated with IWW were higher than the soil irrigated with TWW which are higher than the normal allowable WHO limits. For the purification of IWW, Caroxymethyl Guar (CMG) and Hydoxypropyl Guar (HPG), derivatives of guar gum, innovative coagulants used for the separation of heavy metals at large scale efficiently and economically. Experiments showed significant reduction in the metals contents of IWW after processing with coagulants. The current study suggests the continuous monitoring of soil, irrigation water and agricultural products to prevent heavy metals concentration beyond allowable limits, in the food chain.

Keywords: CMG: Carboxymethyl Guar, HPG: Hydroxypropyl Guar IWW: Industrial waste water

Usage of Nano-Filtration Membrane for the Large-Scale Production of Sustainable Water Supply in Rural Areas

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Nanofiltration membrane (NF) is one of the most important activities employed in the wastewater treatment field. Characteristics of NF fall between UF and RO, and function by both pore-size flow (convective) and the solution-diffusion mechanisms. NF technique is used in a variety of water and wastewater treatment (WWT) in different industrial applications. The selected rural area for the study is the Khyber Agency. NF's main job in this research is to selectively remove ions and organic substances from the water of Khyber Agency areas to provide attainable water in tribal areas and to illustrate the main applications of the NF process in water reuse, producing clean water, WWT as tertiary treatment, water softening, and desalination field comparisons of basic economic analyses with other alternative processes in profitability is also performed. This will not only summarize the removal of target major pollutants (e.g., hardness, pathogen, and natural organic matter), but also paid attention to the removal of micropollutants of major concern. Outlook and perspectives on membrane fouling control, chlorine resistance, integrity, and selectivity are also discussed to provide potential insights for the future development of high-efficiency NF membranes for stable and reliable drinking water treatment. Commercial NF membranes are thin-film composite (TFC) membranes, made of a polyamide (PA) barrier layer synthesized by the interfacial polymerization (IP) on top of an ultrafiltration membrane. The membrane will allow flow up to 7 bar and will show a high rejection of divalent SO4 2− ions. The Mg2+ ion follows the same rejection trend as that of SO4 2− ions to maintain the zero-charge density. The rejection of monovalent K1+ is less than that of all the other ions. NF membrane shows a high rejection for microbial pollutants, but these contaminants will cause degradation to the membrane surface.

Keywords: Nanofiltration membrane, micropollutants, Khyber Agency.

Emissions of black plumes from chimneys of indigenous brick kilns; a plain analysis of the blackish part of the smoke

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The fuel for generating high temperatures is a composition of coal, biomass, pet-coke, and waste rubber materials. Coal and plastic waste materials are usually used as a fuel for causing temperatures in the kiln. In any case, the combustion of a low quality solid fuels produces particulates having a blackish appearance and is considered extra hazardous than the usual greenhouse gases. This study provides the understanding of particulates morphology and the elements composition in order to develop a sustainable mitigation technology. Due to burning of the low quality or un-processed fuel, harmful emissions including all phases of matter, i.e. solid, liquid, and gas are being released into the atmosphere. A powerful scanning electron microscope (SEM) tool having a built in energy dispersive spectroscopy (EDS) gadget was used for the analysis. This study proposes a viable indigenous technology for the reduction of such toxic emissions. A detail analysis of the smoke, particularly the fine blackish particulates is critically evaluated. Several basic analytical methods (SEM, EDX, XRF, TGA, BET such as particulates surface area and size, and gaseous compositions) are used for generating real data.

Keywords: Black plumes emission; brick kilns; Climate change

Hydrophobic, nano-scaled metallic coated fabric for defense against viral spreading

