3rd Conference on

Sustainability in Process Industry

SPI-2016

ABSTRACT BOOK

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TABLE OF CONTENTS

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PREFACE

Sustainability means "to maintain or endure." According to the work of the UN Brundtland Commission, sustainability in the context of development is to "meet the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability in process industries is globally known since last few decades. Sustainable development contains social, cultural, environmental and economic aspects.

Pakistan is facing various problems and energy is one of the main issues today. There are many reasons behind energy crisis in Pakistan, inefficient processes are one of the major factors amongst them. It is high time to address sustainability, link it to the process industries, and to contribute to sustainable development in order to overcome the energy crisis in Pakistan.

The Chemical Engineering Department of University of Engineering and Technology, Peshawar plays a vital role in research areas of national interest. Our faculty is actively involved in applied research at both national and international level.

The 1st conference on **"Sustainability in Process Industries (SPI-2012)**, held at UET, Peshawar on March 28, 2012, attracted prominent researchers from all over Pakistan which created a linkage and presented approaches for the application of sustainability in the process industry.

The Department of Chemical Engineering had again taken initiative to hold a 2nd conference on **"Sustainability in Process Industry(SPI-2014)**", on May 22, 2014 in collaboration with PASTIC and NAYS. Continuing this tradition, the 3rd conference in this series, i.e. **"Sustainability in Process Industry (SPI 2016)"** October 19-20, 2016 is organized with the support of Higher Education Commission (HEC) in collaboration with PASTIC.

The mission of this conference is to identify new directions for research and development on **"Sustainability in Process Industry**" and share success stories regarding applied research and industrial case studies on R&D.

We hope that you will find this 3rd conference on **"Sustainability in Process Industry (SPI 2016)"** interesting and that the conference will provide you with a valuable opportunity to share ideas with other researchers and industrial practitioners.

Dr. Mohammad Younas
Chair

ACKNOWLEDGEMENT

It is our great pleasure to welcome you to the SPI-2016 3rd conference of this series, i.e. "Sustainability in Process Industry (SPI-2016)".Putting together SPI-2016 was a team effort. We first thank the authors for providing the content of the program in the form of oral and poster presentations and all other participants. We are also grateful to the key note 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, and our generous sponsors HEC, PASTIC, NAYS, Technology Links (Pvt) Ltd, Rizvi and Co. (Pvt) Ltd, and Meditron (Pvt) Ltd, without their support it would not be possible to hold this conference.

We are grateful to all organizers, who worked hard in order to make this conference successful.

ABOUT PASTIC

Pakistan Scientific and Technological Information Centre (PASTIC) formerly known as Pakistan National Scientific and Technical Documentation Centre (PANSDOC) was established under auspices of Pakistan Council of Scientific and Industrial Research (PCSIR) with the technical assistance of UNESCO. PANSDOC was later transferred to Pakistan Science Foundation, an autonomous organization of Ministry of Science & Technology and was renamed as Pakistan Scientific and Technological Information Centre (PASTIC). At present PASTIC is functioning under administrative control of Pakistan Science Foundation, Ministry of Science and Technology. PASTIC is the premier organization in the field of scientific and technological information dissemination serving thousand of researchers and R&D workers in the country. PASTIC mission to serve as a Gateway for S&T information for research and development community by catering to their information needs through its anticipatory and responsive scientific information services. PASTIC collects information from within the country as well as from abroad, processes and organizes the same and disseminate to its users. Major users of PASTIC services are S&T and R&D organizations, educational institutions, medical professionals, Govt departments and industry. PASTIC National Centre is housed in its own building at Quaid-i-Azam University Campus, Islamabad and its six Sub Centres are located at, Karachi, Lahore, Peshawar, Faisalabad, Quetta and Muzaffarabad (AJ&K). PASTIC is functioning under following aims and objectives.

- Acquisition, processing and dissemination of scientific & technological information to the researchers, scientists, academicians, R&D workers, industrialists, entrepreneurs etc.

- Provision of S&T documents and literature searching facilities, both On-line & Off-line.
- Development of inter-library cooperation and resource sharing at national level.
- Interaction and collaboration with regional and international information agencies / networks.
- Provision of trainings in contemporary techniques and methods of information handling & dissemination.

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Trainings / Workshops
Information Dissemination through Media (TV)

PASTIC is striving for information support of S&T and R&D community of the country and playing its indirect role in the socio economic development of the country.

ABOUT NAYS

-Faith, Knowledge, Dedication-

National Academy of Young Scientists (NAYS) Pakistan is a registered organization with Government of Pakistan under Societies Registration Act XXI, 1860. It was established in 2009 with the basic objective to promote and popularize science in Pakistan through collaborative effort of young researchers under the guidance of senior scientists.

Young researchers are always keen to play their role for development of the country but unfortunately no big platform was present for them at that time and for this we laid the foundation of NAYS® on 14 August 2009, presently we have more than 3500 registered member of NAYS. Among them, more than 200 young researchers are working as volunteer officials of NAYS,

Several projects have been started to promote science and help young scientists including include e-bulletin, e-newsletter, NAYS e-magazine, NAYS lecture series, Science for Youth, Community Education and Awareness Program, NAYS international Office, Mobility and Migration, Public Health Services, NAYS-Survey, Scientific Workshop series etc.

NAYS® is 5th in NYAs (National Young Academies) all over the world and now 19 have been established in a similar way. NAYS have organized number of workshops, trainings & Seminars for young researchers in various cities of Pakistan. NAYS®-Pakistan is trying to play its role by providing a platform and a place for networking among youth.

Reference:

www.nays.com.pk
https://www.facebook.com/nayspakistan
http://www.linkedin.com/groups/National-Academy-Young-Scientists-Pakistan

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CONFERENCE PROGRAM

Time	1st Day, 19th October, 2016 **New Academic Block, Reynold Hall**		
08.00-09.00	**REGISTRATION**		
Inauguration Ceremony			
09.00-09.05	**Recitation from the Holy Quran**		
09.05-09.15	**Welcome address: Dr. M. Younas, Conference Chairman**		
09.15-09.30	**Dr. M. Akram Shaikh (DG, PASTIC)**		
09.30-09.40	**Opening Remarks by Prof. Dr. Iftikhar Hussain (VC, University of Engineering and Technology, Peshawar)**		
09.40-09.50	**Guest of Honor, Prof. Dr. Niaz Ahmad, SI (VC, University of Engineering and Technology, Taxila)**		
09.50-10.00	**Address by Chief Guest**		
10.00-11.00	**Tea Break and Poster Exhibition**		
11.00-11.30 Plenary lecture 1 (Reynold Hall) **Prof. Dr. Glenn Lipscomb, University of Toledo, USA** **Application of Membrane Technology for CO_2 Capture from Natural Gas**			
Technical Session 1A (Reynold Hall) **ENERGY ENGINEERING-1**			
Session Chair: **Dr. M. Suleman Tahir** Session Co-Chair: **Dr. Waqar Ali Khan**			
11.40-12.00	Keynote-1	Prof. Dr. Abdul Waheed Bhutto *(DUET Karachi)*	Greener Energy: Issues and Challenges for Pakistan-Biomass Energy Prospective
12.00-12.15	Invited Talk-01	Dr. Najeeb Ullah *(USPCASE, UET Peshawar)*	Fabrication of Novel Nano Ag-TiOX Composite by Sustainable Redox Process for Energy and Environment Applications
12.15-12.30	EE-04-L-04	Dr. Salman Raza Naqvi *(SCME, NUST Islamabad)*	Physicochemical properties of agricultural biomass residues in Pakistan for future 'energy mix' potential
12.30-12.45	EE-03-L-03	Dr. Gul Reman *(Institute of Chemical Sciences,University of Peshawar)*	Electrochemically deposited Pure and Metal-doped α-Fe_2O_3 Thin films for Hydrogen Production from

			Photoelectrochemical Water Splitting
12.40-13.00	EE-05-L-05	Dr. Farid Ullah Khan *(Institute of Mechatronics Engineering, UET Peshawar)*	Energy harvesting from vehicle's suspension vibrations
13.00-13.15	EE-01-L-01	Engr. Asad Riaz *(U.S.-Pakistan Centre for Advanced Studies in Energy, NUST Islamabad)*	Feasibility and Potential of Parabolic Trough Solar Thermal Power Plants in Pakistan
Technical Session 1B (Richardson Hall) **SEPARATION SCIENCE AND TECHNOLOGY-1**			
Session Chair: **Dr. Asim Laeeq Khan** Session Co-Chair: **Dr. Jamil Ahmad**			
11.40-12.00	Keynote 2	Prof. Dr. Arshad Hussain *(SCME, NUST Islamabad)*	Fabrication and Characterization of Cellulose Acetate based Mixed Matrix Membranes for Gas Separations
12.00-12.15	SP-22-L-12	Dr. Nawshad Muhammad (*COMSATS Lahore)*	Ionic Liquid as a Green Solvent for Biomass Dissolution and Separation
12.15-12.30	SP-17-L-10	Dr. Asmat Ullah *(UET Peshawar)*	Slotted pore membranes and oil/water separation
12.30-12.45	SP-13-L-06	Engr. Zaman Tahir *(COMSATS, Lahore)*	Functionalized UiO-66 Sulfonated ISA Membranes for Gas Separation
12.45-13.00	SP-10-L-05	Engr. Sami Ullah *(UET Lahore)*	Alkali Activated Coal Fly ash for the adsorption of Ni (II) from an aqueous solution
13.00-13.15	SP-09-L-04	Engr. Raza Khalid *(UET Lahore)*	Removal of chromium (VI) from aqueous solution by adsorption using Acacia Nilotica (keekar) saw dust
Technical Session 1C (Schmidt Hall) **HEALTH SAFETY & ENIVONMENT**			
Session Chair: **Dr. Shagufta Ishtiaque** Session Co-Chair: **Dr. Saeed Gul**			
11.40-12.00	Keynote 3	Prof. Dr. Shahid Raza Malik *(NFC-IEFR Faisalabad)*	Air Pollution Control Techniques and Technologies for Process Industries
12.00-12.15	Invited Talk-	Prof. Dr. Naveed Ramzan	Root Cause analysis of

	02	*(UET Lahore)*	Catastrophic Fire in paints industry
12.15-12.30	HSE-07-L-05	Dr. Naseer Ahmad Khan *(UET Peshawar)*	A laboratory scale investigation of N_2O catalytic reduction over cobalt and iron catalysts
12.30-12.45	HSE-08-L-06	Mohammad Sohail *(National Center of Excellence in Physical Chemistry, University of Peshawar)*	Assessment of different industrial ceramic wastes and their potential for possible applications: A pilot scale renewable materials investigation
12.45-13.00	HSE-09-L-07	Engr. Muhammad Kamran Mahmood *(SCME, NUST Islamabad)*	Slow release urea fertilizer from Sulphur, gypsum and starch coated formulations
13.00-13.15	HSE-04-L-03	Humza Bin Masood *(FC College, Lahore)*	Environmental Terrorist: Electric Generators increasing lead in environment
13.15-14.10 **Lunch/Prayer Break – Poster Exhibition**			
Session 2A (Reynold Hall) **CHEMICAL ENGINEERS CONVENTION**			
14.15-14-20	**Recitation from Holy Quran**		
14.20-14.30	**Presenting agenda of the convention by Dr. Mohammad Younas**		
14.30-14.40	**Welcome Address by Prof. Dr. Iftikhar Hussain, VC UET Peshawar**		
14.40-15.05	**Health Issues of Chemical Engineers at the work place by Engr. Younas Khan, Askari Cement, Wah**		
15.05-15.30	**Quality of Chemical Engineering Education in Pakistan by Prof. Dr. Arif Butt**		
15.30-15.55	**Job placement and Career Development of Chemical Engineers by Prof. Dr. Zafar Noon**		
15.55-16.20	**Strengthening and integration of Chemical Engineering in the national and global prospective by Prof. Dr. Niaz Ahmad, SI, VC, UET Taxila**		
16.20-16.45	**Open Discussion for future planning**		
16.45-17.00	**Closing remarks**		

Session 2B (Richardson Hall) **MODELING AND SIMULATION-1**			
Session Chair: **Prof. Dr. Siraj-ul-Islam** Session Co-Chair: **Dr. Marjan Uddin**			
14.10-14.30	Keynote 4	Prof. Dr. Siraj-ul-Islam *(UET Peshawar)*	Mathematical Modeling and Simulation
14.30-14.45	MS-M-03-L-01	Habib Nawaz Khan (*UET Peshawar)*	Numerical evaluation of multi-dimensional integral over planar and non-planar regions
14.45-15.00	MS-M-05-L-03	Hazrat Bilal *(UET Peshawar)*	Numerical solution of an integro-differential model for the spread of alcohol abuse using Radial basis function and fourth order Runge Kutta methods.
15.00-15.15	MS-M-10-L-07	Muhammad Usman (*UET Peshawart)*	Higher order compact finite difference method for the solution of two-dimensional time fractional diffusion equation
15.15-15.30	MS-M-18-L-12	Ishtiaq Ahmad (*KUST, Kohat)*	Evolution strategies based on multiple crossover operator for global optimization problems
15.30-15.45	MS-M-23-L-17	Hina Mujahid *(Shaheed Benazir Bhutto Women University, Peshawar)*	Numerical solution of Fisher's Equation by using Meshless method of lines
15.45-16.00	MS-M-17-L-11	Zahir-ud-Din *(CECOS University, Peshawar)*	A numerical solution technique of 1D Fredholm integral equation having oscillatory kernel with stationary points
16.00-16.15	MS-M-21-L-15	Salma Noreen *(Shaheed Benazir Bhutto Women University, Peshawar)*	Solving the non-linear Harry Dym equation by Kansa's method
16.15-16.30	MS-M-08-L-05	Muhammad Naveed Anjum *(UET Peshawar)*	Analysis of Unsteady Squeezing Flow Between Two Porous Plates with Variable Magnetic Field.
16.30-16.45	MS-M-25-L-19	Ali Ahmad *(UET Peshawar)*	A fuzzy based active contour model for image segmentation using Gaussian distribution
16.45-17.00	MS-M-27-L-20	Hassan Shah *(UET Peshawar)*	Segmentation of Texture Images via L0 Norm Smoothing

Session 2C (Schmidt Hall) **MINERALS PROCESSING AND MATERIAL ENGINEERING**			
Session Chair: Dr. Nehar Ullah **Session Co-Chair: Dr. Muddasar Habib**			
14.10-14.30	Keynote 5	Prof. Dr. Suhail A. Soomro *(MUET Jamshoro)*	Synthesis of zeolite from coal power plant ash
14.30-14.45	Invited Talk-03	Dr. Asim Laeeq Khan *(COMSATS Lahore)*	Matrix Membranes comprising of fluorinated and sulfonated PEEK and functionalized mesoporous COK-12 for CO_2 separation
14.45-15.00	MS-CH-01-L-01	Dr. Ishaq Ahmad *(UET Peshawr)*	Bauxite Washing: Kinetic Modelling Approach
15.00-15.15	MPE-01-L-01	Engr. Zia- ur-Rehman *(UET Peshawr)*	Beneficiation Study on Teerah barite
15.15-15.30	MSE-07-L-03	Sohail Aamer *(UET Peshawar)*	Effect of Soluble and Neat cutting oils on machining Alloy steel
15.30-15.45	MSE-08-L-04	Fayyaz Ur Rahman *(UET Peshawar)*	Effects of infill wall modelling on design of reinforced concrete buildings
15.45-16.00	MSE-03-L-02	Fareed ul Haq Khan (*UET Lahore)*	A Study on Gelatin based Metal Powder Conductive Composites
16.00-16.15	MPE-03-L-03	Sajid Khan (*UET Peshawar)*	Crushing Circuit Design for Processing of North Waziristan Copper Ore
16.15-16.30	MPE-02-L-02	Abdur Rahman (*UET Peshawar)*	Exploration Framework for the Sustainable Development of Dimension Stone Industry, A Case Study of Buner
16.30-16.45	MSE-01-L-01	Aamir Malik (*COMSATS Lahore)*	Functionalized UiO-66 Polyimide ISA Membranes for Nanofiltration
16.45-17.00	MS-CH-05-L-04	Kausar Sultan Shah (*UET Peshawar)*	Application of Monte Carlo Simulation for Cement Raw Material Blending Optimization

19.00-22.00 Gala Dinner			
2nd Day, 20th October 2016			
09.00-09.25 **Plenary Lecture 02 (Reynold Hall)** **Prof. Dr. Jose Sanchez MARCANO, University of Montpellier, France** **Modelling and Simulation of Multichannel** **Enzymatic Membrane Reactors**			
Technical Session 3A (Reynold Hall) **ENERGY EMGINEERING-2**			
Session Chair: **Dr. Suhail A. Somroo** Session Co-Chair: **Dr. Najeeb Ullah**			
09.30-9.50	Keynote 06	Prof. Dr. Nadeem Feroze *(UET, Lahore)*	Performance Evaluation of API Grade Lube Oils in Internal Combustion Engine
09.50-10.05	Invited Talk-04	Prof. Dr. Mahmood Saleem (*ICET, University of Punjab)*	Entropy Generation and Work Lost Analysis of Rice Husk Fired Thermal Power Plant; A Case Study
10.05-10.20	EE-12-L-011	Fatma TAKTAK (*Laboratoire 3E (AD-10-02), Ecole Nationale d'Ingénieurs de Sfax, BP, 3038 Sfax, Tunisia)*	Sedimentation, Eustasy and Tectonic Constraints of the Eocene to lower Miocene Hydrocarbon Systems of the Gulf of Gabes Basin in Tunisia
10.20-10.35	EE-11-L-10	Muhammad Alam Zaib Khan *(UET Peshawar)*	To Study the Performance of Diesel Engine Using Blends of Bio-Diesel form Jatropa Curcas L
10.35-10.50	EE-09-L-08	Tasmiyah Javed *(Lahore College for Women University, Lahore)*	Design of an Optimized Hybrid Power System
10.50-11.05	EE-13-L12	Abdul Rehman Memon *(MUET, Jamshoro)*	Downstream pH control and process-efficient kinetics during copolymer-induced pelagic cultivation of benthal Chlorella vulgaris
11.05-11.20	MS-CH-09-L-05	Jawad Mustafa (*SCME, NUST Islamabad)*	Computational Fluid Dynamic (CFD) based Exergy Analysis of Naphtha Reforming process

Technical Session 3B (Richardson Hall) **SEPARATION SCIENCE AND TECHNOLOGY-02**			
Session Chair: **Dr. Saeed Gul** Session Co-Chair: **Dr. Asmat Ullah**			
09.40-10.00	Keynote 07	Prof. Dr. Asad Ullah Khan (*COMSATS Lahore)*	Photocatalytical Degradation of Congo Red (CR) Dye by nano Titanium Dioxide Coated Glass Beads Exposed to U.V Light Irradiation
10.00-10.15	SP-16-L-09	Dr. Muhammad Aasim *(University of Malakand, Lower Dir)*	Surface energetics of protein adsorption onto chromatographic supports
10.15-10.30	SP-18-L-11	Salma Amir *(University of Peshawar)*	Synthesis and Functionalization of mesoporous silica for effective removal of metal ions from aqueous solutions
10.30-10.45	SP-15-L-08	Sara Abid *(SCME, NUST Islamabad)*	Separation of Nitrogen from Air using Polymeric Membranes
10.45-11.00	SP-04-L-01	Ayesha Ilyas (*COMSATS Lahore)*	High CO_2 selective novel supported ionic liquid membranes using (3-Aminopropyl) trimethoxysilane and acetic acid
11.00-11.15	SP-06-L-02	Irum Tahira (*UET, Lahore)*	Characterization and Evaluation of Grafted Chitosan for Congo red removal from aqueous media
11.15.11.30	SP-07-L-03	Mohsin Ali (*COMSATS, Lahore)*	Zeolitic Imidazolate Framework (ZIF) based Mixed Matrix Membranes for Organic Solvent Resistant Nanofiltration
Technical Session 3C (Schmidt Hall) **CHEMICAL PROCESS SIMULATION AND OPTIMIZATION**			
Session Chair: **Prof. Dr. Shahid Raza Malik** Session Co-Chair: **Dr. M. Imran Ahmad**			
09.30-9.50	Keynote-08 MS-CH-10-L-06	Dr. Iftikhar Ahmad *(SCME, NUST)*	Dimension of Uncertainty in Models of Industrial Processes
09.50-10.05	MS-CH-04-L-03	Kanwal Shabbir *(UET Lahore)*	Parametric Optimization of an Internally Heat-Integrated Distillation Column
10.05-10.20	MS-CH-02-L-02	Haseeb Jatoi	Analysis of Various Control

		(UET Lahore)	Configurations of a Packed Bed Reactive Distillation Column
10.20-10.35	MS-M-12-L-09	Samreen Ismael (*UET Peshawar)*	Numerical Solution of Inverse Heat Problems
10.35-10.50	SP-14-L-07	Noureen Aamir Khan *(National Centre of Excellence in Physical Chemistry, University of PEshawar)*	Kinetics modelling and mechanism of Pb(II) sorption on chemically modified activated carbon
10.50-11.05	MS-M-09-L-06	Muhammad Ahsan *(UET Peshawar)*	Haar Wavelet Based Numerical Scheme to Solve Convection Diffusion Equations
11.05-11.20	HSE-02-L-02	Muhammad Sagir *(University of Gujrat)*	CO_2 mobility control by using surfactants for EOR applications
11.15-11.40 Tea Break and Poster Exhibition			
Technical Session 4A (Reynold Hall) **MODELLING AND SIMULATION-02**			
Session Chair: **Dr. Marjan Uddin** Session Co-Chair: **Dr. Rehan Ali Shah**			
11.40-12.00	Keynote Lecture 9 (MS-M-11-L-08)	Sakhi Zaman *(UET Peshawar)*	Numerical approximation of rapidly oscillatory Bessel integral transforms
12.00-12.15	MS-M-04-L-02	Hajia Naseem *(UET Peshawar)*	Numerical solution of a system of reaction diffusion PDEs arising in EN plasma
12.15-12.30	MS-M-06-L-04	Khug Alam (*KUST, Kohat)*	Biogeography Based Algorithm for Optimization Problems: Preliminary: Experimental Results
12.30-12.45	MS-M-22-L-16	Hifza Shiraz *(Shaheed Benazir Bhutto women university, Peshawar)*	Numerical solution of Harry Dym equation by meshless technique
12.45-13.00	MS-M-15-L-10	Suleman Ahmad *(UET Peshawar)*	On the Numerical Solution of Linear Multi-Term Fractional Order Differential Equations using Laplace Transform and Quadrature
13.00-13.15	MS-M-24-L-18	Yusra Maheen *(Shaheed Benazir Bhutto women university, Peshawar)*	A meshfree collocation technique for the numerical solution of Fisher Equation

Technical Session 4B (Richardson Hall) **ENERGY ENGINEERING-03**			
Session Chair: **Abdul Waheed Bhutto** Session Co-Chair: **Dr. Naseer Ahmad**			
11.40-12.00	Keynote-10	Prof. Dr. M. Tayyeb Javed *(PIEAS, Islamabad)*	Technology Entrepreneurship: a mindset required for sustainability of chemical process industries and economic growth
12.00-12.15	Invited Talk-05	Dr. Suleman Tahir *(University of Gujrat)*	Effective utilization of Pakistani Reserves for Sustainable Energy Production
12.15-12.30	Invited Talk-06	Dr. Waqar Ali Khan (*NFC-IEFR, Faisalabad)*	Effect of Operating Parameters on Tyre Derived Fuel from Pyrolysis of Waste Tyres.
12.30-12.45	Invited Talk-07	Prof. Dr. Hafeez ur Rehman Memon *(MUET, Jamshoro)*	Energy generation from municipal solid wastes
12.45-13.00	EE-08-L-07	Engr. Muhammad Faizan Sharif *(USPCASE, NUST, Islamabad)*	Hydrotalcites Based Cobalt Catalyst for Synthesis of Hydrocarbons from Syngas
13.00-13.15	EE-14-L-13	Muhammad Imran (*NFC -IEFR, Faisalabad)*	Effect of Different Parameters on Coal Washability by Float & Sink Analysis
Technical Session 4C (Schmidt Hall) **GREEN, SAFE AND SUSTAINABLE PRODUCTION**			
Session Chair: **Naveed Ramzan** Session Co-Chair: **Dr. M. Younas**			
11.40-12.00	Keynote-11	Shagufta Ishtiaque *(University of Karachi)*	Hazard and Operability (HAZOP) study of wastewater treatment
12.00-12.15	Invited Talk-09	Prof. Dr. Khadija Qureshi (*Mehran University of Engineering and Technology Jamshoro, Sindh*)	Modified iron ore for the removal of arsenic from underground water at Matiari city
12.15-12.30	MS-M-19-L-13	M. Shahzad Akbar *(Al Ain University of Science and Technology, Al Ain,United Arab Emirates)*	Sustainable State-of-Practice in the Industrial Plant Business for Multi-Ethnic Organization

12.30-12.45	MS-M-20-L-14	N. Zafar Azeemi *(University of Modern Sciences (UoS), Dubai, United Arab Emirates)*	A Novel Approach—Modeling Vulnerability in Non-Invasive Industrial Instrumentation for Luminescence Scanning Technology
12.45-13.00	HSE-10-L08	Suraiya Jabeen *(Institute of Environmental Studies, University of Karachi)*	Degradation Kinetics of Phenol by Indigenous Soil Flora (Bacillus subtilis)
13.00-13.15	EE-15-L-14	Syed Riaz Uddin *(OGDCL, Islamabad)*	Granex power cycle: Investigation of an efficient cycle for utilizing waste heat.
13.15-14.15 Lunch and Prayer Break			
14.15-14.45 Plenary Lecture 3 (Reynold Hall) By Fausto Gallucci (Eindhoven University of Technology, Eindhoven, The Netherlands) Membranes and Membrane Reactors for Energy Applications			
Closing Ceremony (Reynold Hall)			
15.00-15.05	**Recitation from Holly Quran**		
15.05-15.15	**Wrap-up by Dr. M. Younas, Chairman, Chemical Engineering, UET Peshawar**		
15.15-15.30	**Award distribution announcement by Dr. Saeed Gul, Director ORIC, UET Peshawar**		
15.30-15.40	**Vote of thanks, Prof. Dr. Noor Muhammad, Dean, Faculty of Engineering, UET Peshawar**		
15.40.15.50	**Closing remarks, Prof. Dr. Iftikhar Hussain, VC, UET Peshawar**		
15.50-16.00	**Address by Chief Guest**		
High Tea			

ABSTRACTS

(Plenary, Keynote, and Invited Talks)

Optimizing Membrane Processes for Carbon Dioxide Capture

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ABSTRACT

Anthropogenic emissions of carbon dioxide (CO_2) from fossil fuel power plants potentially can lead to global climate change. Processes under consideration to reduce CO_2 emissions include absorption, adsorption, and membranes in either a pre- or post-combustion configuration.

Membrane Technology and Research (MTR) proposed a membrane-based, post-combustion process with the potential to reduce capture cost significantly. The MTR process overcomes the challenge posed by relatively low CO_2 concentration in flue gas by using the boiler feed air to strip residual CO_2 in a separate stage. Unfortunately, the reduction in capture cost is accompanied by a reduction in the oxygen concentration of the boiler feed.

The effects of membrane transport properties and process operating pressures on performance are examined for various boiler feed oxygen concentrations. The CO_2/N_2 selectivity is varied over a broad range while the CO_2 permeability is calculated according to the Robeson upper bound. The results are reported in terms of levelized cost of electricity (LCOE). A broad minimum in LCOE is found which decreases as oxygen concentration in the feed air decreases.

Keywords: carbon capture, gas separation, membranes.

Modelling and simulation of multichannel enzymatic membrane reactors

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ABSTRACT

Enzymatic reactors using immobilized enzymes reactors are usually stirred-tank or packed-bed reactors. However, in such reactors the yields can be limited by mass transfer phenomena. In enzymatic membrane reactors (EMRs), the biocatalyst is located on the surface or within the porosity of the membrane and the reaction takes place during the transfer of substrates through membrane pores. Then, mass transfer limitations can be avoided while enhancing the contact between the biocatalyst and the substrates. Indeed, higher yields can be expected. EMRs present additional advantages like operation in continuous mode, relatively easy operation and control and finally straightforward scale-up to large systems. The objective of this work is the employment of computer aided process engineering tools such as modeling and simulation to advance in the knowledge of the performance of enzymatic membrane reactors under different design and operation conditions in three dimensions (3D) model. The model was developed to simulate tubular enzymatic membrane reactors under three different configurations: dead-end, tangential flow with a porous enzymatic membrane and a non-permeable enzymatic wall. The simulations were applied to analyse the influence of reactor configuration, kinetics and mass transport conditions over the reactor performance in order to identify the main aspects to be taken into consideration for attaining optimal designs. The simulations shown that a non-permeable enzymatic wall configuration seems to be more advantageous than a dead-end configuration with porous membranes in terms of substrate conversion for the studied particular conditions, whereas, the tangential configuration looks more favourable to promote more effectively reacted permeate streams, while only low conversions are attained in the retentate streams. It has been demonstrated that reaction kinetics has the greatest influence among all the analysed variables. Almost total conversion in the permeate stream can be attained for the fastest reactions, while slow reactions suffer from irrelevant conversions.

Keywords: Modelling, simulation, multi-channel, enzymatic membrane reactor.

Membranes and Membrane reactors for Energy applications

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ABSTRACT

Inorganic membranes such as oxygen transport membranes and palladium-based membranes for hydrogen separation have been studied by several research groups especially for energy applications (both for pre-combustion and oxy-fuel combustion). Much effort has been paid to improve the flux of these membranes optimizing the supports, deposition/production techniques, etc. High flux and cheap membranes yet stable at different operating conditions are required for their exploitation at industrial scale.
The integration of membranes in membrane reactors (typical example of multifunctional reactors) increases the on the membranes. In fact, the integration of reaction and separation in a single devise, decreases the degree of freedom on the operating conditions, also interaction between the catalyst and the membrane surface can occur, damaging both membranes and catalyst.
In this work, the recent advances on inorganic membrane preparation, membrane reactor design and testing and the scale-up of these reactors are discussed in details, especially for energy related applications.

Keywords: Inorganic membranes, gas separation, energy applications.

Greener energy: Issues and challenges for Pakistan-Biomass energy prospects

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ABSTRACT

Diversification of fuel sources is imperative to address the energy security, climate change, and sustainable development issues; therefore, it is essential to address the energy crisis through the extensive utilization of abundant renewable energy resources, such as biomass energy, solar energy, wind energy and geothermal energy. Improving energy services for poor households in developing countries remains one of the most pressing challenges facing the development community. Earlier studies suggest in South Asia the households are likely to follow the energy ladder comprising fuels like dung, crop residue, firewood, kerosene, gobar gas, LPG, and electricity for cooking purposes. Evidence suggests that while it is possible to observe such transition in urban and semi-urban areas, the change is very slow in rural areas. In rural Pakistan, the access to commercial energy resources is limited, the majority of the households still heavily rely on traditional methods of using wood, animal waste and crop waste for domestic fuel needs. Efficiencies of use are very low and most of the potential is wasted because of non-scientific conventional technologies. Consequently, there is an obligatory need to develop modern bio-energy technologies since renewable resources may serve to supplement the long-term energy needs of Pakistan to a significant level. Though the bio-resource base of Pakistan is substantial, its contribution to useful energy is low. In this paper we called attention to issues and challenges in biomass utilization for energy in Pakistan in context of sustainable development. This paper has identified areas in Pakistan where there is considerable scope to modernize biomass energy production delivery systems to provide varied energy carriers such as electricity, industrial and domestic fuel and gases. Barriers are examined over the whole biomass energy spectrum and policy issue and institutional roles and responsibilities are discussed.

Keywords: Greener Energy, Diversification of fuel, Biomass

Fabrication of Novel Nano Ag-TiOx Composite by Sustainable Redox Process for Energy and Environment Applications

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ABSTRACT

Different types of novel Ag-metal-oxide nano composites were synthesized and characterized by Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), X-Ray Diffraction (XRD) and Raman spectroscopy techniques. Photoluminescence and UV Vis spectroscopy techniques were used to know the absorption behavior of these novel nano composites. Black Ag-TiO_2 and Ag-TiOxNy were prepared by unique sustainable redox chemical process and can be replicated easily if large production of these materials is required.

These nano composite materials have large commercial application for ranging from fabricating third generation solar cells, water & air treatment by sunlight and Li-S batteries etc.

Keywords: Solar Cell, Redox Process, Raman Spectroscopy.

Fabrication and Characterization of Cellulose Acetate based Mixed Matrix Membranes for Gas Separations

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ABSTRACT

Presence of CO2 in natural gas decreases the calorific value which makes its removal indispensable. Most of the polymers or their blends used for CO2 separation are very expensive but cellulose acetate (CA) being cheap is a lucrative choice. PEG has been utilized to increase the chain flexibility which in turn modifies the permeability of different gases through polymers while CNTs increases the tensile strength. In this research polyethylene glycol (PEG) and carbon nanotubes (CNTs) were incorporated in cellulose acetate (CA) using solution casting technique to study the permeation behavior of CO2 and CH4 through polymeric membranes. Membranes of pure CA, CA/PEG blend of different PEG concentrations (5%, 10%, 15%) and CA/PEG/CNTs blend of 10% PEG with different CNTs concentrations (5%, 10%) were prepared. Fabricated membranes were characterized using scanning electron microscopy (SEM), Fourier transform infrared (FTIR) spectroscopy and universal testing machine (UTM). The dense morphology and proper blending of PEG/CA and PEG/CA/CNTs were confirmed by SEM analysis. Change in structure and presence of certain functional groups due to addition of PEG and CNTs were confirmed by FTIR analysis. Incorporation of PEG decreased the tensile strength from 10.05 to 6.59 while further incorporation of CNTs enhanced the tensile strength to 12.27. Results from permeation behavior show remarkable increase in CO2/CH4 selectivity for both single and mixed gas on addition of PEG and a further increase in CO2 permeability and CO2/CH4 selectivity was also observed through CA/PEG/CNTs membranes.

Keywords: Gas Separation, Max Matrix Membranes, SEM

Air Pollution Control Techniques and Technologies for Process Industries

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ABSTRACT

Three major threats to the nation's environment and to the health of billions of peoples is acid rain, urban air pollution, and toxic air emissions.

The overall motivation for clean air is protection of health. There are essentially only two general methods for ensuring high quality air. These options are the application of control technologies that clean air or remove pollutants, and methods of prevention. Indicates that more than billions of tones of toxic air pollutants are emitted annually in the world. EPA studies suggest that exposure to such quantities of air toxics result in thousands of cancer deaths each year.

Keywords: Air Pollution, EPA, Control Technologies.

Root Cause Analysis of Catastrophic fire in paints industry

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ABSTRACT

Paint manufacturing facilities being largest consumer of flammable solvents are more prone to industrial fire incidents. There are many paint industries currently operating in Pakistan and one of them has suffered same fate as Union Carbide due to a catastrophic fire incident. Even after the fire; primary company also erected a new facility but fire prevention setup was neither enough to cater any huge incident nor they given any substantial priority. Still insignificant fire incidents are happening in facility that may escalate to any top event any moment of time. This imposes compulsion of proper accident investigation of such events and identification of underlying causes to prevent them in future. Most commonly inadequate management control, poor supervision or any engineering fault creates basic causes of undesired yet evitable events called accidents. It has been estimated that over 80 percent accidental injuries and deaths are occurred due to actions of individuals rather than other externally imposed causes. It is, therefore, needed that all process industries should keep record of incidents and conduct investigation to identify failures in safety management systems on yearly basis. This way all process industries can judge performance of their safety management systems, pin point lacks in particular elements and can plan for the future improvements. Different techniques such as Sequence Diagrams, Brain-storming, Casual Factor Identification, What-if Checklists, Fault or Event Tree can be employed for incident investigations to identify root causes. In this article a major catastrophic fire accident, 2008 in paint industry is evaluated using Root Cause analysis highlights the importance of applying process hazard analysis techniques to the design and operation of potentially hazardous processes in paints industry. Furthermore, fire incidents occurring during 2010 and 2014 in various operational paint industries analyzed using Why Tree analysis. More than 200 minor fire incidents and four hundred various underlying causes signifies that proper root cause analysis for catastrophic incident would have prevented further fire accidents/incidents. Fault Tree and Event Tree models are constructed that shows flaws in operating procedures, lack of

trainings in staff, poor maintenance procedures and ineffectiveness of risk assessment of incidents are most common and recurrent failures in safety management system.

Keywords: Root cause analysis, catastrophic fires, paint industry fire, Fault tree analysis, Event tree, Why Tree analysis, Safety Management system.

Mathematical Modelling and Simulation

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ABSTRACT

In this talk, we will focus on mathematical modeling and some newly developed simulation procedures with specific emphasis and relevance to chemical engineering. Mathematical modelling has a pivotal role in science and engineering in the formulation of qualitative questions about an observed phenomenon and subsequently casting them into mathematical form. Some case studies of general engineering interests will be deliberated as well to show efficacy of the mathematical.

Synthesis of Zeolite from Coal Power Plant Ash

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ABSTRACT

The increased use of coal around the world for power generation & the amount of ash generated needs urgent consideration for the effective disposal & treatment. In this context researchers had not only focused on disposal & treatment techniques but also they are engaged in effective utilization of coal ash for the different purposes. The paper is focused on the progress made on the different techniques used for the synthesis of zeolite from coal ash and its applications.

Ash contain high percentage of silica alumina that is the basic requirement for zeolite synthesis. Zeolite can be synthesized from ash using alkali fusion method followed by hydrothermal treatment via conventional heating or microwave irradiation technique. Different types of zeolites, such as Na-X, Na-A, Na-P1, Na-Y, zeolite beta, sodalite and Zeolite 4A etc. can be synthesized using different process conditions such as curing time, hydrothermal temperature and molar ratio. Zeolites are multi-utility crystalline structure and have an acquired attention of many researchers.

The characterization of synthesized zeolite may be carried out using specific surface area (BET method), morphological analysis (SEM), mineralogical composition (XRD) and XRF, CEC (cation exchange capacity), LOI (Loss of ignition), N_2-adsorption-desorption measurements, granulometry, FT-IR and TGA.

Keywords: zeolite, coal, ash, power plant, synthesis.

Mixed Matrix Membranes comprising of fluorinated and sulfonated PEEK and functionalized mesoporous COK-12 for CO_2 separation

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ABSTRACT

The excessive use of fossil fuels such as coal and petroleum products is one of the primary sources of CO_2 emissions. CO_2 thus emitted is a major contributor to the greenhouse effect of earth, resulting in increase in global warming. Membrane technology is an attractive choice to perform this task due to its many advantages over other separation techniques such as environment friendly, cheap and energy efficient [1]. Mixed matrix membranes (MMMs) comprising of an inorganic filler and a polymer matrix have shown the potential to increase the performance of gas separation membranes [1].

In this study, new types of MMMs composed of novel polymer, a fluorinated and sulfonated aromatic poly (ether ether ketone) (FSPEEK) and $–SO_3$ functionalized mesoporous silica spheres were prepared by solution casting method. The dispersion of the fillers in the polymer matrix was improved by employing solution blending and probe sonication techniques. The thickness of the membranes was controlled at 50-65 µm. Sulfonated polymers have shown their potential to surpass the Robeson upper bound [2-3]. The incorporation of bulky fluorinated groups in the polymer is expected to further increase the separation performance due to inhibition of chain packing and increased steric hindrance [4]. The presence of C_2F_6 type fluorinated groups improves the fractional free volume by the inhibition of chain packing. These bulky groups also restrict the torsional motion of the polymeric chains and simultaneously increase the rigidity of polymer resulting in strong ability of size sieving. The degree of sulfonation was fixed at 50% for all the synthesized MMMs.

CO_2 permeation and SEM images of the synthesized MMMs suggest that the fillers adhered well to the polymer matrix. The non-functionalized COK-12 based MMMs showed up to 26% increase in CO_2 permeability at 30% filler loading. The selectivity values however decreased upon addition of more COK-12. In contrast, the $–SO_3$ functionalized filler showed a 35% and 29% higher CO_2/CH_4 and CO_2/N_2 selectivity respectively at the 30 wt. %. This behavior resulted from the increase in the content of polar $–SO_3$ sites, the introduction of fixed mesopores by the filler and disruption of chain packing by the addition of fillers. The performance of the synthesized MMMs were also tested under mixed gas conditions to evaluation their commercial application. The results showed slightly lower permselectivity values in comparison to pure gas tests. This was attributed to the competitive sorption effect of the permeating gas molecules. The effect of pressure was also studied to evaluate the plasticization performance. The observed increase in permeability and selectivity along with good anti-plasticization properties make this novel fluorinated and sulfonated polymer with $-SO_3$ based mesoporous COK-12 a promising candidate for gas separation membranes.

Fig. 1. SEM images of cross-sections of MMMs containing (a) 20 and (b) 30% loading of COK-12 particles.

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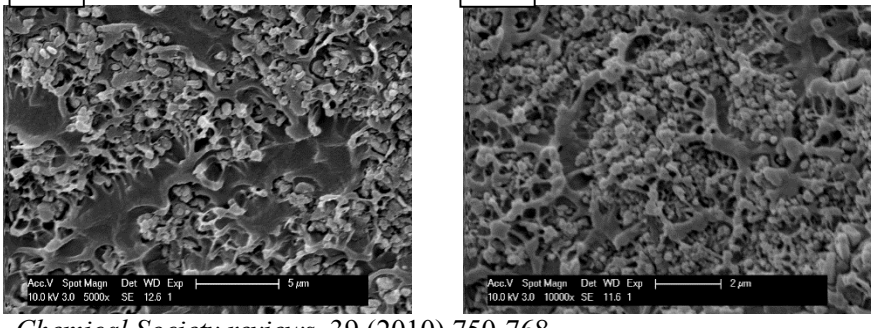

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Entropy Generation and Work Lost Analysis of Rice Husk Fired Thermal Power Plant: A Case Study

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ABSTRACT

Energy and Environment both is the core for human comfort and global survival now days. In order to achieve a secure and stable energy supply that does not cause environmental damage, renewable energy sources must be explored and promising technologies must be developed. This paper represents a comprehensive entropy generation and work lost analysis of rice husk fired thermal power plant. This analysis has been carried out in order to evaluate its performance and irreversibility's of a rice husk fired thermal power plant by using the generalized mathematical formulation and it is concluded that the entropy generation and work lost is highest in Furnace/Boiler that is 3487.12352 KWK-1 and 1039.685 respectively. The work lost in Furnace/Boiler is about 32.4641% while the overall efficiency of the power plant is 59.8917%.

Keywords: Steam Power Plants, Thermodynamic Analysis, Energy Analysis, Thermal Efficiency, Ideal Work, Lost Work.

Photocatalytical Degradation of Congo Red (CR) Dye by nano Titanium Dioxide Coated Glass Beads Exposed to U.V Light Irradiation

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ABSTRACT

Waste water containing Congo-red (CR) dye was subjected to degradation in a newly designed multi-column immobilised glass reactor irradiated by the U.V radiation. Nano-sized Titanium dioxide was synthesized by the sol-gel technique and applied on the soda lime glass beads employing dry mixing method. The effect of several parameters such as the glass surface treatment (etching), glass bead size, CR dye concentration in waste water, pH of solution, catalyst (n-TiO_2) loading, U.V exposure, irradiation time, and regeneration of catalyst were studied. The gradual change in the CR dye absorption intensity (U.V spectra) was analyzed to evaluate the catalytic performance and photo-activity of the n-TiO_2 coated glass beads. It was found that the acidic media favored the photocatalytic activity as more soluble CR anions were formed at lower pH.CR dye degraded to 65% in just 10 minutes of U.V exposure with 6 times more regeneration cycle for the catalyst (n-TiO_2) due to the employment of the catalyst glass support. The immobilisation of n-TiO_2 on to the glass bead surface enhanced the catalyst regeneration making the entire process a promising economical method for waste water treatment. SEM analysis confirmed the formation of spherical TiO_2 particles on to the glass bead having 160-240 nm nano-sized particle and EDX analysis quantified the elemental analysis of the catalyst sample. No characterisation peaks other than TiO_2 were detected in XRD pattern signifying the synthesis of pure TiO_2 in the presented study. The surface area measured by BET analysis was found to be 26.48 and 5.16 m^2/g for the Titania samples calcined at 625° C and 825° C, respectively. U.V spectrophotometer was used to measure the CR dye degradation.

Keywords: Photocatalytical Degradation, Congo Red (CR) Dye, Titanium Dioxide Coated Glass Beads.

Dimension of Uncertainty in Models of Industrial Processes

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ABSTRACT

Robust and efficient modelling of industrial process is vital in realizing stable and economical process designs, operation and control. However, inherent uncertainties of the processes and the models make the job very challenging. These uncertainties are of three dimensions; location, level and nature of uncertainty. Location of uncertainty comprises of contextual uncertainty, modeler uncertainty, inputs uncertainty, parametric uncertainty and output uncertainty. The level of uncertainty places the location of uncertainty within the range between perfect determinism and total ignorance. The nature of uncertainty comprises of epistemic uncertainty and variability uncertainty. Epistemic uncertainty can be reduced by more research while the variability uncertainty is inherent variability and cannot be coped with effectively. In order to cope with such uncertainties, extensive work has been carried out in environmental and water quality research sectors. However, researchers in the engineering domain lately started work on dealing with uncertainty in process design, operation and control. This study focuses on identifying the sources of uncertainties in modelling the process industries. In this regard models of steelmaking and naphtha reforming process are taken as case-studies and all the three dimensions of uncertainties are elaborated with appropriate examples from the two process models. This study is helpful for model developers of process industries to identify the sources of uncertainties and effectively quantify their effect on decision making in design and control.

Keywords: Process industry, Steelmaking, Naphtha reforming, Uncertainty.

Numerical approximation of rapidly oscillatory Bessel integral transforms

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ABSTRACT

This paper presents a Levin type procedure based on multiquadric radial basis function for numerical evaluation of highly oscillatory integrals containing first kind of Bessel functions $J_v(wx)$. The case of singularity of the Levin type procedure is considered in the context of Bessel oscillatory integrals. For this purpose, the Hybrid functions and Haar wavelets based quadratures [1] are used. Numerical test problems are solved to justify the accuracy of the proposed method.

Keywords: Rapidly oscillatory integrand, Bessel Function of the first kind, MQ RBFs, Hybrid and Haar quadratures.

References

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Technology Entrepreneurship: A Mind-set Required for Sustainability of Chemical Process Industries and Economic Growth

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ABSTRACT

Pakistan is blessed with very talented and hardworking people who are capable of bringing a positive change provided they have the right mindset. Over past five years the renewed interest in entrepreneurship has changed the perception of engineers. There are now many students who are taking entrepreneurship as a potential career. There are opportunities available to benefit and allow one to follow the dreams.
In this talk some fundamental philosophy of entrepreneurship will be share along with some prominent examples in which engineers has played a pivotal role for sustainability in chemical process industry and thus acted as an engine of economic growth.