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The COVID-19 pandemic is the worst and largest global public health outbreak of 21st century. According to WHO more than 5 million people have died and 250 million are affected with SARS-CoV-2. One of the major sources of infection is the spreading droplet released by the infected person through cough, exhale, or sneezing. These heavy droplets rapidly fall on different surfaces and live there for some time depending on conditions. The surfaces infected with living viruses is one of the reasons to infect a healthy person. Smart surfaces with contact killing properties can help in slowing down the spread of viruses, are strongly needed. In this study, copper oxide nanoparticles were synthesized by one-pot process and subsequently deposited by dip and dry method onto the surface of fabric. The size of CuO nanoparticles was found 16 ± 1.6 nm from PXRD using Scherrer equation. Also, FE-SEM images shows that CuO nanoparticles aggregate to form ginger like structures (<100 nm) which are uniformly distributed on the surface of fabric. Thus, the smaller size and even distribution of CuO particles yields maximum zone of inhibition for antibacterial as well as antiviral activity. The virucidal activity of CuO

nanoparticles treated fabric against adenovirus was found to be 99.99% with comparison to the untreated fabric which shows no reduction in viral litres according to ISO 18184 testing standard. The deposited CuO coating sustained 25 washes without losing activity. The coating can be applied to variety of fabric types and can be widely used in the face mask, clothing, and bedding in hospital settings.

Keywords: SARS-CoV-2, Antiviral fabrics, Copper oxide nanoparticles, Face mask, Antivirals, Antibacterial activity.

Numerical Modeling and Analysis of Inorganic Germanium Perovskite Solar Cell with ZnSe and CMTS Charge Transport Layer

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Perovskite are organic-inorganic hybrid materials. The organic component of the perovskite decomposes rapidly due to humidity and moisture exposure. Cesium (Cs) has successfully been proposed as the alternate A-cation in the perovskite material. Cs is purely organic material that has comparatively low degradation due to humidity. In this work nontoxic gallium-based cesium perovskite absorber is used in the PSC. The Cs-PSC is numerically modelled through solar cell capacitance simulator (SCAPS-1D). ZnSe has been chosen as ETL in the structure due to having large band gap and transmittivity. While kesterite CMTS material has been used as the HTL due to its high electric conductivity. The effect of Cs-perovskite and the CTL on the photovoltaic cell's performance are analyzed in detail though using continuity and Poisson equations. The IV characteristics, electric potential, recombination, band alignment, power conversion and quantum efficiency are studied. Moreover, the effect of increasing absorber defect density on optimized thickness of the layer has also been found. The optimized thickness at defect density of E13 was found to be 0.9 µm with PCE of 19.66%, for E14 0.8 µm with 19.54% PCE and for E15 0.8 µm with 19.34% PCE

Keywords: Charge transport layer, $CsGeI_3$, Non-toxic, Perovskite solar cell, SCAPS

Impact of co-torrefaction on the fuel characteristics of rice husk, coffee bean ground and their blends

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Co-torrefaction (CT) was performed on rice husk, coffee bean ground and their various blending ratio such as CBG:RH (25:75%), CBG:RH (50:50%), CBG:RH (75:25%), CBG 100%, and RH 100% as well as the impact of temperature were studied. The co-torrefaction experiments were performed using a laboratory scale tube furnace varying temperature from 200 °C- 300 °C. Reduction in mass and energy yields was because of increased temperature. At (75:25%) biomass concentration the volatile matter dropped to 8.03% while carbon content raised 12.9%. Also, the oxygen-to-carbon reduced 34.45% with increased temperature. The FTIR spectrum which confirmed release of the functional group of the volatile components such as H_2O, CO and CO_2 etc. In addition, the torrefaction index on a yield basis (weight loss, performance index, and torrefaction index) is increased at temperature of 300 °C. The high carbon content and better fuel properties were found for CBG 100% and blending ratio of CBG:RH (75:25%) at 300 °C for 60 min as a bio-solid production of 65.2%. This research found that co-torrefaction improves CBG, RH, and their blends as bio-solid fuel for energy applications.