Keywords: Entrepreneurship, Process Industry, Innovation.

Effective utilization of Pakistani Reserves for Sustainable Energy Production

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ABSTRACT

Coal is used across the world for power generation and a lot of metallurgical process. Combustion of coal produces CO, CO_2, SO_2, SO_3, ash etc. which are hazards for our environment. Ash and sulfur contents in coal directly affect the mechanical and thermal efficiency of boiler. Removal of major impurities from Pakistani coal is a challenge.

This project presents the design of coal beneficiation unit and effect of various chemicals to eliminate the impurities from Pakistani coals to make it clean coal for sustainable energy production.

There are two sorts of coal beneficiation. One is wet coal benefaction and other one is dry coal benefaction. Different solvents are leached with coal for some time at specific temperature.

Various coal samples analyzed and used for investigation to remove the unwanted impurities by using NAOH solution. Ash and sulfur contents are tested in contradiction of three variables, concentration, temperature and leaching time. Coal is leached with different concentrations of sodium hydroxide (NaOH) (2.5M, 5.0M, 7.5M and 10.0M) here at different temperatures (40^{o}C, 60^{o}C and 80^{o}C) with two different leaching times (20 minutes and 40 minutes).

Statistical data is distributed to study the effects of temperature, concentration and leaching on ash and sulfur contents. It is indicated that maximum ash and sulfur is reduced up to 60.98% and 33.544%, respectively, at 80^{o}C when 10.0M NaOH is leached with coal solution for 40 minutes.

Beneficiated coal has less impurities and can increase the combustion efficiency for enhanced production of energy with less environmental hazards.

Keywords: Energy production, NAOH solutions, Combustion efficiency**.**

Effect of Operating Parameters on Tyre Derived Fuel from Pyrolysis of Waste Tyres

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ABSTRACT

In the present study, effect of operating parameters such as temperature, heating rate and particle size on tyre derived fuel. A new lab scale Fixed Bed Pyrolysis Reactor was developed at NFC-IEFR for the research. The oil produced was treated to remove impurities and analysis. It was found that maximum yield of oil was at 550^{o}C furthermore particle size and heating rate had minor effect in paralytic oil yield. The analysis of oil showed that it was comparable with furnace oil. Results were compared with the results of furnace oil.

Hazard and Operability (HAZOP) study of wastewater treatment

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ABSTRACT

Risk assessment is an important process carried out in chemical process plants to ensure health and safety. This paper deals with the risk assessment of a particular case study by using reliable technique of HAZOP (Hazard and Operability). The main goal of this work is to apply this tool in a theoretical scenario for which a typical modern industrial wastewater unit producing bio-hydrogen was selected. For reliable HAZOP study whole process design was done on the basis of Process flow diagram (PFD), Piping and Instrumentation diagram (PID) and standard key words. Then the hazards of whole process were identified and initially some basic safety techniques have been applied to address these issues. The results were analyzed indicating that an overall assessment yielded about 57 risks. However, for more safer system design, about 63 actions were recommended whereas most of them (50%) will need to install new safety related instrumentation.

Keywords: HAZOP, Process Flow Diagram, Waste Water Treatment, Bio Hydrogen process, Piping and Instrumentation Diagram.

Modified iron ore for the removal of Arsenic from underground water at Matiari city

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ABSTRACT

Arsenic (As) is among one of the most lethal naturally occurring metallic elements present in water resources. As in water is serious natural calamity and public health hazard which originates from both anthropogenic as well as geological sources. Drinking water contaminated with As is the worldwide problem which causes severe health hazards to humans. As is considered a potent human carcinogen, associated with risk of cancer of skin, lungs, urinary bladder, liver and kidney. Pakistan is also facing serious public health adversities due to As contamination. According to the report of Pakistan Council of Research in Water Resources (PCRWR) and United Nations Children's Emergency Fund (UNICEF) Sindh and Punjab are two major provinces of Pakistan affected by As contamination. Still there is no proper treatment plant for the removal of As contamination from drinking water resources in interior Sindh areas. As reported the As concentration in Matiari underground water is higher than the WHO limits. For its problem resolution, Matiari is considered as the research study area. This study investigates the applicability of the naturally occurring iron ore for the remediation of As contamination from underground drinking water resources. Iron ore at the micron size of 600µm with the activation molaritie of 0.5M of hydrogen per oxide has removed up to 90% As from contaminated water in column study when water flow rate was maintained at 01ml/minute. This study helps in developing appropriate technology that could be cheap, simple to use and easily adaptable for domestic purposes.

Theme 1: Energy Engineering

Physicochemical Properties of Agricultural Biomass Residues in Pakistan for Future 'Energy Mix' Potential

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ABSTRACT

This paper characterizes various locally available agricultural residues in Pakistan to evaluate their potential as feedstock for renewable energy production and contributing toward solving energy crisis and environmental issues. The thermo-chemical characterization has been performed in order to determine if the residues have potential to be used in biomass conversion technologies producing combined heat and power. The characterization methods for comparing different agricultural residues include proximate and ultimate analysis, heating value, ash content, thermo gravimetric analysis (TGA) and functional group analysis (FTIR). Widely available agricultural wastes in Pakistan were selected for the characterization i.e. bagasse, corn cob, rice husk, wheat straw and wood chip. The analysis showed that the corn cob had the highest moisture content that will result in low energy efficiency of the thermal conversion technology due to energy requirement for drying whereas wheat straw had the lowest moisture content. Ash and volatile contents were found to be highest in rice straw and wood chip respectively. The thermo gravimetric analysis and functional group identification showed that most of the agricultural residues can be easily decomposed and represent potential feedstock for biomass flexible combined heat and power systems through pyrolysis or gasification.

Keywords: wastes, bioenergy, characterization, pyrolysis, gasification.

Electrochemically deposited Pure and Metal-doped α-Fe_2O_3 Thin films for Hydrogen Production from Photoelectrochemical Water Splitting

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ABSTRACT

Sustainable hydrogen generation through photoelectrochemical water splitting using sunlight and semiconductor electrode is a promising approach for the conversion of solar energy into green fuel such as hydrogen. Hematite (α-Fe_2O_3) has attracted great attention as one of the most promising semiconductors for photoelectrochemical water splitting. It has an ideal band gap of 2.2 eV which absorb most of visible light of solar spectrum and stable in most of the electrolytes at pH > 3. Besides, it is cost effective and environmentally friendly. However, the water splitting performance of hematite is limited by its intrinsically low electronic conductivity in addition to other issues such as short hole-diffusion length and poor light absorption properties. This study demonstrates the synthesis of highly active pure and metal doped α-Fe_2O_3 films by electrospray technique and their application as photoanode for water splitting reaction. The resulted film showed water spitting photocurrent density up to ~ 0.92 $mA.cm^{-2}$ at 1.5V vs. RHE under 1sun illumination. The effect of Ti and Si doping on the water splitting efficiency of α-Fe_2O_3 was also investigated. SEM result showed that the size of particles in the film decreases with Ti doping while Si doped film showed more porous/open structure. Ti doped film (2 wt. %) showed a maximum current of 1.53 mA. cm^{-2} at 1.6 V which is 60 % higher than undoped film. However, Si doped film showed a lower photoactivity than undoped and Ti-doped films.

Keywords: Electrospray synthesis, Nanostructured α-Fe_2O_3 films, Photoanode.

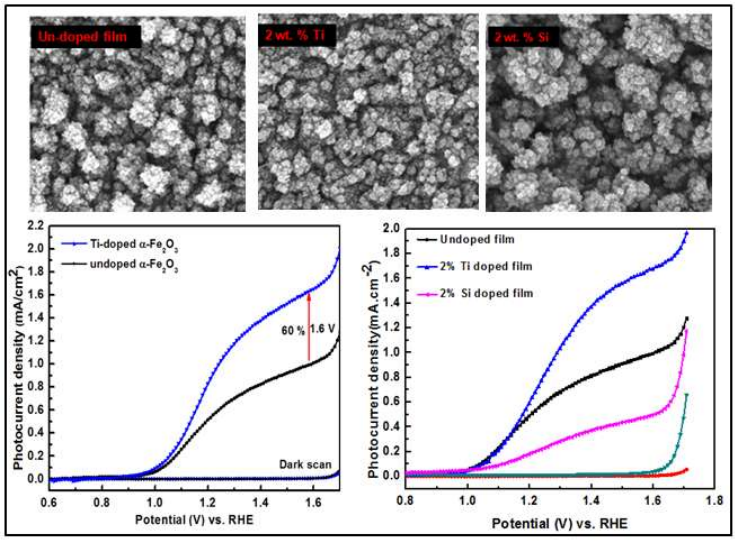

Fig. SEM and current – potential characterization of α-Fe_2O_3 thin films.

Energy Harvesting from Vehicle's Suspension Vibrations

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ABSTRACT

In this paper, the fabrication and experimentation of a vibration-based, electromagnetic type energy harvester is reported for vehicles vibration. The harvester is suitable for harvesting energy from vehicle suspension vibrations and consists of movable permanent magnets and static wound coils. When the harvester is subjected to vibration, due to the movement of magnets relative to coils, the coils experience the change in magnetic flux density which causes an EMF to generate at the coils terminals. The developed energy harvester can be easily attached to the vehicle suspension system and its power generation can be easily utilized to operate the wireless sensor nodes in the smart vehicles. The developed energy harvester is characterized under a sinusoidal vibration from 0.5 to 3 g base acceleration. At base acceleration of 3 g and resonant frequency of 16 Hz, the energy harvester produced an open circuit voltage of 13.43 V. However, under same excitation level, when a matching impedance of 256 ohms is attached to the harvester's coil, it produced a power of 151 mW.

Keywords: Electromagnetic, energy harvester, Faraday's law, suspension system, vehicle vibration, wireless sensor nodes.

Feasibility and Potential of Parabolic Trough Solar Thermal Power Plants in Pakistan

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ABSTRACT

Pakistan is currently facing severe energy crises due to its growing population and expansion in industrial and agricultural sector. Addressing the energy crises by installing fossil fuel based power plants has severe adverse effects on environment and also will result in depletion of fossil fuel resources. Pakistan lies on a sunny belt that receives Direct Normal Irradiance (DNI) of 4.45 to 5.83 kWh/m^2/day as compared to the world average DNI of 3.61 kWh/m^2/day. Thus solar energy emerged as the most promising candidate to fulfill the electricity and heating requirements even for rural communities as roughly 35 % of population in Pakistan is off-grid. Solar energy has potential of generating around 2.9 million MW of electricity. Harnessing of this huge amount of energy will not only reduce the CO_2 emissions but will also save the conventional energy resources. It is generally assumed that solar thermal power plants are feasible for areas where DNI is greater than 5 kWh/m^2/day. In Pakistan many such locations exist where installation of solar thermal power plants are most feasible.

This paper aims to give the feasibly study and the associated levelized electricity cost (LEC) at different suitable locations of Pakistan using TRNSYS simulation software. It was found that LEC of the power plants are less than solar photovoltaic power plants for location where DNI is too high. By installing solar thermal power plants will not only address environmental problems but cost effective energy solution.

Keywords: Direct Normal Irradiance, Levelized Electricity Cost, TRNSYS.

Sedimentation, Eustasy and Tectonic Constraints of the Eocene to Lower Miocene Hydrocarbon Systems of the Gulf of Gabes Basin in Tunisia

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ABSTRACT

The objective of this work is to demonstrate the close time palogeographic relationships and geodynamic configurations of the Eocene to Langhian series considered two major and superposed petroleum systems in the GGB covering a time span from the Eocene to the Lower-Middle Langhian times. Based on recent fieldwork, stratigraphic data, well results and wireline log details, and seismic 2D/3D data, the main aim of this studyis to demonstratethe close time palogeographic relationships and configurations of these two major and superposed petroleum systems in the GGB covering a time span from the Eocene to the Lower-Middle Langhian times. The major constraints on the lithotectonic evolution, differentiation of sedimentary deposits and basin geometry are also examined in the light of sismostratigraphical and sismotectonic interpretations. The modeling approach helps to contribute of theeconomicpotential of the carbonate platform of Eocene to Langhian series in the GGB. The main results Mesozoic era dominated by distension / transtension in relation to global Tethyan and geodynamic events, a period of transpressional initiated in the Santonian-Campanian, are formed in larger bending radii folds, with a recovery during the Eocene (Pyrenean phase). Basin platform transition towards SW-NE, appears clearly controlled by tectonic transverse steering dominant NW-SE, Nature of the sliding tectonic cross resulted in flowers fault structures, elevated structures, platforms deposits seats carbonate and blocks collapses half grabens in the presence of significant vertical component of rejection on oblique sliding cross accidents.
In this work, we identified a very similar scenario occurs again during the Oligocene transition with the same polarity direction, platform facies of the Kétatna formation, and pelagic facies of Salammbo formation. The benthic El Garia and Ketatna Formations and the corresponding coeval but pelagic Boudabbous and Salammbô Formations extend in a broad area covering the gulf of Hammamet, Pelagian Block and gulf of Gabes in the Southeast Tunisia. A similar geodynamic fact generates the same

structures and paleogeography results. The reconstruction of petroleum system series in the GGB help decipher a stratigraphical scenario of repetitive benthic carbonate platforms stacked in the sequence of stratigraphic ages, fitting laterally and upwards into pelagic counterparts. The Eocene El Garia reservoir passes laterally to into the Boudabbous source rock Formation. This complex is sealed by Cherahil Formation, which in turn is transgressed over by a repetitive benthic but moderately to highly thick limestone packages in the Ketatna Formation and fits laterally into its pelagic counterpart the Salammbô Formation.

Keywords: Petroleum Industry, Seismic 2D/3D Reflection, Hydrocarbon petroleum system, Superposed carbonate platforms, Eocene to the Lower-Middle Langhian times.

To Study the Performance of Diesel Engine Using Blends of Bio-Diesel from Jatropha Curcas

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ABSTRACT

The known reserves of fossil fuels of our world are depleting at faster rate. Our vehicles run on fossil fuels and with the depletion, we are facing an imminent threat. This calls for research in alternative fuels. This current research has been done in biodiesel from Jatropha seeds. Biodiesel from Jatropha seeds has the desired physio-chemical and performance characteristic comparable to petro-diesel. Jatropha oil has higher cetane number (51) compared to other oils, which is comparable to diesel (46 to 50) that makes it an ideal alternative fuel and requires no modification in the engine up to a certain mix ratio.

This paper deals with the utilization of Jatropha Curcas as supplements in the diesel fuel at different blend ratios using a four stoke diesel engine with engine working at various speeds and loads. The differences in the measured performance and exhaust emissions from the baseline operation of the engine, and the four bio-diesels blends were determined and compared. Theoretical aspects of diesel engine combustion with the different physical and chemical properties of these blends, aid the correct interpretation of the observed engine behavior.

Keywords: Jatropha, Biodiesel, Biodiesel Blending, Diesel Engine Performance.

Design of an Optimized Hybrid Power System

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ABSTRACT

Rapidly depleting energy resources and increasing electricity demand motivated the researchers to explore new alternative solutions to generate electricity by efficiently using green and clean energy systems. Renewable energy sources like solar and wind are abundantly available around the globe. Collecting most of the free energy simultaneously from different energy resource and its optimum utilization is quite challenging. Realizing the problems mentioned, this research proposes the effective use of renewable energy resources by developing a hybrid system with simple control strategy. This work investigates the dynamic operation and control strategies of a hybrid wind-solar-battery storage based power supply system. The selection criteria for optimally choosing one of the resource at a time is based upon the voltage threshold value for direct load consumption, due to the low wind conditions and low irradiance factor. The power generated from solar-wind system is stored in battery via dc link to fulfil load demand. The research investigates the proposed system by simulating in MATLAB Simulink and developing a prototype. The analysis reveals that systems can be made flexible by the interconnection of different renewable power sources anywhere on the same power line. It is further assured that this hybrid power generation system contributes to global environmental protection.

Keywords: renewable energy resources, hybrid wind-solar-battery supply system, DC link, environmental protection.

Downstream pH control and process-efficient kinetics during copolymer-induced pelagic cultivation of benthal *Chlorella vulgaris*

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ABSTRACT

Chlorella vulgaris (*C. vulgaris*) cultivation particularly at exponential growth stage is proportional to growth limiting pH reduction, which calls for its stabilization beforehand. This research attempted the use of copolymer Polyacrylate polyalcohol (PP) to harvest dual benefits of its application such as *in-situ* pH control and cell suspension at the surface. Free and immobilized cultivation of *C. vulgaris* was carried out in prepared sugar water in a fabricated bioreactor tank (BT). The free cell cultivation was carried out with 100% and 20% concentration of BG-11 broth with no PP, whereas the cells were immobilized with different PP proportions. The PP introduction in the medium caused an increase in the pH value by 32% irrespective of the copolymer dosage applied.*C. vulgaris* immobilized with optimum copolymer dosage of 80 mg l^{-1} grew at 0.9 g l^{-1} d^{-1}, with corresponding maximum COD removal of 60% compared to 1.2 g l^{-1} d^{-1} obtained with 100% BG-11 broth incurring COD removal of 66% during benthic free cell cultivation. The cell cultivation profile also transpired that every 1 g cell growth during log phase was inducing COD decrease of 13% fixing 2100 mg of COD.

Keywords: *C. vulgaris*, Sugar water, growth kinetics, Polyacrylate Polyalcohol, Cell immobilization, pH control.

Computational Fluid Dynamic (CFD) based Exergy Analysis of Naphtha Reforming process

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ABSTRACT

In order to realize an energy efficient naphtha reforming process, various energy analysis methods are adopted. These methods are based on first law of thermodynamics or a combination of first and second law of thermodynamics. The conventional method of energy analysis based on first law of thermodynamics is inadequate because it cannot grasp the effect of system irreversibilities. Exergy analysis which embeds second law of thermodynamics in the conventional method overcomes this deficiency and represents the true thermodynamic efficiency of the process. Exergy has three major components; physical exergy, chemical exergy and mixing exergy. Several methods have been developed for exergy analysis of naphtha reforming process using process simulators such as Aspen PLUS, Aspen HYSYS etc. In this work physical exergy analysis which is based on pressure and temperature of the system, and mixing exergy analysis of naphtha reforming process is performed using a novel technique based on computational fluid dynamic (CFD). N-heptane cut of naphtha reforming process which comprises of paraffins, aromatics and naphthenes is used to conduct this analysis. Semi-implicit Method for Pressure Linked Equations (SIMPLE) algorithm is used for pressure-velocity coupling. First order upwind scheme is used to discretize the turbulent dissipation rate and turbulent kinetic energy. Reynolds-Averaged Navier-Stokes (RANS) which is a turbulent model calculates eddy viscosity using K-epsilon. Second order upwind scheme is used for discretization of pressure, momentum and reaction components. It is analyzed that the contouring of pressure and mixing exergies in the reactors are nearly constant due to less pressure drop whereas the contouring of thermal exergy shows abrupt changes due to difference in heat capacity of different components. Furthermore, a method of adjustment of thermal parameters is devised to make the system more energy efficient.

Keywords: Semi-implicit Method for Pressure Linked Equations (SIMPLE) algorithm, Reynolds-Averaged Navier-Stokes (RANS), K-epsilon, Eddy viscosity, Discretization, Turbulent dissipation rate.

Hydrotalcites Based Cobalt Catalyst for Synthesis of Hydrocarbons from Syngas

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ABSTRACT

The potential of using hydrotalcite based cobalt catalyst for Fischer-Tropsch Synthesis application was studied in this paper. The hydrotalcite based cobalt (HT-Co) catalysts were prepared by using two different methods, co-precipitation and hydrothermal method. The main focus of the study is to see the effect of method of preparation on the activity and selectivity of catalyst. The catalysts were characterized by using various techniques like X-ray diffraction, scanning electron microscope, Brunauer-Emmett-Teller analysis, thermal gravimetric analysis, and Fourier-transform infrared spectroscopy. The prepared catalyst is tested for Fischer Tropsch synthesis in a fixed bed reactor. The results showed the performance of hydrotalcite based cobalt catalyst in Fischer-Tropsch synthesis were quite good.

Keywords: Cobalt Catalyst, Fischer-Tropsch Synthesis, Co-precipitation Method, Hydrothermal Method.

Promoted Hydrotalcite Based Cobalt Catalyst for Fischer-Tropsch Synthesis Application

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ABSTRACT

The effects of using promoted and un-promoted hydrotalcite based cobalt (HT-Co) catalyst for Fischer-Tropsch Synthesis was studied in this paper. The HT-Co catalysts were synthesized by using co-precipitation method whereas zinc and zirconium were added separately as promoters, by wetness impregnation method. The main aim of the study is to see the difference in activity and selectivity of both promoted and un-promoted catalysts. The catalysts were characterized by using several characterization techniques like scanning electron microscope, X-ray diffraction, thermal gravimetric analysis, Brunauer-Emmett-Teller analysis and Fourier-transform infrared spectroscopy. The prepared catalysts were tested for Fischer Tropsch synthesis in a fixed bed micro reactor. The results showed the difference in the performance of catalysts for Fischer-Tropsch synthesis.

Keywords: Cobalt Catalyst, Fischer-Tropsch Synthesis, Co-precipitation Method, Zinc Promoted, Zirconium Promoted.

Theme 2: Separation Science & Technology

Ionic Liquid as a Green Solvent for Biomass Dissolution and Separation

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ABSTRACT

The use of solvents such as phenol, alcohols, glycols and ketones, or acidic or basic catalysts for dissolution or liquefaction process of lignocellulosic biomass is toxic or corrosive, difficult to recover for reuse and pose some pollution problems. Ionic liquids (ILs), due to their recycleable nature, are considered as green solvents and have been found suitable for dissolution of biomass. In this work, bamboo fiber, Gigantochloa scortechinii, a native plant of Malaysia, locally known as buluh Semantan was dissolved in IL, 1-butyl-3-methylimidazolium chloride (BminCl) at 120°C. Then water and acetone mixture in the ratio of (3/7 v/v) was used to recrystallize the cellulose of bamboo fiber. The cellulose powder obtained was characterized by thermogravimetric analysis (TGA), x-ray diffraction (XRD), and scanning electron microscope (SEM analysis). The TGA analysis shows that the decomposition temperature of regenerated cellulose, after dissolution in BminCl is reduced as compared to untreated bamboo biomass. While XRD analysis shows that the crystallinity of the regenerated cellulose has changed from cellulose I to cellulose II, and also the crystallinity index has decreased from 39.34 to 2.8 after treatment with ionic liquid. Scanning and optical microscopic analysis also confirmed the dissolution in BmimCl by change in physical structure of bamboo after treatment.

Keywords: Biomass, BminCl, Dissolution, Regeneration, Characterization.

Slotted Pore Membranes and Oil/Water Separation

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ABSTRACT

Around the globe, researchers have been investigating ways of separating oil and other particles from water. They have developed and designed a new filter that uses microfiltration media that are similar to very fine sieves. Furthermore, there is no internal deposition of solids, and the pressure that is required to pass liquids through the media is low. This article provides details of this technology, which could be used on offshore oil rigs to vastly reduce the amount of oil discharged into the world's oceans.

A novel and robust microfilter with a slotted pore opening of 1–10 μm and length of 400 μm has been developed for microfiltration applications where conventional membranes are challenged by conditions of strength, mechanical abrasion, chemical compatibility and internal membrane fouling.