Keywords: Rice husk; Coffee bean ground; Co-Torrefaction; Blending ratio

Removal of Chromium (VI) from textile industry wastewater by developing algal-derived biochar adsorbent using slow pyrolysis process

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The work's aim is the development of a sustainability goal for waste-water treatment by adsorbing and removing chromium (VI)) ions using algal biochar. The algal biochar is synthesized in a tube furnace using a process of slow Pyrolysis at 500˚C for 60 min. In the present study batch experiment is performed with different concentrations of Chromium (VI)(1,10,25,50,100ppm) at different time (15,30,60,120,240 min) to evaluate the removal efficacy. The reagent with 1,5 diphenyl carbazide is used as a reagent for the determination of chromium (VI) and analyzed at 500 nm using a UV -Vis spectrophotometer. The adsorption mechanism was assessed using the linear Langmuir and Freundlich model and evaluated which model is best fitted for the removal of Chromium VI. The Langmuir model fitted the experimental data, with a maximum adsorption capacity of 54.94505 mg/g. The best kinetic fit was found with the pseudo-second-order. The maximum removal percentage of chromium (VI) is 97.8428% obtained at pH 4 and metal concentration of 1ppm. The results obtained are useful for future works by using algal biochar as

an adsorbent of Cr (VI) from the textile waste water to attain sustainability development goal.

Keywords: Algae; Biochar; Chromium; Adsorption; Isotherm data

Efficient Photodegredation of Methl Violet Dye Using N/S Codoped Graphene Hydrogel Photocatalyst for Waste Water Treatment

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Water pollution is the main environmental problem nowadays. Heavy discharge of industrial waste such as organic dyes is one of main reason of water pollution. For this purpose photocatalyst N/S codoped Graphene Hydrogel (N/SGH) was synthesized by hydrothermal method and was used for photocatalytic degradation of dye under irradiation of UV lamp. The N/S codoped Graphene Hydrogel was characterized by UV-Visible double beam spectrophotometer, X-Ray Diffraction pattern (XRD), Fourier transform infrared spectroscopy (FT-IR),Energy dispersive X-Ray Analysis(EDX) and Scanning electron microscope(SEM). Batch experiments of adsorption were carried out by varying solution pH, adsorbent dose, initial dye concentration and contact time. The results revealed that optimum time in which degradation is maximum is 40 minutes, the degradation of dye decrease with increase in dye concentration 10ppm methyl violet show maximum degradation of about 93.3%, The pH of solution was varied from 2 to 14 for methyl violet dye and also dye adsorption capacity increased with increased adsorbent dosage up to 0.04 g, where degradation is 98.2%.

Polyaniline- (PAni-Rare earth metal oxide) coated graphene oxide as counter electrodes for dye-sensitized solar cells

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Natural resource depletion and environmental issues like pollution are the main problem that we face now a days but the most appropriate option is photovoltaic technology that seems to be the best option to get rid of these problems. In this study, via in situ polymerization, a ternary nano composite graphene- Rare earth metal oxide/porous polyaniline (rGO- Rare earth metal oxide /porous PANI), was prepared. Than as a potential counter electrode material for Dye Sensitized Solar Cells (DSSCs) this nanocomposite (rGO-Rare earth metal oxide/porous PANI) was used in order to yield a Dye sensitized solar cells having very high specific

capacitance, outstanding rate capability and life of cycle. A series of characterization such as Scanning electron microscope (SEM), X-ray diffraction (XRD), and Fourier transform resonance infra-red (FTIR) has done. This study showed that a ternary nanocomposites with well-connected nanosheets and porous structure can be successfully synthesized. By using these new CEs photovoltaic performance of the DSSCs was investigated using I-V measurements. In relationship to the other nanomaterials, the brilliant electrochemical performance of rGO- Rare earth metal oxide /porous PANI nanocomposite is due to large specific surface area brought from graphene and porous PANI, excellent electrical conductivity, energy density and good life cycle derived from Rare earth metal.

Physical & Biological Treatment of Drinking Water using graphene based Nanomaterials/Nanostructures

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The extraction of graphene through hummers method is one of the oldest techniques & it is one of the most suitable methods for the formation of bulk grapheme. Graphene is usually obtained in the form of reduced Graphite oxide, sometimes also referred as Graphene oxide. The effectiveness of process can be evaluated by the magnitude of carbon/oxygen ratio of the obtained graphene. In this study, we synthesized graphene oxide (GO) by oxidizing the purified natural flake graphite (NFG) and was characterized using XRD, SEM-EDAX, and UV- Visible spectroscopy. Two different tab water were used for the purification purpose and analyzed for their chemical and physical properties before and after treatment with GO. The microbiological load before and after treatment with the composite was also analyzed. The current study reveals the importance of water purification application using GO and the measurement of water purification efficiency with conventional techniques.