Keywords: Microfilter, slotted pore membranes, oil/water separation, microfiltration.

Functionalized UiO-66 Sulfonated ISA Membranes for Gas Separation

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ABSTRACT

Metal-organic frameworks (MOFs) have fascinated massive attention all through the last 2 decades because of outstanding properties such as high surface areas, tunable porosity, convenient properties, tolerable thermal stability and act as a host for guest molecules. These properties have made MOFs an interesting choice for various applications including Gas separation storage media for gases, high capacity adsorbents, catalysis, sensing, drug delivery, thin film devices, clean energy, luminescence and magnetism.

In present work, Polyimide and functionalized UiO-66 based membranes were prepared. The surface of the as-synthesized UiO-66 was functionalized with the sulfonate group via a grafting method. Mercaptopropyl trimethoxysilane (MPTMS) was added in the mixture solution for chemical modification along with H_2O_2 and H_2SO_4.

Influence of sulfonated functionalization of the MOF on performance of membranes was studied in this work. It is revealed that the $–SO_3H$ functionalized UiO-66 forms demonstrated the premier selectivity, privileged CO_2 uptake, elevated physicochemical stability and superior heat of adsorption due to strong interactions of grafted groups as compared to UiO-66. These are synthesized using reticular chemistry and these materials exhibited high thermal and chemical stabilities, yet functional groups are also attached to the linkers.

Keywords: Gas separation, UiO-66, Metal Organic Framework (MOF), integrally skinned asymmetric (ISA) membrane.

Alkali Activated Coal Fly Ash for the Adsorption of Ni (II) from an Aqueous Solution

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ABSTRACT

The present study explored the adsorption behavior of low-cost adsorbent named as coal fly ash (CFA), for purification of metals ion bearing water. CFA, produced during the burning of coal for energy production, is an industrial by-product which is sanctioned as an environmental pollutant. Heavy metal such as nickel (II) in the aquatic habitat is a matter of major affair as it is highly toxic to human beings and aquatic life. This metal accumulates in the food string and can be obdurate in nature. Therefore, it is necessary to remove toxic metals from liquid-waste. For this purpose, CFA as industrial waste is presently being explored as an adsorbent for the removal of the heavy metals from wastewater. Alkaline treatment of CFA has been carried out to enhance its adsorption capacity. The effect of sorption on batch experimental parameters such as initial metal concentration, temperature, contact time, and adsorbent dose has been presented in detail. Based on the adsorption experiment, the modified CFA showed adsorption capacity of 60.5 mg/g at solution pH and 25°C. The equilibrium data for sorption were analyzed using Langmuir and Freundlich isotherm models and Langmuir model proves to be superior with $R^2 = 0.98$. Experimenting with change in pH showed that the adsorptive removal of metal was higher in acidic medium as compared to the case when the pH was on basic side. Raw and modified materials were also characterized using the FTIR, SEM, XRF (chemical composition), BET (surface area) and XRD techniques to explore the modifications incorporated into the material.

Keywords: Industrial wastes, Boiler ash, Nickel, Adsorption, Wastewater treatment.

Removal of chromium (VI) from aqueous solution by adsorption usingAcacia Nilotica (keekar) saw dust

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ABSTRACT

Industrial operations like mining, electroplating, tanning of leather, making of corrosive paints and photographic material generates aqueous stream containing objectionable concentrations of heavy metals apart from other pollutants. The occurrence of chromium effluent streams is also of great worry. The allowable limit of chromium to discharge into aqueous stream is 5 mg/L for Cr (III) and 0.05 mg/L for Cr (VI). The objective of this research was to enhance adsorption capacity of Acacia Nilotica (keekar) sawdust for the abatement of chromium bearing wastewater and investigate the effect of process parameters such as PH, initial concentration of chromium, contact time, temperature, and adsorbent dosage on adsorption capacity. The saw dust was activated by acid wash and functionalized subsequently with formaldehyde.
The prepared adsorbents were characterized using SEM-EDX (Scanning Electron Microscopy coupled with Energy Dispersive X-ray), BET analysis, TGA (Thermo-gravimetric Analysis) to study the morphology and elemental composition by spot analysis, surface area and pore size calculation and thermal degradation analysis respectively. The batch removal of Chromium was performed at room by varying various process parameters under fixed 200rpm in an orbital shaker. Functionalization of activated saw dust raised its chromium removal efficiency to 10% as compare to its adsorption efficiency of HCl treated saw dust. Experiments showed that 300min were required to reach at equilibrium. Rise in initial solution pH inversely affects the removal of chromium for both acid treated and subsequent functionalized material. The adsorption of Cr(VI) were endothermic when studied by varying temperature from 20 ºC to 50 ºC for both activated and functionalized adsorbents.

Keywords: Acacia Nilotica, Chromium, Adsorption, Formaldehyde.

Surface energetics of protein adsorption onto chromatographic supports

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ABSTRACT

Protein adsorption onto chromatographic supports has been studied utilizing the extended DLVO approach. Hydrophobic interaction chromatography was mainly explored due to it wide applicability in the recovery of a number of biologically significant macromolecules in its native form. The interactions between a number of selected model proteins and commercially available chromatographic beads i.e., Phenyl Sepharose 6 Fast Flow®, Source 15 Phenyl®, Toyopearl Phenyl 650-C® and Toyopearl Butyl 650-C® was studied *via* extended DLVO (XDLVO) calculations. The physicochemical properties of the proteins and the chromatographic beads, required for the calculations, are achieved by contact angle measurements and zeta potential determinations. The mentioned approach allowed the calculations of interaction energy of proteins to chromatographic supports as a function of distance, at the operating buffer conditions. The XDLVO calculations were correlated with the actual separation behavior of the model proteins. The correlations plotted for all the chromatographic supports under study revealed that all the proteins can be segregated into two main groups; the proteins showing higher interaction energy minimum are eluting late while proteins showing low interaction energy are eluting earlier in the chromatographic experiments. Moreover, the calculations were able to expose the role of backbone chemistry harboring the same ligand and the effect of different ligands immobilized on the same supports. These studies have also shown the effect of the supporting surface used for protein immobilization.

Thus, the XDLVO calculations were able to understand the underlying phenomenon and will suggest a broader tool to enhance a better understanding of the downstream bioprocessing, which will facilitate development, optimization and finally implementation of the bioprocess design.

Keywords: Surface energetics approach, Protein adsorption, Hydrophobic interaction chromatography, Extended DLVO theory.

Synthesis and Functionalization of Mesoporous Silica for Effective Removal of Metal Ions From Aqueous Solutions

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ABSTRACT

The removal of metal ions onto chelating adsorbents anchored to mesoporous silica and their application for the preconcentration and separation has been investigated using batch adsorption techniques. The adsorbent was characterised by FT-IR and SEM. The extent of adsorption was investigated as a function of pH, adsorbent dose, contact time and initial metal ion concentration. The metal ion chelation was pH-dependent. Experimental data were analyzed by Langmuir, Freundlich, D-R and Temkin adsorption isotherms. The characteristic parameters for each isotherms and related correlation coefficients have been determined. The maximum adsorption capacities for metal ions were calculated from the Langmuir isotherm. Pseudo -first-order, pseudo-second-order, Elovich kinetic and intraparticle diffusion models were used to fit the experimental data. Kinetic parameters, rate constants, equilibrium adsorption capacities and related correlation coefficients, for each kinetic model were calculated and discussed. The kinetic studies showed that the pseudo-second-order rate equation was better described by the adsorption process. The adsorption of functionalized mesoporous silica for metal ions is effective and increases selectivity.

Keywords: Chelating adsorbent, Langmuir, Pseudo second order.

Separation of Nitrogen from Air using Polymeric Membranes

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ABSTRACT

The present invention relates to an improved method for separating one gas from another or a mixture of gases. Most particularly, the present invention relates to the effective separation of nitrogen and oxygen from air. Nitrogen gas of high purity is produced from air by membrane separation technique using polymeric membranes made from the polymer (e.g. PESf, PSf and PI) and a suitable solvent (e.g. NMP, DMAc and propionic acid). The membranes are fabricated by solution casting method. The process focuses on the gas separation and the membrane synthesis. Several characterization techniques are studied for the membrane.The membranes are characterized by measuring their gas permeation properties for N2 and O2 and by examining cross-sectional structures using scanning electron microscopy (SEM). Other characterization techniques such as X-Ray Diffraction technique (XRD) and Fourier transform infrared spectroscopy (FTIR) are also studied. This process improves single stage membrane separation effectiveness and is particularly useful for providing maximum value of selectivity and permeability of nitrogen.

Keywords: polysulfone, Gas separation, SEM.

High CO_2Selective Novel Supported Ionic Liquid Membranes using (3-Aminopropyl) Trimethoxysilane and Acetic Acid

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ABSTRACT

The literature reports that supported ionic liquid membranes (SILMs) outperform the conventional polymeric membranes and solvents for the separation of CO_2/CH_4 and CO_2/N_2, as the ability to tailor the ionic liquids can result in very high separation efficiency. In this study, a new ionic liquid was synthesized with high CO_2 absorption capacity employing (3-Aminopropyl) trimethoxysilane and acetate ion, both of these have been reported to exhibit high affinity for CO_2. The ionic liquid was characterized and the membrane has been tested to determine the selective separation of CO_2 from CH_4. Experiments were conducted at different temperatures and feed conditions, and pure and mixed gas permeability/selectivity data are reported. This combination of $–NH_2$ group containing cation and acetate ion dramatically improved the membrane separation performance as the SILM displayed CO_2 permeance of 23 GPU combined with CO_2/CH_4 selectivity of 40. Synthesized SILM was stable upto 40 bar as no leaching of ionic liquid was observed and the permeance increase from 23 to 31 GPU as the temperature rises from 25^OC to 65^OC while the selectivity decreased from 40 to 35 over the same temperature range. The considerably high selectivity of CO_2/CH_4 makes [APTMS][Ac] a promising ionic liquid for CO_2 separation even at high temperature and pressures.

Keywords: Supported ionic liquid membrane (SILM), (3-Aminopropyl) trimethoxysilane, Carbon dioxide, novel ionic liquid.

Characterization and Evaluation of Grafted Chitosan for Congo Red Removal from Aqueous Media

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ABSTRACT

The present research summarizes the effect of Ethylene di-amine (EDA) and Methyl acrylate (MA) grafted chitosan on the adsorption of Congo red. In order to study the physiochemical properties of adsorbent and to provide evidence for confirmation of successful grafting, prepared EDA and MA grafted chitosan was characterized by different techniques such as FTIR, SEM, DSC, XRD. Mechanical and thermal properties were analyzed by DSC which showed significant change in enthalpy and decomposition temperature of grafted Chitosan, chemical structure and morphology was identified by FTIR and SEM images respectively. To determine the optimized process variables effect of adsorbent loading (0.01-0.5 mg), initial dye concentration, solution pH (3-11), contact time (10-420 min) and temperature (20, 30, 40, 50) °C on adsorption phenomena was investigated. The results demonstrated that adsorption capacity increases with increase in initial concentration, temperature and contact time, while the adsorbent dose and pH of the dye solution influenced adsorption capacity inversely. Maximum adsorption capacity was achieved using optimized adsorbent dose i.e. 0.1 and 0.15 g of EDA and MA grafted chitosan after shaking for 7 hr. with 100 ml volume and 100 ppm concentration of dye solution at 6 pH at 40 and 50 °C, respectively. Analysis of the experimental results showed that equilibrium data fitted well with Langmuir model ($R^2 = 0.9997$)with a maximum adsorption capacity of 1447 and 1790 mg/g in case of MA and EDA grafted chitosan, respectively. The kinetics of adsorption was studied using pseudo 1st and pseudo 2nd order models and to find the rate controlling step, inter-particle diffusion model was also studied. Modification of chitosan with EDA resulted to be superior as compared to MA grafted material.

Keywords: Grafting, Waste water treatment**,** Dyes removal, Chitosan beads.

Zeolitic Imidazolate Framework (ZIF) based Mixed Matrix Membranes for Organic Solvent Resistant Nanofiltration

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ABSTRACT

The hazardous organic solvents wasted by the industries such as toluene, hexane, chloroform are producing acute problems for the environment. The efficient recovery and re-use of chemicals (solvents & catalysts) in industrial processes provides a pathway to reduce pollution and cost of processing leading to reduction in product cost. Membrane technology is a potential alternative to the conventional industrial separation processes due to its low energy consumption and reduced environmental impact. Solvent-resistant nanofiltration (SRNF) is used as a separation process for product recovery in organic media. There is a rapid increase in SRNF application. Both polymeric and inorganic materials are used for the fabrication of membranes for SRNF applications. Mixed matrix membranes, combining the advantageous properties of polymers and inorganic fillers, are a new class of membrane materials. Such membranes not only exhibit high rejection but they have also high thermal and solvent stability which is excellent considering the working conditions and parameters in practical and industrial applications. Among the fillers used for the synthesis of mixed matrix membranes, Zeolitic Imidazolate Frameworks have shown promising results due to their very high surface areas and better affinity with polymer matrix. The objective of this work is to synthesize Zeolitic Imidazolate Framework (ZIF) based Mixed Matrix Membranes for Organic Solvent Resistant Nanofiltration to boost the separation capability and stability of membrane in organic solvents removal.

Zeolitic Imidazolate Framework-8 (ZIF-8) was selected as filler for MMMs to enhance the separation performance. ZIF-8 was prepared at lab scale and was characterized by different techniques to determine its morphology, thermal stability, surface area and pore volume etc. Membranes synthesis was done by preparing PI supports followed by the coating of poly dimethoxy silane (PDMS) layer containing different percentage loadings of ZIF-8. Finally these membranes were tested by passing a feed solution, having Congo red dye (solute) and IPA (organic solvent), to check the performance of membrane for SRNF application.

The results showed that the increased in the percentage of ZIF-8 in PDMS lead to increase in the solvent permeability as well as the rejection of Congo red dye from solution. Membrane swelling tests were performed in toluene and IPA with the conclusion that filler amount has inverse relation with membrane swelling.

Keywords: Solvents Recovery, Nanofiltration, Polyimide and Poly Dimethoxy Silane (PDMS).

Theme 3: Health Safety & Environment

A Laboratory Scale Investigation of N_2O Catalytic Reduction Over Cobalt And Iron Catalysts

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ABSTRACT

Pakistan is an agriculture economy. Nitric acid plants are operating in different parts of the country for the synthesis of fertilizer ($N_2H_4O_3$). N_2O is one of the byproducts formed during the process, particularly in old nitric acid plants. Unfortunately, N_2O is more potent greenhouse gas in comparison to CO_2 and CH_4. Furthermore, it plays a main role in ozone (O_3) layer depletion. At present, the production of nitric acid is a single largest source of N_2O emissions. The optimal N_2O mitigation technology varies between the production facilities and thus requires the development of a comprehensive indigenous research program. In this work, the laboratory scale N_2O dissociation reaction is examined over different cobalt and iron catalysts in a fixed bed tubular reactor. The temperature and pressure of the reactor was varied between 300 °C – 500 °C, and 1 bar – 10 bar, respectively. ICP, TPD, XRD, TGA, and N_2 adsorption/desorption isotherms were used for the characterization of the prepared catalysts.

Experimental results suggest that the catalyst support plays a vital role in N_2O conversion. H-ZSM-5 support is inactive in a studied range of temperature (300 °C – 500 °C). When cobalt was loaded on H-ZSM-5 support, by wet deposition method, showed a highest activity among the other catalysts. The surface morphology of the catalysts changes with cobalt or iron loading, as indicated by the variation inLangmuir surface area (m^2g^{-1}). As a whole, the activity of H-ZSM-5 increases with cobalt or iron loading, however, every loaded metal is not active for the N_2O dissociation reaction. Co^{2+} species seems to be highly active for the N_2O activation.

Additionally, it was also observed that the mass of the Co-ZSM-$5_{(W.D)}$ decreases by 18 % due to the water desorption during catalyst activation process. The evidence for the formation of different surface species is also discussed in the present work.

Keywords: N_2O cobalt species, iron species, catalytic decomposition.

Assessment of Different Industrial Ceramic Wastes and Their Potential for Possible Applications: A Pilot Scale Renewable Materials Investigation

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ABSTRACT

In Pakistan, ceramic industry has been identified to produce large quantities of wastes that have become an environmental concern due to their misplaced disposal. Solutions to reuse and incorporate industrial ceramic wastes can be rewarding for many reasons, specifically for environmental, economic and technical aspects. In the present study, three ceramic wastes collected from the premises of ceramic factories are characterized. Chemical composition of these wastes was determined by energy dispersive X-rays spectroscopy (EDX) showing that they are the mixtures of various metal oxides. Thermo-gravimetric analysis (TGA) confirmed that the materials are thermally stable up to 700°C. Extensive dielectric properties were studied in the frequency range from 1 MHz - 3 GHz at ambient temperature which showed that ceramic wastes will be best alternatives for application in embedded capacitors. Adsorption behaviour of the ceramic wastes was checked for methyl orange dye based waste water. All the samples succeeded in removing the dye from the water with absorption efficiency in the range 30-60%. Rheology studies showed that the materials are mechanically rigid and stiff drawing attention to the reusability of these wastes in mechanically tough composites, hence encouraging further research.

Keywords: Ceramic wastes, TGA, Dielectric properties, AC conductivity, Dye absorption, Rheology.

Slow Release Urea Fertilizer from Sulphur, Gypsum and Starch Coated Formulations

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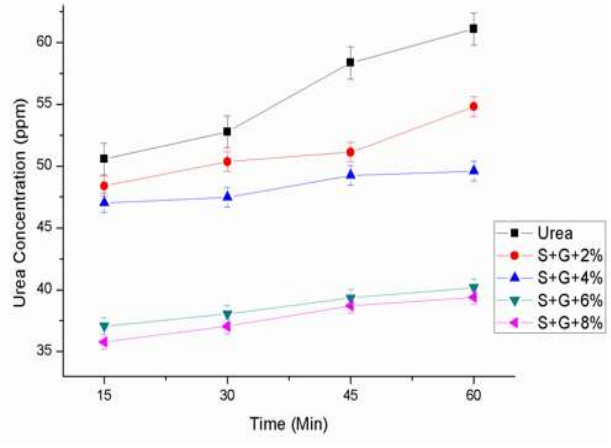
ABSTRACT

Slow release fertilizer (SRF's) starts to regresses as a favorable route proposing a tremendous means to control and manage nutrient applications, by efficiently overcome environmental problems even though retaining good quality crop yields. Study was conducted on the decrease in release of essential nutrients from urea by applying Sulphur, gypsum, bentonite and starch as a coating material. Paraffin oil was used as binder. The dissolution rates had been studied by changing the different composition of coating mixture using high performance liquid chromatography analysis technique. SEM analysis depicted the morphology of coated urea in terms of its thickness, smoothness and uniformity. The elemental analysis provided the significant information about the presence of Sulphur which act as base material for soil and increase its fertility. The UV spectroscopy analysis further authenticated the slow release behavior of coated urea in terms of concentration. Coating materials (Sulphur, Gypsum, Starch and Bentonite) reduces the release rate of nitrogen from urea by 37% in terms of uncoated urea.



Keywords: Dissolution Rate, Paraffin Oil, Spectroscopy Analysis, urea.

Environmental Terrorist: Electric Generators Increasing Lead in Environment

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ABSTRACT

Energy Crisis is a biggest challenge in developing countries like Pakistan. Many developing countries are fighting with this issue both at governmental and individual level. In Pakistan, mostly at individual levels UPS or Electric Generators are used for both offices and homes. In Electric Generators, usually methane, petrol or diesel is being used in this country. It is being promised by any petroleum organizations that petroleum provided is lead free but still there is a petroleum that is being sold in the country. The study was conducted in the capital of Punjab Province in the rich community area where the bio-accumulator of lead plants near the electric generators were studied and it was found with the help of GC-MS and flame AAS that the plants near the generators were having petroleum compounds and lead in their leaves. The study emphasizes the treatment of petroleum to make it lead free and the reduction of use of generators as they increase the lead in environment and further causes the increases the risk of diseases in plants.

Keywords: Electric Generators, GC-MS, flame AAS, bio-accumulator plants.

Increase of Aluminium Particles in the Environment due to Chemtrails during the period of Autumn 2012 to Summer 2015 within Lahore, Pakistan

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ABSTRACT

Currently the most prevailing issue of the climate change in the world is geo-engineering and one of the most prevailing issue in this is using of Chemtrails to change the climate. These Chemtrails are left over in the sky with the help of special types of jet planes which use to spray Aluminum, Barium and Strontium is the sky to make a thick parallel lines with the help of condensation due to change of air pressure at the height. These thick parallel lines are the condense layers of Aluminum, Barium and Strontium which use to stop some rays of sunlight coming to the sky but sadly it also prevents the heat rays to go out of the earth space due to the layers formed. These sprays are causing the increase of Aluminum in the Environment as these particles can move trillions of miles and are causing different problems and diseases like Asthma in our planet earth. The analysis performed helps to know about the increase of these Aluminum particles in our planet and the studies performed shows the problem caused by the spraying to these nanoparticles in the Atmosphere.

Keywords: Water, Atmosphere, Sky, Seasons, Soil.

Degradation of contaminants of emerging concern by electrochemically generated active chlorine species on the surface of Ti/$Ru_{0.3}Ti_{0.7}O_2$ anode

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ABSTRACT

Contaminants of emerging concern (CECs), including pharmaceuticals and personal care products (PPCPs), are frequently being detected at low levels in surface water, and there is concern that these compounds may have an impact on aquatic life. The present study evaluates the treatment of sulfamethoxazole (SMX) an antibiotic used in the prevention and treatment of human and animal diseases through electrochemically generated active chlorine species. The experiments were carried out in a flow cell reactor and the effects of current density, pH, concentration of sodium chloride and temperature were determined. The Drug could be removed completely at all current densities while TOC abatement was appreciable during the process. The process followed pseudo-first order kinetics and values of electrical energy-per-order were dependent on current density and sodium chloride concentration. Different reaction intermediates were separated and identified by liquid chromatography coupled with mass spectrometry (LC-MS), thereby providing an insight into the mechanistic details of the degradation pathway. The

electrochemical degradation proceeded through competitive reactions such as chlorination, hydroxylation and substitution on the aromatic ring, while further ring opening gave rise to more simple organic compounds and, ultimately, the mineralization of SMX. The possible degradation route were also proposed and discussed.

Keywords: emerging contaminant; drug; electrochemical process;

Theme 4: Modelling & Simulation

Numerical Evaluation of Multi-Dimensional Integral over Planar and Non-Planar Regions

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ABSTRACT

In this paper triple integrals are evaluated over planar and non-planar regions having finite limits of integration. The domain regions consist of cuboid, tetrahedron, prism and pyramid. Haar wavelets and hybrid functions are used to evaluate the integrals. Some test problems are included to justify accuracy and efficiency of the new methods. Some numerical results of the proposed methods are compared with the methods reported in the literature as well.

Keywords: Triple integrals, Hybrid and Haar functions, Planar and Non-planar domain regions.

Numerical Solution Of An Integro-Differential Equation Model For The Spread Of Alcohol Abuse Using Radial Basis Function And fourth order Runge-Kutta methods

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ABSTRACT

Alcohol abuse level is the public health problem; it depends on the resilience and peer influence of individual in a population. Here some causes that can effect on the spread of alcohol abuse in a neighborhood. "Peer influence" is one of reason, particularly in the alcohol consumption of college students. The aim of this research is to improve a mathematical correlation representing the effect of peer influence on alcohol abuse. Our model includes an integro-differential equation. However, continuum problems can be studied numerically, using radial basis function, travelling wave, fourth order Runge-Kutta methods as well as scientific computation. The modified outlook of model leads to an inertia on the spread of alcohol abuse on sober dependent population.