Keywords: Graphene oxide, water purification, nanocomposite, characterization techniques

Hybrid n-ZnO nanorods/p-polymer Blue Light Emitting Diodes Based on Low Temperature Solution Processed Nanostructure

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Here, this study is a demonstration of all step solution processed heterojunction light emitting diode (LED) based on a hybrid configuration consisting of Poly(9,9-di-n-octylfluorenyl-2,7-diyl) (PFO) thin film deposited on ITO glass substrate followed by grown of n-type ZnO nanorods on top of PFO by a low-temperature chemical aqueous method. Field emission scanning electron microscope (FESEM), X-ray diffraction (XRD), photoluminance spectroscopy (PL) and UV–vis spectroscopy analysis indicated the shape, density, crystallinity and defects level of the ZnO nanorods. As-fabricated organic-inorganic LEDs showed a stable rectifying diode behavior, and it was also observed that the turn-on voltage of the LEDs is depending upon thickness of PFO film optimized by spin coating speed. The broad PL spectrum of ZnO nanorods in the blue and green regions lead to observation of the blue light by a naked eye under forward bias. The results indicate that solution processed hybrid ZnO/polymer LED structure with reasonable electrical properties greatly influences the reduction of processing cost and promising for large area lightening applications.

Keywords: Nanomaterials, chemical sensor, heavy metals, drinking water

The development of a nanomaterial-based electrode of chemical sensor for the detection of heavy metals in underground drinking water

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In Pakistan, a large number of people are affected by the presence of heavy metals in groundwater as well as drinking water. Iron (Fe), copper (Cu), cadmium (Cd), chromium (Cr), lead (Pb), and especially arsenic (As) are the heavy metals present in higher quantities in water as compared to allowable limits by WHO and NEQS. With the advancement in the detection of these heavy metals and nanomaterials, they have been playing a vital role. Despite the many properties of nanomaterials, their high sensitivity, selectivity, effectivity, onsite detection portability, and low cost are important factors for selecting. Heavy metals, particularly arsenic, found in

drinking water can be detected by metal oxide hybrid sensors even at low concentrations. In this research, nanomaterial, hybrid sensors are being designed to detect heavy metals at low concentrations. XRD, SEM, UV adsorption and other characterization techniques will be used.

Keywords: Nanomaterials, chemical sensor, heavy metals, drinking water

Fabrication of nanomaterial adsorbents for colour removal and enhancement of the physical and biological properties of sugar distillery wastewater

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Distilleries play a key role as backbone industries, contributing significantly to Pakistan's national economy along with exports. As per practical experience, one-tone molasses, which contains 48-50% fermentable sugar, produces approximately 240–270 liters of alcohol. During the production of every liter of alcohol, approximately 15–18 liters of wastewater are generated. The wastewater is a dark brown liquid with high chemical oxygen demand, biological oxygen demand, and organic material. Due to the release of highly toxic wastewater, distilleries are considered one of the most environmentally hazardous industries nowadays. It also reduces soil fertility by decreasing its alkalinity and manganese content. In this research work, we will investigate the efficient removal of color from spent wash by using several physicochemical, coagulation, and oxidation treatment methods with as-synthesized nanomaterial. The synthesized materials and color removal will be characterized by FE-SEM, XRD, XPS Spectroscopy, and UV Spectrophotometer. Different physicochemical parameters like BOD, DO, COD, pH, acidity, chloride content, and hardness will be determined by standard methods.

Keywords: Distillery, waste water purification spent wash, characterization techniques

Comparative study of CO_2 absorption performance of different frothing agents by process simulation

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Continuous increase in the global warming resulting from emission of greenhouse gases, has been a serious challenge faced by the modern world. CO2 is the major component among all greenhouse gases, which has touched the atmospheric concentration of 421 ppm in 2022. In this study, CO2 capture performance of Na2CO3 mixed with different frothing agents (tri-ethylene Glycol-butyl ether, Diethylene-Glycol diethyl ether, hexanol, octanol and pentanol) at different molar concentration has been investigated and compared numerically using Aspen Plus software. Additionally, the effects of temperature and flowrate of liquid on absorption capacity of Na2CO3 were studied. The obtained results suggested that, absorption rate of dilute sodium carbonate was increased from 45% to 99.9% after the addition of frothing agents. Absorption capacity of Na2CO3 was decreased with increasing temperature, however, increasing liquid flowrate resulted in increased CO2 absorption performance.