Keywords: Alcohol abuse, Integro-differential equations, Travelling waves, Radial basis function.

Higher Order Compact Finite Difference Method for the Solution of Two-Dimensional Time Fractional Diffusion Equation

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ABSTRACT

In this paper, a new sixth order compact finite difference scheme for the solution of two-dimensional time fractional diffusion equation is proposed. The second order spatial derivatives are approximated by higher order compact finite difference method. A Grunwald-Letnikov approximation is used for the Riemann-Liouville time fractional derivative to obtain a discrete implicit scheme. The scheme is based on block penta-diagonal matrix and each matrix has five-point stencil. Fourier analysis is used to discuss the stability of the proposed scheme showing the spatial accuracy of sixth order. At the end a detail numerical experiments are conducted to demonstrate the theoretical results to verify the accuracy and efficiency of the proposed algorithm.

Keywords: Fractional diffusion equation, HOC iterative scheme, AOS scheme, Stability, Convergence, Fourier analysis.

Evolution Strategies Based on Multiple Crossover Operator for Global Optimization Problems

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ABSTRACT

Evolution Strategies(ESs) are a sub-class of nature-inspired direct search that use mutation, recombination, and selection. ES apply the aforementioned operators over the set of solutions called population) of individuals aiming at to evolve them unlike traditional optimization techniques in order to optimal solutions for the given optimization and search problems.In this paper, we use different set of crossover such as discrete recombination, panmictic discrete recombination, Intermediate recombination, panmictic Intermediate recombination, generalized intermediate recombination, panmictic generalized intermediate recombination in the ES framework to analysis the behavior of each mentioned crossover for dealing with various optimization and search problem. The experimental results show that different crossover suite different test problems.

Keywords: Single objective Optimization, Evolution Strategies,Different crossover.

Numerical Solution 0f Fisher's Equation by Using Meshless Method of Lines

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ABSTRACT

Many problems in science and engineering field are modeled by Partial Differential equations (PDEs). Non-linear, reaction diffusion equation Fisher's equation models different problems in ecology, biology and mass and heat transfer.

This paper concern with the development of meshless method of lines for solving Fisher's equation. This method is applied in two steps. In the first step, Space derivatives are approximated by different radial basis functions. It results in conversion of PDE to system of ordinary differential equations which are then solved by Runge-Kutta method of order 4 (RK4) in the second step.

Finally L_2, L_∞ and root mean square (RMS) error norms are hired to check the behaviour of the method. Our method is compared with some other methods in literature.

Keywords: Multi Quadric (MQ), inverse Multi Quadric (IMQ), Gaussian (GA), inverse Quadric (IQ), Runge-Kutta method of order 4 (RK4).

A numerical Solution Technique of 1D Fredholm Integral Equation having Oscillatory Kernel with Stationary Points

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ABSTRACT

A boundary value problem having oscillator can be converted to its equivalent Fredholm integral equation having oscillatory kernel and vice versa. A 1D Fredholm integral equation having oscillatory kernel model of the second kind can be expressed as Equation 1. Where f, h and o are smooth functions. o is an oscillator function and w is the frequency of oscillator. As w gets higher and higher value, the model given in above equation become highly oscillatory Fredholm integral equation. In this paper, a numerical meshless solution algorithm for the model in hand is put forward. The proposed algorithm is based on Levin's quadrature theory incorporating multi-quadric radial basis function and is specially designed to handle the case when the kernel function involves stationary-point(s). The advantage of the meshless procedure is that, it can be easily extended to multi-dimensional geometry. The existence of the stationary-point(s) in such models has immense physical applications in science and engineering and therefore offers difficulties to its solution. Applications abound are in the field of scattering, acoustics and electromagnetic waves etc. Numerical results at the end show that the proposed meshless method is accurate and efficient and provide a reliable platform to solve highly oscillatory Fredholm integral equations.

$$s(x) = f(x) + \int_a^b h(x,y)e^{iwo(x,y)}s(y)dy, x \in [a,b], \qquad (1)$$

Keywords: Fredholm integral equations, Ordinary differential equation, Multi-quadric radial basis functions (MQ RBF), Levin's quadrature, Radial basis function differentiation matrix.

Solving the Non-Linear Harry Dym Equation by Kansa's Method

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ABSTRACT

The Harry Dym equation plays an important role in physical systems. It is used to represent the system in which dispersion and non-linearity are coupled together. The distinguish aspect of Harry Dym equation is its completely integrable nature. Moreover, it obeys an infinite number of conversion laws. Harry Dym equation is related to Kortwege-de Vries equation (KdV).

In this paper Kansa's method is used to find the approximate solution of Harry Dym equation. This approach uses the combination of collocation method and first order accurate forward difference scheme. Radial basis functions (RBFs) are used for collocation. It reduces Harry Dym equation to system of linear equations which is solved by direct solver. L_2, L_∞ and L_{RMS} error norms are used to assess the method. Relationship between numerical and exact solution is shown with the help of figures Our method is compared with some other methods in the literature. Results shows the accuracy of our method over other methods.

Keywords: Multi Quadric (MQ), inverse Multi Quadric (IMQ), Gaussian (GA), inverse Quadric (IQ), θ-weighted scheme, Crank-Nicolson scheme.

Analysis of Unsteady Squeezing Flow Between Two Porous Plates with Variable Magnetic Field

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ABSTRACT

In this work the non-isothermal Newtonian fluid flow between two unsteady squeezing plates under the influence of variable magnetic field is studied. The similarity transformations are used to transform the partial differential equations into nonlinear coupled ordinary differential equations. The modeled nonlinear differential equations representing the flow behavior in the geometry under consideration are investigated using analytical and numerical method. Comparison between both the techniques is carried out.

Keywords: Porous walls, HAM, permeation Reynolds number, Non dimensional wall dilation rate, Differential transform method, Magnetic field.

A Fuzzy based Active Contour Model for Image Segmentation Using Gaussian Distribution

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ABSTRACT

Image segmentation is an important and fundamental problem in image analysis and computer vision. The main aim of image segmentation is to partition an image into different sub-regions of homogeneous intensities such as texture, color etc. The main challenge of this problem is how to construct effective algorithms and methods to solve such problems.

A variety of variational and active contour models have been proposed to solve image segmentation problem. They are mainly classified into two main categories, edge-based models and region-based models. Edge-based models such as geodesic active contour (GAC) mainly rely on edge information to stop the curve evolution. The main defect of edge-based models is sensitivity of the curve to its initial position and noise. On the other hand, region-based models use statistical information of the image for the detection of objects instead of gradient information. Region-based models basically overcome the difficulties of edge-based models, robust to noise and have no dependence on the initial position of the active curve. One of the most popular region-based model is the Chan-Vese (C-V) model, which is a piece-wise constant case of the Mumford and Shah (MS) model.

Fuzzy sets which are widely used in data clustering and image segmentation is first introduced to the active contour frame work by Krinidis and Chatzis, who developed the fuzzy energy based active contour (FEBAC) model, which is fast, free of its initial position and takes very few iterations to converge. In this paper, a novel fuzzy variational model for image segmentation based on novel generalized averages is proposed. Generalized averages are usually very effective in images having minimum, maximum or average intensity background. Therefore, our proposed model works well in images having such properties. Pseudo zero level set (fuzzy membership) is regularized using Gaussian smoothing filter instead of length term. Our proposed model is robust to its initial position and works well against noise and outliers.

Keywords: Segmentation, Pseudo level set, Active contour, Gaussian smoothing filter, Fuzzy logic.

Alternate Smoothing and Segmentation of Texture Images via L0 Norm

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ABSTRACT

The problem of image segmentation has been widely studied in the last three decades, but great challenges still remain in this field. Several variational models have been developed for this task. The well-known of these variational models are Mumford Shah model (MS) and Chan Vese model (CV). Although these segmentation models work well in synthetic and real images, yet these models fail to segment texture images accurately. Xu et al. proposed the L0 Gradient minimization (LGM) model for image smoothing. The LGM Model presented a well-principled and strong smoothing method. It is based on the mechanism of discretely counting spatial changes, which can remove low-amplitude structures and globally preserve and enhance salient edges.
In this work, we use LGM model and Fast global minimization of the active contour/snake model (FGM) alternatively. In the first part, LGM model is use to smooth texture in the image and in the second part, FGM model is used on the smoothed image for segmentation. Comparison and experimental results show that the performance of alternate smoothing and segmentation approach is more accurate and efficient than CV-model and FGM-model.
Keywords: Variational model, Gradient minimization, Smoothing and Segmentation.

Theme 5: Mineral Processing and Material Engineering

Bauxite Washing: Kinetic Modelling Approach

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ABSTRACT

Bauxite ore normally consist of clay impurities and the ore could not be directly send to Bayer process for the production of alumina. Therefore, the ore is pre-concentrated to decrease the clay and other impurities as far as possible by a beneficiation technique. Bauxite washing is mostly applied which is a physical separation process in which clay agglomerates are detached and washed away from the bauxite surface with the action of water applied for specific time. A technique has been developed to model the bauxite washing phenomenon. Bauxite washing has been observed as a rate process which depends upon the particle size distribution (PSD) of feed material, PSD obtained at some reference time and the ultimate PSD at steady state conditions which is obtained after some time. At the start of bauxite washing maximum amount of clay agglomerates detaches and as the time progresses the fines detachment decreases progressively (exponentially) as now less amount of fines present on bauxite surface and it get cleans. The phenomenon has been modelled. The model parameter obtained could be split into material and process parameters. The overall results of the experimental and model justified the kinetic modeling approach of the bauxite washing process.

Keywords: Beneficiation, Empirical modeling, Particle Size Distribution, Clay, Silica.

Beneficiation of Barite ore from Teerah by Chemical Treatment

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ABSTRACT

Barite ore may be concentrated either physically or chemically depending upon the unwanted constituents within it. Several physical and chemical processes such as, shacking table, magnetic separation, jigging, leaching, flotation and/or combination of these processes may be used for the beneficiation of barite. Three samples of comparatively low, intermediate, and high quality barite ore from Teerah Valley of Khyber Agency (Pakistan) were investigated for the possible upgradation. The samples were treated with 25% HCL solution (in a feed to solution ratio of 1:1). The elemental analysis of the samples (feed and product) was carried out using EDX (Energy Dispersive X-rays Spectroscopy). Results show that barite ores assaying 93.50%, 78.80%, and 58.77% barium sulphate can easily be concentrated up to 96.00%, 94.00%, and 88.56% barium sulphate. The concentrated barite ores with more than 90% barium sulphate can be used by various barite utilizing industries.

Keywords: Barite, Size Reduction, HCL Treatment, EDX Analysis.

Effect of Soluble and Neat Cutting Oils On Machining Alloy Steel

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ABSTRACT

In today's era of industrialization, quality throughput and low production cost are keys ingredients to survival in competitive global market. These aspects are further pronounced while dealing machining processes. Hitherto, Metal cutting fluids occupy a nucleus position in industry and a play a sheet anchor role in drooping cutting area temperature and provision of requisite lubrication. Numerous factors affect work piece surface quality and tool life while machining, major being the type of cutting fluid vis a vis tool type and cutting conditions. In this paper, effect of 2 x cutting fluids (1 x neat cutting oil & 1 x soluble cutting oil with 8% concentration being used in local industry) on surface quality and tool life have been examined while turning AISI4140 alloy steel, at specific cutting conditions / parameters, i.e. spindle speed, feed rate, depth of cut using carbide inserts. During experimentation it was revealed that type of cutting fluid bears significance while studying surface quality of AISI 4140 & carbide insert life. Moreover, it was concluded that soluble cutting oil are fruitful to be employed as cutting media as compared to neat cutting oil considering surface finish / tool life as output responses while machining AISI4140.

Keywords: Spindle speed, depth of cut, feed rate, lubricant, tool life and surface finish.

Effects of Infill Wall Modelling on Design of Reinforced Concrete Buildings

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ABSTRACT

This paper presents an analytical work to study the effects of infill wall modeling on the design parameters i.e. fundamental time period, design base shear, maximum story drift and design reinforcement of a reinforced concrete building. Twenty-one 3-D models of a nine story regular reinforced concrete frame, with different arrangements of infill walls, were analyzed and designed for different seismic demands in finite element software ETABS 2015 in accordance with UBC-97. Infill walls were modeled using single strut approach. The results showed that the fundamental time period of the building decreases with increase in the number of infill walls in a given direction and vice versa for the design base shear. Infill walls reduce the maximum story drift in all cases of infilled frames. Modeling infill walls reduce the flexure reinforcement in all cases of regular and irregular infilled frames, analyzed and designed through static lateral force procedure or response spectrum procedure and the reduction is proportional to the number of infill walls. The percentage of reduction in reinforcement of infilled frames as compared to corresponding bare frame increases with increase in seismic demand. It was also observed that bare frame analysis significantly underestimates the design reinforcement of soft story columns. Based on these observations, it is concluded that modeling infill walls is mandatory from the view point of both safety and economy.

Keywords: Time period, Base Shear,Drift, Reinforcement.

A Study on Gelatin based Metal Powder Conductive Composites

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ABSTRACT

This study was intended to make conductive polymer composites by using different metallic fillers. Different fillers used included carbon black, graphite and metal powders including copper, nickel and iron. The conductive polymer composites were prepared by melt processing on an internal mixer at 200°C and 40 rpm spindle speed. Samples for conductivity testing were prepared by compression molding technique at 220°C. The conductivity of the samples was compared by altering the amount of filler and tested by 4 probe conductivity method. Nickel based composites showed better electrical and thermal conductivity.

Keywords: Conductive composite, Metal, Fillers, Gelatin.

Crushing Circuit Design for Processing of North Waziristan Copper Ore

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ABSTRACT

The material parameters required for the design of a crusher for mineral processing operations are type of ore, strength, density, moisture, and clay contents. The characteristics of North Waziristan (NW) copper ore were studied to select suitable crusher type and to design the crushing plant flow sheet. Crusher types usually classified are primary, secondary and tertiary which is normally selected on the basis of material parameters. However, the size of the crusher is identified by the plant throughput, its feed and product size. A detailed discussion on the design parameters of crushers have been given. The moisture and clay contents of the NW copper ore are negligible. Therefore, there is no need of the addition of drying or washing units for the ore before crushing. The ore can be classified as soft in nature on the basis of its strength characteristics. The run-of-mine size of NW copper ore determined was 500 mm and the feed size required for the tumbling mill i.e. grinding operation in average is 12.5 mm. The reduction ratio of one crushing stage is usually 3 to 6. Therefore, 2 to 3 crushing stages are required to obtain the desired feed size for tumbling mills. On the basis of material properties jaw or gyratory crushers could be used for primary operations whereas roll or cone crushers are recommended for secondary and tertiary operations.

Keywords: Material parameters, design, ore, strength, North Waziristan copper, plant through put.

Exploration Framework for the Sustainable Development of Dimension Stone Industry: A Case Study of Buner

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ABSTRACT

Mining operations are an integral component in dimension stone process industry's value chain. Scientific exploration of dimension stone deposits is a pre-requisite for planning and design of these mining operations. Therefore, an exploration framework is necessary for the sustainable development of the industry. This research focuses on formulating exploration framework and its application to dimension stone mineral industry cluster in district Buner. The proposed framework is based on modern ways of exploration, technologies and methods for the effective characterization of dimension stone deposits. The results of the application of framework on a case study of district Buner revealed that, despite the use of modern mining techniques, projects became technically and economically unsustainable due to inadequate and insufficient exploration. Therefore, an exploration framework is required for sustainable development of dimension stone mineral industry cluster.

Keywords: Dimension stone, characterization, sustainable development.

Functionalized UiO-66 Polyimide ISA Membranes for Nanofiltration

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ABSTRACT

Functionalized metal organic framework ISA membranes not only enhance the mechanical and thermal properties and flexibility in overall chemical composition, but also are strong candidates in number of significant practical applications in the field of organic solvent nanofiltration (OSN) like non-thermal solvent recovery, solvent exchange at ambient temperature, in-situ recycling of organic solvents, purification and concentration of intermediates, monomer removal, dewaxing and product upgrading. However, successful applications of these ISA membranes demand high selectivity which can only be achieved by the uniform porous structures.

In the current work, functionalized metal organic framework (MOF) polyimide ISA membranes was prepared by adding UiO-66 (Zr-ABDC) MOF within the pores of polyimide membranes. Amino functional groups were deposited on the surface of as-prepared UiO-66 via a grafting method. Further these membranes are chemically modified by hexane-1, 6-diamine (HDA) to enhance the performance of ISA membranes.

Hence, the major focus in this current work is to study the influence of amine functionalization of the MOF on performance of membranes, so we can compare it to non-functionalized MOFs and see the effect of functionalization on polarity, pore sizes and their distribution within the membranes. The overall combined polar effect of UiO-66 and its functionalization imparts very good hydrophilic properties which lead to higher permeation ability of polar solvents along with high rejection ability to meet the demand of practical applications in the field of OSN.

Keywords: Organic Solvent Nanofiltration (OSN), Metal Organic Framework (MOF), Integrally skinned asymmetric (ISA), Permeation ability, Rejection ability.

Application of Monte Carlo Simulation for Cement Raw Material Blending Optimization

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ABSTRACT

One of the most significant process in cement manufacturing is raw meal preparation for the kiln. Multiple raw materials are blended in appropriate proportions to produce a raw meal. Raw mix design requires a balance of different oxides for good burn ability and to produce a quality product. One of the challenges relating raw mix design and cement quarry operations is the uncertainty in chemical composition of raw material mined from the quarry and purchased from the market. These uncertainties affect the mining activities and raw mix design. In this research, Monte Carlo simulation was used to cope with the challenges associated with uncertainties in raw material composition. Drill hole samples data was used to generate statistical models and identify the statistical distribution of the quality parameters of raw material. Monte Carlo simulation and linear programming optimization model was developed in MS Excel. The results of a case study revealed that the variation in chemical composition of raw material which affects the cement plant operations can be handled using simulation and optimization techniques.

Keywords: Uncertainties, burn ability, Quarry, Statistics and probability distribution.

Theme 6: Chemical Process Simulation and Optimization

Parametric Optimization of an Externally Heat-Integrated Double Distillation Column (EHIDDiC) System

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ABSTRACT

Distillation is the most widely used fluid separation process in the chemical industry. The relatively low thermodynamic efficiency of conventional distillation has urged researchers to develop newer technologies such as heat integrated distillation systems. Heat integration in distillation columns can be performed in a number of ways and can significantly reduce the overall energy consumption of the process. In this talk, we present a systematic methodology to design and simulate an Externally Heat-Integrated Double Distillation Column (EHIDDiC) system using commercial process simulator Aspen Plus®. The proposed methodology is then applied to an industrial-scale i-butane/n-butane fractionator as a case study. First, the conventional distillation column is rigorously simulated using Aspen Plus®. The model is fine-tuned to match available data and reference cost analysis is performed. Second, two separate columns at different pressures are employed for heat integration. The low-pressure column operates at the same pressure as the conventional column whereas the pressure of high-pressure column is adjusted to provide the required temperature driving force for heat integration. Heat integration between the rectifying section of high-pressure column and the stripping section of low-pressure column is employed to reduce process irreversibility. Third, optimization of key design variables and operational parameters is performed to obtain an optimum EHIDDiC configuration for the i-butane/n-butane system. The economic requirements of alternative configurations are compared with the conventional distillation column. Up to 35% savings in direct operating cost and 5% savings in net total annualized costs are observed in the optimum EHIDDiC configuration.

Keywords: Energy conservation, Heat integration, Process simulation, Process intensification.

Analysis of Various Control Configurations of a Packed Bed Reactive Distillation Column

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ABSTRACT

Reactive distillation (RD) is an integrated operation that allows the simultaneous production and separation of desired product in a single column. The design, analysis and comparison of possible control configurations and prediction of dynamic effects of various disturbances for such concurrent operations are similarly challenging. The results of this research would summarize the design of an effective control configuration for a real-world packed-bed reactive distillation column. The column under consideration is a pilot scale unit for production of Ethyl ter-butyl ether (ETBE) from Ter-butyl alcohol (TBA) and Ethanol (EtOH) over an ion-exchange resin catalyst.

The base case was studied and fine-tuned using Aspen Plus software. This case was upgraded to be exported to Aspen Dynamics to study the transient behavior of the process. Different parameters including product purities, energy consumption, and temperature on subjected stage of column were examined using two types of disturbances in the feed; one being the feed flow and the second in feed composition. The results suggest that the control of ETBE RD column is magnitude dependent. The results also suggest that the disturbances of 20 to 30 percent give feasible control configurations. The level and pressure controllers were tuned using Tyrus-Lyben tuning method. The temperature and composition controllers were tested using three tuning criteria, i.e. Tyrus-Lyben, Cohen-Coon and Ziegler criterion of tuning. Possible lags associated with temperature and composition control were also incorporated in the dynamic study.

Keywords: Ethyl-Ter-Butyl-Ether, Dynamic Simulation, Controllers, Tuning.

Numerical Solution of Inverse Heat Problems

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ABSTRACT

Inverse heat problems are known to be ill-posed which make it difficult to solve. In this paper we develop a meshless method for the solution of an inverse heat problem. The numerical scheme is developed by using radial basis function collocation method which can recover the time dependent heat source as well as right boundary condition. Example of inverse heat problem verifies the accuracy and efficiency of the method under a large noise.

Keywords: Meshless collocation method, Radial basis function, Inverse heat source problem.

Kinetics Modelling and Mechanism of Pb (Ii) Sorption on Chemically Modified Activated Carbon

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ABSTRACT

Low cost activated carbon was prepared from tea waste material by chemical activation with phosphoric acid, modified and used for the adsorption of Pb (II) from aqueous solutions. The modified activated carbon showed substantial capacity to adsorb Pb (II) from aqueous solutions. Adsorption kinetics data were modelled using the pseudo-first and pseudo-second-order models. The mechanism of adsorption was investigated using different adsorption kinetics models. The kinetics data followed pseudo-second-order for adsorption of Pb (II). The effective diffusion coefficient is of the order of 10^{-14} m^2 s^{-1}. Adsorption isotherm modelling shows that the adsorption of Pb (II) chemically modified activated carbon is such that the Pb (II) are adsorbed at definite localized sites. The interaction among the adsorbed molecules is repulsive and there is no association among them. The chemically modified activated carbon is observed to be an economical material for the cation exchange removal of Pb (II) from aqueous solutions.

Key words: Adsorption, kinetics modelling, isotherms.

Haar Wavelet Based Numerical Scheme to Solve Convection Diffusion Equations

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ABSTRACT

The most common strategy existing in the literature for solving convection dominated convection diffusion equation (CDE) is using central approximation to the diffusion terms and upwind approximation to the convective terms. In the present work, we propose a Haar wavelet based numerical scheme for solving convection dominated CDE. In this method, the first and second order derivatives are approximated by Haar Wavelets. The Haar wavelet approximation reduces CDE with given boundary conditions into a system of algebraic equations. This system of algebraic equations is solved simultaneously for the Haar coefficients. The numerical solution can be found by putting these Haar coefficients in the expression of Haar wavelet solutions. Numerical tests are presented at the end to show the accuracy of the method.

Keywords: Haar wavelet, Collocation method, Convection–diffusion equation, upwind approximation, Central approximation.

Foaming surfactant formulation for CO_2 mobility control for EOR applications

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ABSTRACT

The efficiency of the CO_2 in trapped oil mobilization process is severely effects by many problems including gravity override, viscous fingering, and early breakthrough. The said problems can efficiently be reduced by foaming agents.

A study has been conducted to evaluate CO_2 philic surfactants which have exhibited more practical advantages over conventional surfactants. The interfacial tension (IFT) between neat CO_2 and the newly produced surfactant solution was examined and is reported. By using the surfactant in 0.5 % concentration It was observed that the CO_2/ water IFT appreciably decreased from 30 mN/m to 2.41 mN/m.The static foam durability experiments in 1000 ml cylinder and by using foam analyzer at high temperature (95 ^{0}C) in the presence and absence of the Dulang crude oil were conducted and are reported. The adsorption of surfactant formulation was investigated and was found 0.91 mg/g. The Coreflood experiment were also conducted to measure the mobility reduction factor (MRF) and was found 3.3. In addition, 94 % oil recovery was achieved by conducting high pressure high temperature (HPHT) coreflood experiments by using Berea core sample by using the new CO_2 philic surfactant.

The results showed that as compared to conventional surfactants, CO_2 philic surfactants significantly reduce the mobility of the injected CO_2 and can recover additional trapped oil.

Keywords: Mobility control, surfactants, trapped oil.

Theme 7: Modelling & Simulation

Numerical Solution of a System Of Reaction Diffusion Pdes Arising in EN Plasma

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ABSTRACT

Converting a system of ODEs to PDEs to describe the diffusion of particles inside electronegative EN plasma is relatively new work. The resulting system of PDEs is a reaction diffusion model. For the numerical solution of reaction diffusion PDEs arising in EN plasma, we have used explicit method based on meshless procedure. In this work the diffusion of atomic oxygen inside the plasma and dependencies of plasma parameters on gas pressure and applied power has been studied. As exact solutions are unavailable, the numerical solutions attained are compared with the experimental results. The variation of plasma parameters and diffusion of atomic oxygen density, with chamber pressure and applied power, gives pertinent information regarding the understanding and optimization of plasma processing application.

Keywords: Meshless method, Finite difference method, Radial basis function,Plasma parameters, Diffusion.

Biogeography Based Algorithm for Optimization Problems: Preliminary Experimental Results

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ABSTRACT

Evolutionary Computation is an emerging area of research in the last few years and so. An abundance of evolutionary algorithms (EAs) have been suggested for dealing with different types of optimization and search problem. Biogeography Based Optimization (BBO) is recently newly and efficient developed EA that uses a set of uniform and random solutions in order to approximate a set of optimal solution in single simulation unlike traditional optimization methods. BBO is mainly shares information between species of migration from one island to another island based mathematical model. Differential Evolution (DE) is another powerful evolutionary algorithm for dealing with global optimization problems. DE generates new set of population solutions by previously generated set of solutions by using different its mutation variants. In this paper, we have integrated different DE mutation strategies in the framework of the BBO to evolve its population. The suggested algorithm has tackled most of the test problems designed for the 2005 IEEE Conference of Evolutionary Computation (CEC'05) promisingly as compared to the original BBO algorithm.

Keywords: Optimization Problems, Evolutionary Computation, Evolutionary Algorithms, Biogeography Based Optimization (BBO).

Numerical solution of Harry Dym Equation by Meshless Technique

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ABSTRACT

The Harry Dym is an important non-linear partial differential equation (PDE). It has applications in physical systems. Different system in which dispersion and non-linearity are coupled together are represented by Harry Dym equation. It is completely integrable and also it obeys an infinite number of conversion laws.

A meshless technique, named Method of lines (MOL) is proposed to solve non-linear Harry Dym equation. This method has an edge over traditional methods due to its meshless nature. Different types of Radial basis functions are used to discretize the problem domain in space variable which reduces PDE to system of ordinary differential equations (ODEs). RK4 is used to solve system of ODEs.

Numerical results are given to show the accuracy of the method. For this purpose L_2, L_∞ and L_{RMS} error norms are used. Figures are used to show exact and numerical solution. Our method is compared with some other methods in the literature. Results shows the accuracy of our method over other methods.

Keywords: Multi Quadric (MQ), inverse Multi Quadric (IMQ), Gaussian (GA), inverse Quadric (IQ), Runge Kutta method of order 4 (RK4).

On the Numerical Solution of Linear Multi-Term Fractional Order Differential Equations using Laplace Transform and Quadrature

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ABSTRACT

Fractional differential equations appeared in many fields of science and engineering. The analytic results on the existence and uniqueness of solutions to the fractional differential equations have been investigated by many authors. In general, most fractional differential equations do not have exact analytic solutions, so approximation and numerical techniques must be used.
This paper considers the time discretization of linear multi term fractional order differential equations. The approximate solution of these equations depends on Laplace transform and then we represent it as a contour integral by using inverse Laplace transform and solved with a highly order quadrature rule. The corresponding discretization takes place in complex field. By comparison better results have been achieved.

Keywords: Linear multi-term fractional order differential equations, Laplace transform, Quadrature.

A mesh Free Collocation Technique for the Numerical Solution of Fisher Equation

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ABSTRACT

Fisher's equation is one dimensional, non-linear, reaction diffusion equation. It has interesting applications in many fields e.g. heat and mass transfer, ecology and biology.
In this paper, we present a simple classical radial basis functions (RBFs) collocation method (also known as Kansa method) to find the numerical solution of the Fisher equation. For this purpose, different types of RBFs are used. Accuracy of the method highly depends on a constant called shape parameter. It is an open problem to find the reasonable value of shape parameter. In this work Brute force technique is used to find the optimal value of shape parameter.
Accuracy of the method is tested in terms of L_2, L_∞ and root mean square (RMS). Our method is compared with some other methods in literature.

Keywords: Multi Quadric (MQ), inverse Multi Quadric (IMQ), Gaussian (GA), inverse Quadric (IQ), θ-weighted scheme.

Segmentation of Vector-Valued Texture Images using Adaptive Scale Local Variation

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ABSTRACT

Image segmentation plays a fundamental and indispensible role in the field of image processing and computer vision. Its aim is to find a partition of an image into a finite number of semantically important regions. Various variational models have been proposed to extract objects of interest in images. Some of the well-known models are the Snake model, Momford-Shah (MS) and the Chan-Vese (CV) active contour models. Although these models perform well in synthetic and real images, yet these models fail to segment texture images. To overcome this problem, Min et al. proposed the adaptive scale local variation degree (ASLVD) algorithm for image smoothing. The ASLVD smoothing approach remove low-amplitude structures and globally preserve the salient edges.

In this paper, we propose a new image segmentation model for vector-valued/color texture images. The proposed model work in two stages: In the first stage, we will smooth the image while preserving its salient edges using ASLVD algorithm. Then in the second stage, we will use vector-valued Chan-Vese model for segmentation of smoothed image. We compare our results with the vector-valued Chan-Vese. Experimental results also validate proposed model works well in images having noise or texture.

Keywords: Active contours, vector valued images, level sets, partial differential equations.

Theme 8: Green, Safe and Sustainable Production

Sustainable State-of-Practice in the Industrial Plant Business for Multi-Ethnic Organization

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ABSTRACT

The spirit of best industrial practices has become synonymous with technology based innovation, whether it is at identifying and developing innovative multi-ethnic work culture with the right qualities throughout the product life cycle, or in the face of countervailing pressures to specialize, downsize, or reduce the asset base and shifts in balance between the short-term and the long-term. While trade scenario at the global trade hub in GCC, i.e., Middle East industry has to quickly concentrate maximum strength on a project of major importance, referred to internally as Flexible Critical Mass (FCM). The method enables the long term sustainability in industry to tackle outsized opportunities.

We identify key indicators to drive technology enabled industrial performance, based on more understanding and agreement on its structure, strategy, and cultural definition, starting at the human capital to the mobile or immobile assets of an industry. We highlight the need to put processes into place to drive this new clarity and focus throughout the organization. The industrial practices needed increased accountability and a balance between the deployment of strategies, goals, and objectives and the maintenance of the culture. While e-hype has often created whiz-bang solutions in search of a problem, our Organizational Developmental Five-Staged (OD5S) model exploits the most appropriate technology wrapped around essential contents, outline the required work and deliverable for their planning process.

Our OD5S model iteratively brings convenience and enhancement in industrial process by definition, and innovation as one of the most fluid, yet socially complex of multi-ethnic business processes in UAE. We deployed virtually our OD5S in various organization in a range of industries, sizes, and positions in the business cycle to identify their top methods of achieving strategic change and objectives. Our study found that there is a strong demand, in particular, in the various areas of Product Life Cycle (PLC), Organization Development and Change (OD&C). We found that ever increasing technology enabled industrial

production trends at UAE; demand changes in order to compete, innovate, and become more effective, productive, and profitable in an increasingly global and challenging economy, the tools, techniques, and practices of OD are necessary in order to harness the great power of human capital—both in customers and employees.
We presented our result for thirteen industries, such as health care, media, business services, electronics, computer hardware, technology and manufacturing, aerospace and defense, consumer products, leisure, restaurant, education and chemicals. Our Quality of Behavior, Culture and Perception (QoBCP) indicators narrate entire organization into innovation transcends— a way of enabling multi-ethnic people to learn together and produce together in common language.

Keywords: Sustainability, Industrial Process, Organization Development, Product Life Cycle, Multi-Ethnic Harmony.

A Novel Approach—Modeling Vulnerability in Non-Invasive Industrial Instrumentation for Luminescence Scanning Technology

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ABSTRACT

Unlike Chemical Force Microscopy (CFM), non-invasive instrumentation provides reliable and precise control in Industrial Process Regulation (IPR), where a chemical compound is always a point-of-care. Additionally, growing trends in analytical instrumentation towards Lab-On-a-Chip (LOC) has shift the manufacturer's emphasis on sensitivity as well as robustness. Though expensive, but imaging spectrometer characterize a process or an object over a large range of luminescence such as Visual, Ultra-Violet (UV), Near Infra-Red (NIR), Infra-Red (IR), and Raman, to name a few. Despite the diversity in application of spectroscopic techniques ranging from pharmaceutical industries, food and beverage or petrochemical industries; scientific data produced by these instrument is still limited in accuracy and errors associated with the luminescence.

In this work, we model the observation obtained from any industrial non-invasive instrument and argue that they always contain an inherent instrumentation errors propagated over the five components, i.e., source, sample, discriminator, detector and output. We use Confocal Microscopy due to its large 3-D visual vulnerability to extract topographical, morphological and composite feature of specimen under consideration. The rastered back and forth 3-D imaging technique enable use of Confocal Microscopy its widest application in biological and material sciences and hence rose challenge of predicting large missing or incorrect data obtained during experiments. We observe that the spatio-temporal measurement can be preserved modeling the ergodicity of information flow across the five components, mentioned above.

We develop a closed-loop control system based on PID controller with transfer function of each of these five components i.e., sample, lens-mirror system, Photo Multiplier Tube (PMT), Laser, and Data Acquisition Unit (DAU). We exploit the dead time transfer function characteristics to simplify our model which is an inherent feature of Scanning Luminance Microscopes (SLM) and Scanning Electron

Microscopes (SEM). The robustness of system is tested against a large variety of luminescence to propagate disturbance across the five components of Confocal Microscope. We obtain a complementary function for the second-order differential equation, which indicate the vulnerability of proposed model, measured as the damping ratio. We expose our result for error propagation across various grid patterns over a $1mm^2$ section, plotting the intensity of a key band or bands over the grid. Vulnerability of SLM instrumentation is depicted in term of error in the covered spectral range and resolution, Signal-to-Noise Ratio (SNR) and the strength of absorption for the sample in the wavelength region.
Our results are useful in choice of instrument to be used in Product Specific Environment (PSE) as in industry, medicine and environment, Regulatory Bodies Standards (RBS) conformance and analytical scientists.

Keywords: Instrumentation, Vulnerability, Microscopes, Modeling and Simulation, Non-Invasive, Bio-Technology.

Granex Power Cycle: Investigation of an Efficient Cycle for Utilizing Waste Heat

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ABSTRACT

Steam turbine thermal power plants are one of the main sources of power generation throughout the world, the Rankine Cycle based on steam provides approximately 85% of worldwide electricity production. Typical efficiencies of these plants range from 33 – 48 %. The simple Rankine cycle is inherently efficient. However, the temperature range of the Rankine cycle is severely limited by the nature of the working fluid– water. In order to overcome this efficiency deficit (temperature limitation) & increase in net power of electricity, this paper we will evaluate a recent research done by Prof. Behdad Moghtaderi of Research Center for Energy, University of Newcastle & Granite Power Ltd., Sydney, Australia. In the research, a conventional steam (Rankine) cycle was used as a reference & in order to make it efficient further, super critical steam was used & a recuperator (heat exchanger) was added to the conventional steam cycle whose service was to pre-heat the boiler feed water (BFW) from BFW pumps to the boiler & pre cool the condensate from turbine to condenser. The new cycle is known as (Granex power cycle). The evaluation study is simulated Cycle Tempo (free for one month) software.

Structural, Magnetic, and Electric Properties of Sol-gel Synthesized Chromium-Gallium (Cr-Ga) Substituted M-type Hexagonal Ferrites for Practical Applications

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ABSTRACT

A series of single phase and nanostructured Chromium-Gallium substituted M-type hexagonal ferrites $BaCr_xGa_xFe_{12-2x}O_{19}$ (x = 0.0–0.4) have been synthesized using sol–gel auto-combustion route. Cold isostatic pressing (CIP) technique was used to press the as-prepared powder samples into pellets of diameter 12 mm at a pressure of 2000 bar. The samples were characterized by different experimental techniques such as differential scanning calorimetry (DSC), thermogravimetry (TG), Fourier transform infrared spectroscopy (FTIR), X-ray diffractions (XRD), scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDXS) and vibrating sample magnetometry (VSM) analyses. The crystallite size calculated by the Scherer equation was found to be in the range of 30–48 nm, which is small enough to obtain a suitable signal-to-noise ratio in the high density recording media. The saturation magnetization and retentivity were observed to increase from 2.078-103 to 2.385-103 Gauss and 1.286-103 to 1.6770-103 Gauss, respectively. The coercivity enhanced which is attributed to increase in the magnetocrystalline anisotropy. DC resistivity enhances with the substitution of Cr-Ga contents. The temperature dependence of the DC resistivity shows the semiconducting nature. The dielectric constant and dielectric tangent loss decrease, while AC conductivity increases with the increasing applied field frequency in the range of 1 MHz-3 GHz consistent with Koops theory and Maxwell-Wagners bi-layer model. The magnetic loss enhances, while the reflection coefficient decreases with the increase of frequency as well as with the increase of Cr-Ga contents. The high values of retentivity and coercivity make these materials suitable candidate for high density recording media and permanent magnets. Owing to improved electric properties, these materials may be potential candidates for high-frequency applications in GHz frequency range.

ABSTRACTS

(POSTER PRESENTATIONS)

Rubber Toughened Polystyrene Silica Nanocomposites: Morphology, Thermal and Mechanical Behaviour

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ABSTRACT

Polymer/silica nanocomposites not only enhance the mechanical and thermal properties of the materials, but also show a number of significant practical applications in coatings electronics and optical packaging materials. However, successful applications of these nanomaterials demand an understanding of their thermal, mechanical and morphological properties with varying silica content.

In the current work, polystyrene (PS) was functionalized with active amino-functional groups to yield amino-substituted polystyrene (APS). APS was then toughened with 10-wt.% styrene-ethylene/butadiene-styrene grafted maleic anhydride copolymers (SEBS-g-MA) by reactive compatibilization technique. Finally, the chemically linked organic–inorganic nanocomposites were formed by in situ sol–gel procedure. Thin hybrid films with various concentrations (0 - 10-wt. %) of silica network were acquired after solvent evaporation.

All the rubber toughened polystyrene/silica nanocomposite films were subjected to thermal, mechanical and morphological analyses. The current study exhibits improvements in thermal and mechanical properties when compared with the matrix polymer. However, only appropriate amounts of both the phases give better interactions and in the present case optimum properties were observed with 2.5-wt.% silica content in the matrix.

Keywords: Amino-Substituted Polystyrene (APS), In–situ, Sol–gel, Reactive Compatibilization Technique.

A weak formulation based meshless method with numerical integration based on Haar wavelets and hybrid functions for boundary value problems

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ABSTRACT

This paper introduces a weak meshless method combined with numerical integration based on multi-resolution Haar wavelets and hybrid functions for the numerical solution of one-dimensional elliptic boundary value problems (EBVPs) with variable coefficients. The meshless weak formulation method is the well-known Element Free Galerkin (EFG) method. The main theme of this research work is implementation of the new quadrature rules introduced in [1, 2] in the EFG method and its comparison with EFG method combined with numerical integration based Gaussian quadrature for EBVPs in one- dimension. The numerical integration based on multi-resolution Haar wavelets and hybrid functions has the distinguish feature of simple calculation of nodes and weights in the context of the EFG method as compared to the EFG method with numerical integration based on Gaussian quadrature.

Keywords: Element Free Galerkin method, Moving least squares, Haar wavelets, hybrid functions and elliptic boundary value problems, Gaussian quadrature.

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Modified Strawberry Algorithm for Global Optimization problems

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ABSTRACT

Evolutionary optimization has become blistering area of research because of their wide applicability in all of fields of Sciences and Engineering. In the last two decades, several different types of evolutionary algorithms (EAs) have been suggested for various optimization and search problems. Strawberry algorithm (SBA) is recently newly developed numerical optimization algorithm inspired by nature as like population based differential evolution (DE) algorithm. Due their simplest structure, DE can easily utilize in the framework of SBA. In this paper, we have employed DE as search operator in SBA framework and as resultant its modified version abbreviated as MSBA is developed. The performance of the modified version of SBA is tested upon a well-known test suit of single objective optimization problems. The experimental results show the MSBA has obtained better experimental results on most test problems.

Keywords: Single objective Optimization, Evolutionary algorithms.

Experimental Study of Separation of CO_2 from Natural Gas through Hollow fiber Membrane Contactors

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ABSTRACT

In current research polypropylene made mini module of hollow fiber membrane contactor is used for the efficient and effective separation of carbon dioxide from natural gas. Aqueous solutions of multiple absorbents such as MEA (mono ethyl amine), sodium hydroxide (NaOH) and water were used for capturing CO_2 within the membrane contactors. Mechanism of flow within the contactors is same as that of shell and tube heat exchanger, in membrane contactors the liquid i.e. the absorbent is allowed to flow from shell side while that of the gaseous mixture is passed through the tube side of the membrane contactor. Different set of experiments were performed through the pilot plant using different parameters like changing the absorbent flowrate, absorbent concentration, time and gaseous mixture flowrate. From experimental results it was found that the CO_2 removal efficiency shows positive response towards the absorbent flowrate and absorbent concentration for a certain period of time and concentration. While the CO_2 removal efficiency decreased with increasing the gaseous mixture flowrate.
Furthermore, it was noticed that increasing absorbent concentration beyond 1M in case of MEA membrane wetting occurred which highly reduces the membrane separation efficiency. It was also found that MEA was more efficient as compared to water and NaOH aqueous solution. Pilot plant results showed that membrane contactors proved to be more efficient for removal of CO_2 from natural gas if transmembrane pressure and concentration of absorbent are selected carefully.

Keywords: Membrane contactors, Natural gas, Gas separation, Membrane wetting.

Experimental Analysis of Pressure Retarded Osmosis from Salinity Gradients Using Hollow Fiber Membrane Contactor

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ABSTRACT

Pressure retarded osmosis (PRO) is a promising membrane separation process that generates electricity through the use of salinity gradients without any adverse effects on the environment. PRO electricity generation unit works on salinity gradient between river water (a low saline feed) through membrane into pressurized sea water (a high saline feed). Beside the use of several membrane techniques, hollow fiber membrane contactors are well suited for its use in PRO processes due to its self-mechanically supportive capability without the use of any spacer. In the current research work, a lab scale PRO unit was fabricated. Power density, reverse salt flux and water flux were the important performance parameters that were analyzed during the study. Effects of applied pressure, feed concentration, draw concentration, process temperature and flow rate were observed on the process performance. Results show that water flux and power density increases significantly by increasing pressure, flow rate and temperature. Maximum power density of 0.194 W/m2 was achieved at optimum applied pressure 5 bar and temperature 30 °C. Salinity of feed and draw solutions were effect PRO performance. Orientating the membrane tube side facing draw solution also enhances process performance.

Keywords: Pressure retarded osmosis, Hollow fiber membrane contactor, Salinity gradients.

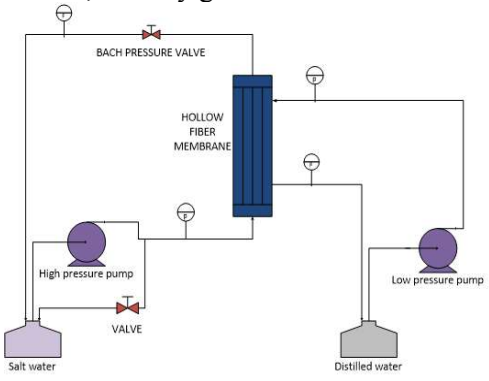

Figure Schematic diagram of PRO process

Electromagnetic Energy Harvesting from Gas Flow in Pipelines

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ABSTRACT

This research presents the development of energy harvester which has the capability of harnessing energy from a gas flow inside pipelines. The generated power of the harvester can be utilized to power different wireless sensory devices mounted on pipelines, such as, wireless pressure, temperature, mass flow rate sensors. The developed harvester is comprised of a tube shaped plastic cavity, wound coil and a spherical magnet and it works on the principal of Faraday's law of electromagnetism. When mounted on a gas pipeline, due to the flow and pressure of the gas, the magnet of the harvester not only levitates but also rotates. The magnet's rotation causes the change in magnetic flux inside the wound coil and results in voltage induction. The developed harvester is tested inside a lab on different flow rates of a air ranging from 0.70 lit/s to 1.03 lit/s. The experimental results showed that when the harvester is connected to an optimum load resistance of 290 ohms, it produced a maximum rms voltage of 650 mV and an optimum power of 1456 μW. The power production of the reported harvester is quite enough to operate the wireless sensor nodes mounted on the pipeline for monitoring.

Keywords: Electromagnetic, energy harvester, gas pipeline monitoring, wireless sensor nodes.

Synthesis and Characterization of Zeolitic Imidazolate Framework (ZIF) 71 based Mixed Matrix Membrane

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ABSTRACT

Mixed matrix membranes comprising of inorganic fillers embedded in polymer matrix have numerous advantageous properties. These are easy to process and have low cost due to polymer matrix and high selectivity or/permeability due to inorganic fillers.In mixed matrix membranes (MMMs), non-selected voids are present due to poor compatibility between polymer matrix and nanofillers. These voids possibly caused losses in selectivity. Zeolitic Imidazolate Frameworks (ZIFs) have good compatibility with polymer matrix, as organic linkers are part of MOFs, resulting in better adhesion with the polymer matrix. In this work ZIF-71 was embedded in Polyimide for water desalination. The synthesized membranes were tested for desalination application under 30 bar hydraulic pressure with 5000ppm NaCl solution d. Results shows that as the loading increase from 0% to 10% the permeance increases from 0.054 $L/m^2bar.hr$ to 0.856 $L/m^2bar.hr$.

Keywords: ZIF-71, Desalination, Mixed Matrix Membrane.