Keywords: Absorption, Carbon dioxide, Frothing agents

Isolated Bubble Ascent in a non-Newtonian media inside an Infinite Bubble Column: A CFD Study

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Gas-liquid interaction is very crucial in many process industries like pharmaceutical, biochemical, and petrochemical. For Gas-Liquid interactions, bubble columns are widely used amongst other equipment due to the absence of moving parts, low maintenance cost, and no wear & tear. It is also efficient in mass transfer and mixing time. Handling and processing of liquids alter the behaviour from Newtonian liquid to non-Newtonian liquid for example in molasses, cooking oil, micro-algae, paint, cornstarch, etc shift of fluid behaviour is seen. Global hydrodynamics factors including gas holdup, mixing time, and mass transfer alter as a result of behavioural changes in the process. The single bubble research is crucial for comprehending this complex phenomenon. In this study, single bubbles are

simulated through ANSYS Fluent using the VOF model. Continuum Surface Force (CSF) model is used to treat surface tension. The single bubble study is carried out in Newtonian liquid water (used as a reference liquid) and non-Newtonian shear-thinning liquid Carboxymethyl cellulose (CMC). Terminal velocity, bubble shape, trajectory, molecular viscosity, strain rate, and velocity vectors including streamlines are studied. The results show the decrease in the terminal velocity in water till the bubble diameter is 5 mm and after that velocity increases as a function of bubble diameter. However, in CMC two domains of terminal velocity were observed. In the first domain, the terminal velocity increases up to 4 mm in diameter and after that, it attains a plateau. A zigzag trajectory is seen in water for lower bubble sizes, as the bubble size increases (db > 6 mm) the path becomes linear. Whereas in CMC, the rectilinear trajectory is observed due to higher viscosity for all bubble diameters studied.

Keywords: Computational Fluid Dynamics, Isolated bubbles, Terminal velocity, Volume of Fluid.

Comparative study of Pb(II) and Cd(II) sorption onto thermally activated mango peels hydrochar

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This study describes the advantages and limitations of trace metal including Pb(II) and Cd(II) ions sorption onto activated hydrochar obtained from waste mango peels. The hydochar prepared by hydrothermal carbonization of biomass under low temperature, which further activated at 400 oC temperature to produce activated hydrchar (ACH). The material characterized physiochemically according to ASTM methods and by other techniques such as BET, XRD, SEM, EDS and FTIR. Equilibrium data for isotherm and kinetic followed Langmuir and Pseudo-second order model for both Pb(II) and Cd(II). The study applied in fixed-bed column experiment for large scale water treatment applications. The obtained results showed that ACH was promising to remove Pb(II) and Cd(II) with obtained column equilibrium adsorption capacities of 38.31 and 3.39 mg g-1 at optimized conditions of bed height, flow rate and metal ions concentration. The obtained experimental results were considered at breakthrough curves and also compared with kinetic models Yoon–Nelson, Adams–Bohart and Thomas according to their linearized forms. ACH compared to commercially available activated carbon was considered

promising sorbent and can be suitable for large scale water treatment applications to remove Pb(II) and Cd(II) ions from polluted water.

Keywords: Activated hydrochar, Fixed-bed column, adsorption, metal ions contamination, water treatment

Iron ore beneficiation using gravity separation technique

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In this research, a study has beed carried out on upgrading valuable mineral i.e. iron ore (magnetite and hematite) using jigging appratus. The study is based on an evaluation of low grade mineral deposits. A comparison of gravity separation techniques such as jigs and liquid fluidized beds are used to carry out the experimental and the effect of different variables like variations of particle size and water flow rate on separation performance of the devices are investigated. In this study, only the results of jigging apparatus have been included showing that almost 30% of valuable iron was recovered from the ore. However, the fines, less than 1 mm, were not recovered due to jigging apparatus limitations.