Low Energy Process for Natural Gas Treatment by Using Polymeric Membrane System

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ABSTRACT

CO_2 is the greenhouse gas and primary candidate responsible for the global warming. CO_2 level is rising in the earth's atmosphere.It is also a major part of natural gas which causes the decrease in calorific value of natural gas as well as increase the pumping cost. It is very important to remove it at the source from the natural gas, demanding a compact technology. Membrane separation technology ideally fits the required criteria. To optimize CO_2/CH_4 separation through membranes three areas need to be addressed: material selection, synthesis of membrane and membrane configuration. Cellulose acetate membranes with varying composition of different nanoparticles and solvents like acetone, tetra hydro furan and formic acid were synthesized using solution casting method. The morphology and dispersion of nanoparticles were observed through Scanning electron microscope (SEM). These membranes were also characterized using several analytical techniques such as X-ray diffraction (XRD) and Fourier transform infrared spectroscopy (FTIR). In this research, CO_2/CH_4 gas permeation behavior, of flat sheet membranes, was examined to explore permeability and selectivity which was found to be increased for blended membranes.

Keywords: Cellulose acetate, Gas permeation, CO_2/CH_4 separation.

Parametric Optimization of an Internally Heat-Integrated Distillation Column

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ABSTRACT

Distillation is the most widely used fluid separation process in the chemical industry and has a relatively low thermodynamic efficiency. The quest for more energy efficient technologies has made distillation processes a prime target of energy conservation and process intensification studies. A reliable solution to this problem is to employ heat-integrated distillation processes that offer both energy and cost savings. In this talk, we present a systematic methodology to design and simulate an internally Heat-Integrated Distillation Column (i-HIDiC) using commercial process simulator Aspen Plus®. The proposed methodology is then applied to an industrial-scale i-butane/n-butane fractionator as a case study.

In the proposed scheme, simulation of conventional distillation column serves as a base case model for the basic i-HIDiC (with no heat integration) and complete i-HIDiC (with heat integration) simulations. The base case model is fine-tuned to match available data and reference cost analysis is performed. A basic i-HIDiC configuration is developed to estimate the temperature driving force available and the total amount of heat that can be exchanged. In the next step, two inter-coupled distillation columns with uniform heat transfer area approach are simulated as complete i-HIDiC. Side heat exchangers are modeled as side heat streams to both columns. Optimization of key design variables and operational parameters is performed to obtain an optimum i-HIDiC configuration for the i-butane/n-butane system. Up to 37% savings in direct operating costs and 5% savings in net total annualized costs are observed in the optimum i-HIDiC configuration.

Keywords: Energy conservation, Heat integration, Process simulation, Process intensification.

Process Design for Bio-Ethanol Fermentation from Potato Peels Waste: Simultaneous Saccharification and Fermentation of Starch by Very High Gravity Process

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ABSTRACT

Bio-Ethanol is one of the bio-energy sources with high efficiency and low environmental impact. Various raw materials have been used as a carbon source for ethanol production. Potato peel waste available from land cultivation and food processing industries has been selected as a carbon source for yeast cells during fermentation due to being a less valuable feedstock. Peels are a high source of nutrients but in itself they have a low starch content. The primary concern is to use a raw material that is inedible and causes disposal problems.

The process starts with pretreating the peels mainly washing to prevent any dirt and grit to enter the liquefaction and Saccharification process. Liquefaction around 65oC causes starch to come out to the surface making it easily reachable for the microorganisms to complete the conversion to glucose and finally to starch. This study employs Simultaneous Saccharification and fermentation for its economic feasibility. Also use of Talaromyces Cellulolyticus as the source for pectin, alpha amylase and Cellulose proven economically beneficial to the production process, is employed to promise higher yields. The research focuses on measuring the project feasibility in accordance with the proposed process conditions for the process.

Keywords: Plant Design, Control methods, Feasibility, Simulation.

Enhanced differential evolutionary algorithm for global optimization problems

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ABSTRACT

In the recent few years and so, differential evolution (DE) hasattracted much attention forsolving numerical optimization problems. However, their performance is quite sensitive to the choice of the mutation strategy and associated control parameters. Different mutation strategies suite different optimization problems as result they perform differently at different stages of the population evolution. In this paper, we experimentally analyse the use of distinct mutation strategies in DE framework to solve a test suite designed for the special session of the 2005 congress of evolutionary computation (CEC'05).

Keywords: Optimization problems, Evolutionary computation, Evolutionary Algorithm, Differential Evolution.

Development of Carbon Fiber Reinforced Composite Pressure Vessel and Effect of Polar Winding Pattern in Mass Saving

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ABSTRACT

Experiments have been performed to study the effects of increasing the aluminum liner thickness with the constant overwrapped composite thickness in the finite element analysis to observe the stresses. After determining optimum thickness, experimental work was performed. The aim of this work is to find out the optimum composite thickness with the maximum optimal mass saving. The results obtained by using the destructive testing technique (hydro-burst test) indicate that increasing the composite thickness value of stress decreases. Whereas the introduction of polar type helical on winding angle 20° is the high density pattern which is quite suitable for up gradation of strength of pressure vessel. This pattern also controls the composite mass of the pressure vessel. This also shows that on increasing the composite thickness % mass saving decreases. While modification in process that is changing the pattern one helical layer replaced by polar layer and addition of one hoop layer keeping the remaining scheme same results optimum mass saving. This improves the composite properties and its economy as mass saving.

Keywords: Polar winding, Helical,Hooplayer, Carbon re-inforced composite, pressure vessel.

Impact of Waste Marble Dust on the Sustainability of Cement Sand Mortar

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ABSTRACT

The Portland cement manufacturing process is a major contributor to greenhouse gas emissions and depletion of natural resources. Waste Marble Dust (WMD) on the other hand is cheap and environmental demeaning form of marble processing units, which if used in civil works will create Sustainable Structures (SS) and will save our environment from degradation with positive impact on our country's Gross Domestic Product (GDP). This paper presents the sustainability of cement sand mortar incorporated with waste marble dust. The influence of marble dust on the mechanical properties of cement sand mortar has been studied using five samples incorporated with different proportions of waste marble dust (upto 20%) and evaluated for Compressive Strength, Tensile Strength, Permeability, Flow, Sulphate Attack resistance, Set Time, Bulk Density, Air Content and Adhesive mechanism. Results obtained show that 10% substitution of cement by WMD provided competent results.

Keywords: Sustainable Structures, Marble Powder, Sustainable Development Goals, Cement Sand Mortar.

MOF-5 based Mixed Matrix Membranes for Solvent Resistant Nanofiltrtion

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ABSTRACT

Porosity is an exceptional property for molecular materials but, surprisingly metal organic frameworks (MOFs) are found as materials which exhibit porosity as well as very high surface area. MOFs have been commonly used in gas separation, gas storage and catalysis but, due to high porosity and high surface area now they are being widely used in microfiltration, ultra-filtration and nanofiltration.

MOF-5 based mixed matrix membranes were fabricated in present work for solvent resistant nanofiltration. MOF-5 (Zn-BDC) was prepared by composing Zinc (II) clusters with terephthalic acid dianion as organic linker. MOF-5 nanoparticles were then dispersed in polymer solution of polyimide and NMP prior to cast the membranes. Mixed matrix membranes were fabricated by in phase inversion. Effect of composition of MOF-5 in polymeric membranes was studied. In this regard, a solution of methanol solvent and Congo-red solute was subjected for nanofiltration experiments to evaluate solvent flux and solute rejection. In past, MOF-5 has been used for storage of nitrogen and hydrogen gas and for catalysis as well. In current work MOF-5 was pioneer used for nanofiltration showing comparatively superior performance.

Keywords: Metal organic framework, nanofiltration, mixed matrix membrane.

Studying the Effects of Design Parameters on the Performance of Regenerator for Cryo-Cooler Applications

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ABSTRACT

Defense and Aerospace sectors use Infrared (IR) sensors for their security and reconnaissance purposes which need cooling to cryogenic temperature for their superior sensitivity. A Cryo-cooler is used to achieve cryogenic temperatures in order to cool down these IR sensors. A Regenerator is the main component of Cryo-cooler and its performance conspicuously disturbs the cryo-cooler efficiency. In fact, the cooling performance of cryo-cooler mainly depends upon the efficiency of the regenerator. In this study, numerical analysis of a regenerator was carried out by solving the matrix material and fluid energy equations simultaneously using a finite difference method. The effect of critical design parameters such as mass flowrate, porosity, screen wire diameter, frequency, number of heat transfer units (NTU's) and Matrix Capacity ratio (CR) on the efficiency of regenerator were investigated for a fixed geometry. It was found that the in-efficiency of regenerator increases with an increase of mass flowrate, matrix material porosity and screen wire diameter but decreases with increase of flow frequency.

Keywords: Regenerator, Cryo-cooler, efficiency, Numerical analysis, Porosity, Wire diameter, frequency.

Efficient Quadrature Rules for Numerical Evaluation of Singular and Hypersingular Integrals

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ABSTRACT

In this paper Newton-Cote type quadrature rule, Haar wavelets and hybrid functions based quadratures are used for numerical solution of singular and hyper singular integrals having singularity at origin. These integrals include the Cauchy principle value (CPV) and Hadamard finite part (HFP) integrals. The proposed rules have tested numerically on some test problems to check the efficiency and accuracy of the new methods.

Keywords: Cauchy principle value integrals, Hadamard finite part integrals, Haar wavelets, hybrid functions.

Numerical Solution of Abel Integral Equation using Transforms and Quadrature

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ABSTRACT

This paper presents the discretization in time of the integral equation. The approximation to the solution of the equation depend on the use of Laplace transform, then by inversion of Laplace transform it is represented as contour integral and evaluated with the help of a numerical quadrature. This discretization will take place in complex Banach space. The idea of the contour of integration used in the methodology, arise from the basic idea of conformal mapping.
Better results have been achieved as compared to other authors for the solution of the corresponding problem. The integral equation used for the modeling of many physical phenomena in astrophysics, applied science, physics and solid mechanics.
Since the methodology depends on the selection of contour and corresponding quadrature, therefore selection of better contour and quadrature will make the results more attractive. The algorithm can be extended to more complicated and different type of problems and proved to be a powerful tool for the solution.

Keywords: Abel integral equation, Laplace transform, Quadrature rule.

Retrofit of Pre-Heat Train of a Crude Distillation Unit

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ABSTRACT

Crude oil distillation unit is the first upstream unit in the refinery complex. The unit performs initial separation of the petroleum fractions which are then further processed in the other refinery units. The energy consumption of the crude distillation unit is quite large due to high fuel consumption in the crude charge heater to achieve the desired feed point temperature at the crude column. The crude is pre-heated through a network of heat exchangers known as pre-heat train before going into the heater. The efficiency of the pre-heat train plays vital role in the overall cost of the crude distillation unit. Pakistan's largest oil refinery pre-heat train has been selected as a case study to investigate any room for improvement. The heat exchanger network energy targeting was carried out by applying the problem table algorithm. The results show that the current heater duty is higher than minimum as depicted by the problem table algorithm indicating the scope of improvement, i.e. reduction in heater duty. Therefore, Pinch based methodology was adopted and applied by which heater duty got reduced by achieving higher upstream temperature, resulting in reduction of fuel consumption at the expense of adding more heat transfer area to one of the heat exchanger which is crude-HVGO (heavy vacuum gas oil) heat exchanger. This capital investment payback time is 13 days only.

Keywords: Retrofit, crude pre-heat train, heat exchanger network.

Meshless Procedure for Solution of the Elliptic Partial Differential Equations

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ABSTRACT

Due to the importance of the elliptic partial differential equations in science and engineering, one can encounter the numerical solution of these types of problems. Meshless procedure based on multiq-uadric radial basis function with three different strategies of selecting best value of the shape parameter is used to solve the elliptic boundary value problems such as Helmholtz and Poisson equations. Comparison of the proposed method is given with some numerical methods reported in literature. Some numerical test problems are included to justify the accuracy and efficiency of the new method.

Keywords: Radial basis function, Elliptic boundary value problems, Helmholtz equation, Numerical method.

Converging, Non-Converging Slotted Pores Membranes and Oil Drops Deformation

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ABSTRACT

The study presented in the paper is the continuation of the previous where a mathematical model was developed for the passage and deformation of oil drops through a converging slotted pore membrane. It was assumed that drops deform from a spherical shape to a prolate spheroid when pass through a converging slot. In the present study it has been assumed that drops deform into an oblate spheroid while passing through a non-converging slot and a mathematical model is developed for the deformation of drops through non-converging slots. The idea of static and drag forces has been extended and it has been found that a higher static force (F_{cx}) for the non-converging slotted pore membrane than the static force (F_{cx}^{*}) for the converging slotted pore membranes is achieved. Drops deform suddenly in the non-converging slots while in case of converging slots the drops deform gradually and that may be one of the reasons of a higher static force for non-converging slots than converging slots. Oil drops of two systems with different interfacial tensions (4 and 9 mN/m) have been used in the study and it has been investigated that a higher rejection is obtained for the drop with a higher interfacial tension using both converging and non-converging slotted pore membranes at various filtration velocities.

Keywords: Passage and deformation of oil drops, converging and non-converging slotted pore membrane, microfiltration.

Non-Linear Time History Analysis of Reinforced Concrete Special Moment Resisting Frames for Loss Estimation

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ABSTRACT

This study presents the non-linear time history analysis of four (3,5,8,10 story) prototype reinforced concrete special moment resisting frames (SMRFs), designed to a modern building code, for quantifying the economic losses due to earthquake-induced structural damages. The structures were modelled in finite element analysis based software Seismostruct and were designed to Uniform Building Code–97, also adopted in the Building Code of Pakistan. Seven natural accelerograms were extracted from the PEER NGA database, compatible with the design spectrum. The considered structures were subjected to increasing levels of ground motion (incremental dynamic analysis) to calculate the economic losses at different intensity levels. Damage to structural components was identified using a damage scale developed from quasi-static cyclic testing of reinforced concrete special moment resisting beams and integrated over the whole structure, with the required repair cost, to calculate the structure repair cost ratio (RCR). The structure RCR is correlated with the seismic intensity to develop seismic vulnerability curves. The vulnerability curves can be used by the design engineers and stakeholders for estimating the economic losses resulting from structural damage to reinforced concrete special moment resisting frames corresponding to a particular seismic intensity.

Keywords: Structural damage, Damage scale, Repair cost ratio, Vulnerability curve.

Exploring the Energy Output Using Bio Solar Cell

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ABSTRACT

It is new and novel approach that blends interdisciplinary research work. There is worldwide shortage of energy. Energy Demand exceeds energy consumption and resources are depleting rapidly. Extracting energy by conventional means has already been saturated. The foresaid research is a way to reduce electricity costs by making efficient on site hybrid electricity production unit. It imparts excellent way to combine solar technology with natural plants material to yield electricity. A BioSolar cell was assembled in laboratory using simple approach that can be duplicated by the people everywhere. The technical knowledge opted in this paper is the applied concept that plants absorb light, and yield excited electrons as a by-product during photosynthesis, which in succession produces voltage across the anode and cathode of the cell. The chlorophyll regains its lost electron with reversible redox reaction. This work utilized three different light sources: red and blue fluorescent lamps and the sunlight; each having different wavelengths in visible spectrum range. The voltages and currents measured from each light source were individually reported. The photo electrochemical parameter for solar cell by using the said material with distilled water as solute depicted the open circuit voltage (Voc) of 330 mV. Cells made from local flora were discretely experimented on, and results depicted that only cells made from the spinacia oleracea yielded reasonable quantity of electrons. This is because they have the highest amount of chlorophyll and the energy band required is minimum enabling the maximum release of electrons when illuminated. The photosynthetic solar cell is very appealing because the materials needed are not only readily available but also cheap. In this laboratory work, efficiency evaluation observed was very good for photosynthetic solar cell

Keywords: Biosolar cell, Photosynthesis, spinacia oleracea, voltage, energy.

Characterization of Produced and Brackish Water

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ABSTRACT

The study investigates the characterization of Produced and Brackish water. The aqueous waste generated along with the oil production is referred as produced water. Brackish water is the water that has got higher salinity than the fresh water and lower than sea water. A brackish water region is a mixture of fresh water and seawater. Produced water contain chemical characteristic of formation, hydrocarbon, water from reservoir, water injected into formation and chemicals added during production and treatment processes. The properties of produced water depend on the geological location, the geological formation, and type of hydrocarbon product being produced.
In current study, four samples of produced water are collected from various oil fields in District Karak, KPK. Also, four brackish water samples are obtained from nearby locations to the oil fields. Both produced and brackish water samples are analyzed and a comparison is drawn based on various impurities.

Keywords: produced water, brackish water, membrane technology.

Study of Polymer Composite Membrane for Pervaporation

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ABSTRACT

Pervaporation membrane separation is promising separation technique that performs isolation of close boiling liquid mixtures on basis of difference in their partial pressure. This research aims the development of a dense, and thin, composite membrane based on thermoplastic polyurethane (TPU) and polyaniline (PANI) that is suitable for pervaporation. Thermoplastic polyurethane substrate membrane was prepared by solution cast technique. For composite membrane polyaniline was deposited on TPU membrane by in-situ oxidative solution phase and in-situ oxidative vapor phase polymerization to obtain a thin layer on top of TPU membrane that improves selectivity as well as permeability for pervaporation separation process. Polyaniline was doped with HCl and camphor sulfonic acid (CSA) to study the influence of dopant nature on perm-selectivity of composite membrane. For solution phase deposition influence of variation in polymerization time was investigated. Fourier transform infrared-attenuated total reflectance (FTIR-ATR) spectroscopy results confirm formation of aniline-urethane linkages by NCN vibrations. Membrane were characterized by swelling in water and aqueous ethanol solutions. Swelling results showed that PANI deposited TPU membranes (TPU/PANI) has improved hydrophilicity. Hydrophilicity was also observed to improve with CSA doping. Investigation of thermal properties by thermogravimetric analysis TGA shows a decrease in thermal stability of TPU membrane after PANI deposition and with an increase in deposition time. Tensile strength and young's modulus was also observed to decrease with PANI deposition and deposition time. Membrane deposition surface was characterized by optical microscopy and atomic force microscopy AFM. Optical force microscopy images shows that vapor phase deposition of polyaniline has produced a thin, uniform surface as compared to PANI solution phase polymerization that resulted in uneven surface. AFM analysis shows difference in PANI layer roughness (R_{rms}) and deposition height (Z_{avg}) formed by both deposition techniques. It confirms a smaller value of both R_{rms} and Z_{avg} for vapor phase polymerization of aniline. Pervaporation separation with thermoplastic polyurethane (TPU) membrane and TPU/PANI composite membrane was performed using

(80/20, 60/40, 96/4) w/w%) ethanol/water solutions on a lab scale pervaporation separation testing unit. Pervaporation test results show that perm-selectivity as well as flux of TPU membrane was improved with PANI layer deposition. Thus this TPU/PANI composite membrane can be used for pervaporation separation process in various chemical industries as pervaporation is an energy efficient separation technique that is being used as a replacement of distillation or as a hybrid system with distillation. Also it is a low cost membrane because of its materials of synthesis and simple process of development. The process of membrane development utilized in this work has no toxic and hazardous steps.

Keywords: Composite membrane, polyaniline, thermoplastic polyurethane, hydrophilic, pervaporation.

Geospray: Geopolymer Coating Material for Industrial Applications

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ABSTRACT

Industrial equipments and pipes are corroded due to harsh environment like acidic or basic, reduces lifetime of these equipments and pipes. Using special materials for construction increases the cost. For that purpose special chemicals are used to coat its surface and prevent surface corrosion.
Geopolymerization is a phenomenon used for making geopolymer material used in various applications such as cements, aggregates, composites, bricks and for coating applications also. Geopolymer was first introduced by Prof. Joseph Davidovits. In making geopolymer the aluminosilicate source such as metakaolin clay, fly ashes, slag etc, rich in silica and alumina are activated by alkaline activator which is the combination of sodium or potassium hydroxide and silicates.
In the present work, Geopolymer spray has been synthesized for coating the surfaces of equipments and pipes used in industrial application. The research includes durability of Geopolymer coating material (Geospray) made from using class F fly ash(alumino silicate source material) with Si/Al ratio 1.79 and alkaline activator using sodium hydroxide and sodium silicate solution, exposed to acidic, basic and sulfate nature comparatively. The concentration of acid, base and sulfate solution was taken 10% in water. The parameters studied were composition and x-ray diffraction (XRD) of fly ash and scanning electron microscopy (SEM) of geospray applied to metallic plates. However, the aim of this research is to make Geospray having good resistance to chemical corrosion. Comparative analysis was made between coated and uncoated metallic plates exposed to different harsh medium at the age of 56 days. However, from the SEM analysis degradation occurred was different in different solutions. The effect of different environments like acidic, basic and sulfate on the coated and uncoated materials will be present in the conference.

Keywords: Geopolymer, geospray, coating material.

Membrane Reactor for Biodiesel Production from Waste Cooking Oil

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ABSTRACT

With increase in population high demand of fossil fuels and the reduction of petroleum reserves have compelled the world to embrace biodiesel as a substitute energy source. Biodiesel due to renewable and nonpolluting fuel has received extensive consideration. Biodiesel market is amongst the fastest evolving renewable energy markets. However, the conventional methods for the production of biodiesel have some serious limitations and inefficiencies like limited mass transfer due to immiscible reactants, unwanted by-products, multiple downstream processing steps, low quality and high production cost that obstructing its commercialization. In this since using membrane reactors can achieve high quality and easy separation of products by means of shifting the reaction equilibrium to product side.

In the present work, membrane reactor has been used for the production of biodiesel from waste cooking oil (WCO) feedstock and alcohol (methanol). The outcome of different operating parameters like temperature, catalyst concentration and flow rate has been examined. For this purpose, a lab scale membrane reactor system is designed and fabricated by using ceramic membrane with pore size of 0.1 to 0.2µm and active surface area of 0.08494 m².

In this research work, Transesterification process initiated by a base-catalyst (NaOH) was used for the production of biodiesel fuel. In semi-batch mode at 55, 60, 65 and 70 C° and at different catalyst concentrations and feed flow rates runs were done in the membrane reactor. Experimental results showed that variation in temperature, catalyst concentration and feedstock flow rate have considerable effect on the conversion of Tri-glycerides (TG) to FAME. Reaction products (biodiesel/glycerol) were effectively separated through membrane reactor. The two-phase membrane reactor was frequently suitable in reducing unreacted TG from the FAME product yielding high purity biodiesel by shifting the reaction equilibrium to the product side.

Keywords: Biodiesel, Reaction Equilibrium, Membrane Reactor and Waste Cooking oil.

Static Adsorption Behaviour of Newly Developed Foaming Surfactants, A Comparative Study

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ABSTRACT

Surfactants are extensively used in chemical EOR applications because of their abilities to alter the properties of surfaces and interfaces. Surfactants are expensive chemical agents and tend to adsorb on surface of rocks in oil reservoirs hence reducing its concentration in injected fluid.The comparison of adsorption behavior of anionic surfactant synthesized in-house on Berea sandstone a commercial surfactant is presented here. The effect of structure, chain length, purity and critical micelle concentration (CMC) was investigated in detail and is presented. Kinetic and modeling studies of developed product were also conducted and compared to the commercial products. Newly developed surfactant has the CMC value of 0.215 % and the point of zero charge (PZC) of Berea sandstone was at pH 8. Anionic surfactant follows a typical four region adsorption isotherm. And it was found that the adsorption of surfactants can effectively reduce by using suitable alakali to a maximum value of 0.9104 mg /g of compared to the static adsorption AOS which was measured 3.4mg/g. The adsorption of surfactants of short and branched structures were lower when compared to long and straight chain structure surfactants. The adsorption of synthesized anionic surfactant was compared to commercially available surfactant (AOS, C16-C18). The synthesized anionic surfactant showed low adsorption value compared to AOS.