Key words: Beneficiation, gravity separation, jigging

Synthesis of Eco Friendly Geopolymer for the Removal of an Azo Dye from Textile Wasterwater

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Textile dyes comprise a very diverse group of coloring agents usually utilized to color a vast range of textile products. These coloring agents remain for a longer period even in the presence of heat and light. The discharge of such untreated effluents from textile industry causes serious environmental problems. The purpose of this work is to investigate the feasibility of removing navy blue (NB) dye from textile dye wastewater using a bentonite clay based geopolymer (BCG). The synthesized BCG sample was characterized with the aid of SEM, BET, XRD and EDS analysis. To optimize the process of removing navy blue (NB) dye onto geopolymer GP, different parameters were studied such as, the effect of pH, initial dye concentration, adsorbent dosage, contact time and temperature. The results showed that the maximum removal efficiency of NB was found in the acidic environment. Best removal efficiency was obtained with 0.4 g geopolymer at pH 4.5 and 2 hrs contact time. Kinetic investigations showed that NB dye adsorption

follow pseudo second order kinetics, with rate constant of 0.001815 g/ (mg. min). The adsorption equilibrium data best fitted with Langmuir isotherm model and adsorption capacity was found to be 5.3760 mg /g. The thermodynamic study indicated that the adsorption was favorable, endothermic and spontaneous.

Binary and Ternary Composites Prepared From Reduced Graphene Oxide Coupled With Zinc and Nickel Oxide Nanoparticles as Room Temperature Ammonia Sensor

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Gas sensors with high stability are used to detect NH_3 (an irritant gas causing coughing, congestion, headache etc) at room temperature even at low concentration. Here we report a synthesis method for binary composite of reduced graphene oxide (RGO) coupled with zinc oxide (RGZ) while ternary composite of reduced graphene oxide coupled with zinc and nickel oxide (RGZN) through solvothermal method for NH_3 sensing at room temperature. The prepared composites were then characterized through XRD, UV visible spectroscopy, FTIR, SEM and used for NH3 sensing through electrochemical method. The sensing electrode was exposed to different concentration of NH_3 and showed good sensitivity. The RGO provided larger surface area and the metal oxides act as catalyst. In both the composites, the ternary composite (RGZN) showed good efficiency towards NH_3 sensing as compared to that of acetone and chloroform. This composite showed good sensitivity of 96.6% towards 60 ppm of NH3 with response and recovery time of 45/150 s at room temperature. Beside this the electrode showed 99% of its initial sensitivity after 50 days which proves its larger stability of using it at room temperature. The prepared composite will be a good material towards ammonia sensing with greater reproducibility.

Development of an optical sensor based on QD@MIP for the detection of sulfadiazine in samples of animal products

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The pharmaceutical industry has great progress in the world's economy, also having great development in recent decades. The drugs application is very important for the development of the quality of life of people and animals, but it is also important to emphasize that unregulated and improper consumption of these drugs, especially in farming industries, generates polluting residues in animal products, which can serious causes to human and animal health. The development of recent monitoring techniques and the fabrication of smart materials that detect the presence of these emerging contaminants is very important, being efficient methods that have low cost, good selectivity, and high durability. Optical materials are used for the detection of sulfadiazine antibiotics through the fluorescence technique. Quantum Dots (QD) semiconductors based on CdTe coated with molecularly imprinted polymers (MIPs) combined in a core@shell format (QD@MIP) are used as probes for monitoring, detection, and quantification of this drug. The measurements were obtained by altering the quantum dot fluorescence through quenching, of sulfadiazine in which the fluorescence intensity of the QD@Shell is reduced, as the analyte is adsorbed, allowing quantitative measurements. In addition, measurement parameters are also optimized to obtain better results, such as pH, retention time, repeatability, reproducibility, and selectivity. Recovery experiments were carried out in spiked samples of animal derivatives such as milk, eggs, and honey.

Keywords: quantum dots, molecularly imprinted polymer, sulfadiazine, fluorescence, quenching.

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