Keywords: Critical micelle concentration, Surfactants, absorption.

CO_2Mobility Control by Using Surfactants for EOR Applications

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ABSTRACT

The efficiency of the CO2 in trapped oil mobilization process is severely effects by many problems including gravity override, viscous fingering, and early breakthrough. The said problems can efficiently be reduced by foam.

A study has been conducted to evaluate CO2 philic surfactants which have exhibited more practical advantages over conventional surfactants. The interfacial tension (IFT) between neat CO_2 and the newly produced surfactant solution was examined and is reported. By using the surfactant in 0.5 % concentration It was observed that the CO2/ water IFT appreciably decreased from 30 mN/m to 2.41 mN/m.The static foam durability experiments in 1000 ml cylinder and by using foam analyzer at high temperature (95°C) in the presence and absence of the Dulang crude oil were conducted and are reported. The adsorption of surfactant formulation was investigated and was found 0.91 mg/g. The Coreflood experiment were also conducted to measure the mobility reduction factor (MRF) and was found 3.3. In addition, 94 % oil recovery was achieved by conducting high pressure high temperature (HPHT) coreflood experiments by using Berea core sample by using the new CO2 philic surfactant.

Coreflood results showed that as compared to conventional surfactants, CO2 philic surfactants significantly reduce the mobility of the injected CO2 and can recover additional trapped oil at the same time helpful in CO2 sequestration.

Keywords: Coreflood,philic surfactants, interfacial tension.

Crime Mapping the Best Option for Criminology: A Review

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ABSTRACT

With the population boom the crime rate is also increasing regularly. The increase in crime rate demands the updated technology to cope with the issue of crime management operations. Crime mapping is one of the best technique which can identify the hotspots for the crimes with respect to time and date. This can be used to record the public presence in the area and helps in pre-planning for the crime control management. Street profile mapping on the basis of area, population density and vehicles provides the estimation of the nature of criminal activities that can be performed and help to calculate the required resources in case of real emergencies. Moreover, the introduction of GPS systems in police vehicles can help to reduce the response time for anti-criminal operations and can helps in motioning of the criminal activity pathway. Crime mapping can result in reduction of many criminal activities.

Keywords: Crime, GIS, street profile mapping.

Optimal Route Guide by GIS for Fire Cases at Public Use Buildings

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ABSTRACT

Due to the increase in population and the increase in demand of technology the cases of fire is increasing regularly which focuses on the high demand for the fire safety services to take the timely decision to cope with the fire emergencies. The study focuses on the 80 highly used public buildings with the highly risked fire catching buildings in the three areas of Lahore, Pakistan. The study shows the optimal route to decrease the time of response to these buildings in case of emergency for the better response and the timely next possible decision. The study was based on the ArcGIS considering U-turns, width, signals and traffic flow. Study highlighted the importance of the preliminary study to deal with the fire emergencies.

Keywords: ArcGIS, Fire Incidents, Decision making.

Environmental and Safety Issues of Forte Ceramics

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ABSTRACT

In this work, the hazardous effects of materials present in a ceramics industry, i.e. Forte Ceramics, released into the atmosphere are investigated. Different samples were analyzed in terms of toxic compounds. Results show that lead present in ceramic products and dust containing respirable particulate matter are hazardous for respiratory and digestive system. In order to get rid of these harmful effects, the percentage of toxic materials should conform to international allowable standards.

Keywords: Rnvironmental concerns, Ceramics industry, Toxic compounds, lead, particulate matter.

Gas Sweetening and Sulfur Recovery by Claus Process

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ABSTRACT

In this work, the sweetening of gas was carried out by removing hydrogen sulfide and carbon dioxide, and sulfur was recovered, by Claus process. Hydrogen sulfide was combusted with oxygen to produce elemental sulfur. The sulfur then passed through condenser where temperature was stabilized between 130 to 150 °C and then passed through degassing tower. Around 80 to 85% of sulfur was recovered through Claus process. If sulfur is not removed from natural gas and burned it produces SO2 which adversely affects the environment.

Keywords: Claus process, Sweetening, Desulfurization.

Investigation of Turbidity using Statistical Experimental Design

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ABSTRACT

Water samples from Islamia College, Peshawar was investigated for turbidity in this work. Samples were collected, analyzed accordingly to W.H.O standards. Factorial experiment was performed to screen factors and to determine factors that significantly influence reduction in turbidity in sand bed filter. Turbidity was affected by retention time, coagulation time and height of filter bed. When these factors were increased, turbidity of effluent water decreased gradually. The optimum values of factors were retention time (45 min), coagulation time (60 min). and height of filter bed (38 cm).

Keywords: Turbidity, Factorial experiment, Coagulation time, sand bed filter.

Production of Magnesium Sulphate from Dolomite Ore Deposits In KP

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ABSTRACT

This paper present synthesis of magnesium sulphate from dolomite ore deposits from KP. Magnesium sulphate is produced from dolomite ore because it is cheaper source as compared to magnesite ore. The raw material was crushed dolomite, passed through a series of steps that include calcination of dolomite, mixing it with HCl, filtration, washing, drying, mixing with H_2SO_4 to produce $MgSO_4$. The results indicate that the $MgSO_4$ produced was 86% pure. It may be concluded that the dolomite ore found in KP, Pakistan can be utilized to produce magnesium sulphate for utilization as nourishing additive in cattle feed, fertilizers, and agricultural processes.

Keywords: Magnesium sulphate, dolomite ore, process design.

Recycling used Automobile Oil by Thermal Cracking

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ABSTRACT

In this work used automobile oil is recycled, to address environmental concerns, conservation of energy, and saving useful materials. There are two main methods used for recycling, pyrolysis and acid clay process, however, in this project an attempt has been made to recycle used automobile oil by the method of thermal cracking. In this process exothermic reaction takes place so temperature is raised and the products are cooled down to room temperature and treated with Sulfuric acid. After Sulfuric acid is reacted completely, sludge is formed at the bottom which is removed and finally the sample is filtered and yellow colour oil is obtained. This oil may be used for lubrication, cooling and as a fuel in furnaces. After comparing the properties of recycled lube oil it was concluded that with further addition of some additives the properties of recycled oil can be improved as virgin lubricating oil.

Keywords: automobile oil, recycling, thermal cracking.

Waste Heat Recovery System for Kohat Cement

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ABSTRACT

In this work the energy audit of Kohat Cement Pvt. Ltd. is presented. Plant data from Kohat cement factory with a capacity 6700 tons per day of clinker was used to obtain the energy balance for pyro-processing system. The specific electricity consumption of Kohat cement factory is 56MW. It is predicted that by installation of waste heat recovery system the factory will produce 9.4MW and the consumption will reduce to 46.6MW. The use of waste heat recovery system may increase overall plant efficiency and reduce operational costs and resulting green house gas emissions.

Keywords: waste heat recovery system, energy audit, improving plant efficiency, Kohat cement.

Treatment of Formaldehyde from Industrial Waste Water

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ABSTRACT

This paper presents experimental investigation of removal of 90% of formaldehyde from industrial waste water. Two methods of removing formaldehyde from waste water are studied. In iodometric method a sample is added to hypo-iodide, which reduces a part of formaldehyde and the unreduced part is converted to iodine, which is further titrated with sodium thiosulphate. In the second method chromotropic acid reacts with the formaldehyde in the water sample which develops a bright purple colour which is tested by spectrophotometer for determination of absorbance created due to it. In iodometric method the removal rate was 58% while with the alternate method it was more than 90%. Chromotropic acid method was found to be better than iodometric method because a lot of chemicals are used in idometric method and it is also expensive.

Keywords: waste water treatment, formaldehyde, iodometric method, chromotropic acid.

Desulfurization of Fuels by Adsorption Through Hydroxy Appetite

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ABSTRACT

In this experiment, desulphurization of tire pyrolysis oil was carried out by adsorptive desulphurization. The adsorbent was prepared from orthophosphoric acid and calcium hydroxide. The metal was loaded on it and calcination process was carried out in order to remove volatile matter. Different experiments used model oil to determine optimum conditions for maximum adsorption. Results show that adsorption of hydroxy appetite increased as the concentration increased keeping temperature and time constant. Adsorptive desulfurization may be employed for desulfurization at small scales.

Keywords: adsorptive desulfurization, hydroxy appetite, desulfurization.

Production of Biodiesel from Animal Fat

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ABSTRACT

In this work biodiesel was prepared from animal fat. Biodiesel is widely produced by transesterification process wherein alkyl group of ester is exchanged with that of alcohol and this reaction may be catalysed by acid or base. Oil was extracted from chicken and mutton fat. Then the tallow was analyzed for density (1011 kg/m^3), viscosity (4.66 kg/ms) and acid number 27 (mg KOH/gm). Pretreatment was done by H_2SO_4 and alcohol in (1:30) to tallow. 600 gram of oil was added to 120 gram of methanol in presence of 3.36 grams of sodium methoxide catalyst. It was concluded that alkaline catalysis was better than acid catalysis and high yield can be achieved using sodium methoxide and fatty acid methyl ester.

Keywords: Transesterification, biodiesel, animal fat, sodium methoxide.

Boiler Designing for Waste Heat Recovery Plant for a Cement Industry

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ABSTRACT

In this work scope of waste heat recovery in a cement plant is determined and a boiler is designed to recover the intensive amount of wasted heat energy. Askari Cement plant, Nizampur produces 2700 ton of cement per day using dry process. Material and energy balances are carried out on pyro-processing unit to determine the potential of saving energy. In literature review and from plant data it was found that lot of input energy gets wasted through waste heat streams. Ten-ton capacity waste heat water tube boiler is designed to generate about 1.7 MW of electricity. This design is estimated to payback within thirteen months.

Keywords: Pyro-processing, boiler design, cement plant.

Effect of Desulfurization on Viscosity of Pyrolytic Oils

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ABSTRACT

The aim of this research is to improve the poor fuel quality of the pyrolytic oils by its treatment with different additives and acids. The quality of fuel can be enhanced by the use of desulfurization thereby improving other fuel properties as well. The experimental conditions throughout the experiment were atmospheric pressure and 50^0C. Addition of mixture of hydrogen peroxide and acetic acid in desulfurization improved viscosity. The addition of sulphuric acid was satisfactory to decrease the viscosity and sulfur content but it is uneconomical. The mixture of H_2O_2-CH_3COOH is recommended because of its low cost and high desulfurization efficiency. This mixture also helped in decreasing the viscosity which increases the smooth fluidity and automization ability of pyrolytic oils.

Keywords: Desulfurization, viscosity, pyrolytic oils.

Extraction of Edible Oil from Rice Husks

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ABSTRACT

In this work oil was extracted from rice husks, using acetone, for use as domestic cooking oil. Experiments were performed in a muffle furnace, and rotary evaporator using acetone as a solvent. Oil yield increased up to 44.5% at 40-45°C. Operating parameters were screened using statistical experimental design to determine the significant factors and to develop a mathematical correlation for predicting the yield within the range of factors investigated. It was concluded that oil obtained from rice husks has potential to be used as edible oil economically.

Keywords: Rice husks, process optimization, statistical experimental design.

Extraction of Sweetener from Leaves of Stevia

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ABSTRACT

The objective of our study is to extract sweetener from Stevia Rebaudiana plant which can be used as an alternative in foods and beverages instead of sugar. It is reported in previous literature that Stevia sweetener is 70 to 350 times sweeter than sugar, and has no calorific value and is stable at high temperature. The liquid can be extracted from Stevia plant by using multistage membrane processes and also by using enzymatic extraction. Enzymatic extraction is expected to give better yield and may be more economical because of less solvent usage. Therefore, it is proposed to extract sweetener by using enzymatic extraction in this project.

Keywords: Stevia, membrane, enzymatic extraction, sweetener.

Factors Effecting Rheological Properties of Polyurethane Composites

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ABSTRACT

In this work the effect of particle size of filler, solid loading and shear rate with time on rheological properties of polyurethane composites is studied. To prepare the polyurethane composites first the binder was weighed and filler was added in two portions at continues stirring. Curing agent was also added and the prepared slurry of polyurethane composite was used for rheological studies. The experimental data showed that viscosity was inversely related to shear rate and increased with solid addition. From the results it is concluded that for good rheological properties increased solid loading without compromising pot life and small particle size must be used.

Keywords: solid loading, polyurethane composites, rheological properties; process optimization.

Effect of Varying R-Values on Mechanical Properties of Polyurethane

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ABSTRACT

In this work, the effect of varying R-values on mechanical properties of polyurethane is investigated. The polyurethane and polyurethane composites were prepared by thin layer solution technique, and due to no film forming property below R-1.0, the R-values were varied between 1.0 and 2.0. R-value is the ratio of equivalents of NCO groups to OH groups taken in the curing mixture. The results showed that the stress significantly increased with increase in weight percentages of filler contents, but the increase in stress values for polyurethane silica composites was higher compared to polyurethane carbon composites. The strain values were decreasing for polyurethane carbon composites and polyurethane silica composites with increase in the filler percentages. The elastic modulus increased with an increase in weight percentages of polyurethane carbon composites and polyurethane silica composites. From the results, it is concluded that both composites have better thermal properties than pure polyurethane.

Keywords: Thin layer solution technique, R-values, elastic modulus, polyurethane, polymer composites.

Preparation of Biodiesel from Waste Cooking Oil Using Magnetically Separable Silica Supported Heterogeneous Acid Catalyst

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ABSTRACT

This study presents development of a magnetic composite solid acid catalyst; which is more active than classical catalysts using advanced Sol-Gel nano synthesis technique, for the production of biodiesel from waste cooking oil. For the synthesis of meso porous silica titania composite, sodium silicate and titanium oxy chloride is used as silica and titania precursors respectively. The composite is then magnetised followed by the impregnation with sulphuric acid, to implant sulphate group. The synthesised compound is evaluated for its catalytic activity in the esterification of waste cooking oil, by using gas chromatography and massspectrometry. Furthermore, Gas chromatograph is used to determine the methyl esters production in the process reaction. The experimental results conclude that the mentioned catalyst show magnetic properties and thus can be easily recovered. The conversion in first run was 84%, in second run was 72%, and in the third run was 67 %, i.e. better than the classical catalysts.

Keywords: Magnetic Composite Solid Acid catalyst, Esterification, Gas Chromatography, MassSpectrometry.

Production of Potassium Chromate By Green Metallurgical Processing

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ABSTRACT

Lab scale processing of chromite for production of potassium chromate by green metallurgical processing is presented. The process takes place in a pilot plant by oxidation of chromite ore in the sub molten potassium hydroxide at 300C. The process is a continuous liquid phase oxidation of the ore in a cylindrical shape stainless steel reactor continuously agitated by mechanical means at a stirring speed of 800 rpm to keep the slurry suspended. $KrCrO_4$ crystals were produced during the process which settled at the bottom of the reactor. The chemical conversion of chromium was about 99% in this process. The test demonstrates that the chromate yield is 99% at the same time using less number of chemicals proving to be cost effective as well.

Keywords: green metallurgical processing, potassium chromate, chromite ore, processing.

Process Design for Production Of Sodium Chromate

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ABSTRACT

In this process, sodium chromate is produced from chromite ore and molten NaOH at elevated temperature. Chromite ore is reacted with $NaNO_3$ in a reactor at 370°C and then concentration of slurry formed is decreased to 50% of NaOH solution. The slurry is then filtered and cooled, the cake formed is leached with water to dissolve Na_2CO_3. After another filtration the residue is separated from sodium chromate and the sodium chromate is crystallized at 25°C. This project, of chromium recovery through novel process from Pakistani chromite ores, gives (40% to 45%) less residue and this process is more energy efficient and economical with processing low cost sodium chromite in Pakistan. Sodium chromate may be utilized for the crystallization in leather tannery, paint, textile industry, wood preservation and petroleum refineries.

Keywords: sodium chromate, chromite ore, sodium hydroxide, leaching.

Treatment of Tannery Waste Water Using Iron Chloride

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ABSTRACT

This paper presents the treatment of tannery waste water by removing the various hazardous chemicals which impart negative impacts on the environment, and focuses on the removal of effluent Cr (VI) that is carcinogenic. This experiment shows the treatment of effluent from light leather processing containing organic matter, chromium, and solid waste including fleshing, trimmings and shavings etc. $FeCl_3$ was employed for chemical treatment of tannery waste water by filtration of waste water followed by coagulation and settling of waste. 92% of chromium was removed from waste water. Thus the study suggests that this method could be promising in order to reduce Cr (VI) from waste water of leather industries.

Keywords: Tannery waste water, iron chloride, coagulation, waste treatment.

Optimizing Viscosity of Urea-Formaldehyde Resin Using Statistical Experimental Design

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ABSTRACT

The aim of the project is to apply the essential principles, laws, and material balance on a pilot plant design for the urea formaldehyde resin plant. This analysis is carried on the batch reactor which has the same working principles as at the industrial scale. The experimental work determined the effect of different physical parameters on viscosity of urea including: temperature, time and the molar feed ratio. The viscosity of the glue was maximum at 80^0C, molar feed ratio of 3.1:1 and for reaction time of 2.56 hours. The results show that out of the three variables time, molar feed ratio and temperature only molar feed ratio and temperature are the significant factors.

Keywords: urea formaldehyde, resin, viscosity, experimental design.

Production of Fuel by Pyrolysis of Waste Plastics

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ABSTRACT

The aim of the project is to produce fuel by the pyrolysis of waste plastics. The process may be conducted through pyrolysis of low density polyethylene (LDPE) and waste bottles (HDPE) of water and beverages. The co-pyrolysis of polystyrene (PS) with bamboo and Polystyrene (PS), polyethylene (PE), polypropylene (PE) with lignin is studied. First the size of plastic is reduced. The temperature for pyrolysis of waste plastic varies between 350 – 800^0C for different feeds and types of reactors. The experimental method employed in this project is carry out co-pyrolysis of waste plastics with lignin. The gaseous and liquid products may be used as aromatic or olefins fuels, solid fuels (CNT), i.e. carbon nanotubes used in electrodes, and water purification.

Keywords: pyrolysis, waste plastics, lignin, co-pyrolysis, fuels.

Simulation and Optimization of Membrane-Thermal Concentration Process for Concentration of Thin Sugar Juice

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ABSTRACT

Evaporating water from aqueous solutions is an energy intensive process due to high latent heat of water. Efforts have been made to remove the water by other methods instead of evaporation for example concentrating solutions through membranes. Concentrating through membranes is energy efficient because it does not involve phase change. But this process has a limitation that it cannot concentrate as high as evaporator. Therefore, membranes are used as pre concentrator and final concentration is achieved in Multiple Effect Evaporator (MEE). In MEE, solution is boiled in a series of heat exchangers (Tubular Calandria). The vapors boiled off in one unit are used to heat the next one, except for in the first vessel which requires an external source of heat. To reduce utilization of heat in sugar industry A Hybrid concentration process i.e. membrane-thermal concentration (MTC) has already been proposed. The MTC process makes use of the concept to pre-concentrate solution via membranes before entering into the MEE. Focus of this research was to find optimum number of effects for a particular sugar concentration process after integration of membranes into conventional MEE. MTC process was simulated in ASPEN HYSYS for evaluation of optimum number of effects to concentrate thin Sugar Juice containing Sucrose and Water from 15°B to 74°B. The actual conventional MEE process included six effects for increasing concentration from 15°B to 74°B. In the present study four models were simulated in ASPEN HYSYS including a model for the actual conventional process of six effects and three models with reduced MEE effects after integration of membrane, each model achieving product concentration of 74°B. Simulation results showed reduction in steam consumption by 85.12% by using membrane for pre-concentration and not making any changes to the effect of actual process. Heat transfer area and steam consumption reduced by 79.67% and 83.99% respectively using MTC process with five evaporator effects. Heat transfer area and steam consumption decreased by 81.48% and 81.94% respectively using MTC process with four evaporator effects. The optimum model was then selected based on reduction in heat transfer area and steam consumption after integration of membrane to the conventional sugar concentration process.

Techno-economical Comparison of Parabolic Trough Solar Thermal Power Plant with Quaid-e-Azam Solar Photovoltaic Power Plant

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ABSTRACT

For economic development energy is the basic requirement while Pakistan is facing severe energy crises. Addressing energy crises by renewable energy technologies is not only environment friendly but it will also decelerate the depletion of fossil fuel resources. One of the renewable energy technology is solar photovoltaic power plants but for large systems it becomes expensive. Parabolic trough solar thermal power plants is cost effective technology for large capacity and locations where solar insolation is high. Pakistan has locations where Direct Normal Irradiance (DNI) of 7 to 8 kWh/m^2/day is received. Parabolic trough solar thermal power plant is proven technology and there are more than 58 power plants installed worldwide.

This paper aims the compression of cost effectiveness technology between parabolic trough solar thermal power plant and Quaid-e-Azam photovoltaic power plant for the same location. A virtual model of 100 MW parabolic trough solar thermal power plant was made in TRNSYS simulation software and it is found that solar thermal power plant has lower Levelized Electricity Cost (LEC) than solar photovoltaic power plant.

Keywords: Direct Normal Irradiance (DNI), Parabolic Trough, Solar Thermal Power Plant.

Energy audit of Askari Cement, Nizampur

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ABSTRACT

Paper presents a method to minimize expenditure of energy in Askari Cement, Nizampur. During the study stoichiometric balances were applied on different equipment and it was estimated that a large amount of energy can be conserved, for which steam cycle was introduced at the outlet of kiln and clinker cooler exit gas. Results show that 4.4MW of energy may be produced by utilizing the energy of steam cycle in the generators. It was concluded that 15.6% of the total energy was conserved.

Keywords: cement, energy audit, heat recovery.

Video Streaming data estimation and management for efficient bandwidth utilization using Probabilistic Models

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ABSTRACT

Proficient bandwidth usage demonstrated for Moving Picture Expert Group (MPEG-4) traffic by using estimation and scheduling algorithm in various traffic scenarios. For multiuser MPEG-4 Variable Bit Rate (VBR) traffic, both linear regression and probabilistic methodologies are entertained to discover the most ideal combination of estimation and scheduling. The future VBR traffic is calculated using ARMA (Auto Regressive Moving Average) and MACD (Moving Average Convergence Divergence). The VBR traffic estimation proves to perform better than present statistical models. The estimation is followed by four unique algorithms: SRPT (Shortest Remaining Processing Time), Fixed, Probabilistic, and Priority based scheduling. Different traffic scenarios in various numbers of users are entertained for all these networks and results are arranged. The outcomes show challenging results with estimation of as high as **98%** and efficient use of bandwidth up to **50%** with no packet drop.

Keywords: Bandwidth Estimation, Scheduling, Shortest Remaining Process Time (SRPT), MPEG-4 Traffic.

Derivative Based Hybrid Genetic Algorithm: A Preliminary Experimental Results

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ABSTRACT

Global Optimization is an important branch of mathematical analysis and numerical analysis in the recent past few years. Practical example of the optimization problems including the design and optimization of electrical circuit in electrical engineering, object packing problems, the Gibbs free energy in chemical engineering and the Protein structure prediction problems. Genetic algorithm (GA) is one of the most popular population based and stochastic nature based techniques in the field of evolutionary computation (EC). GA mimic the process of natural evolution and provides the maximum or minimum objective function value in single simulation run unlike traditional optimization methods. This paradigm has great ability to efficiently locate the region in which the global optimum of the used test problems exists. However, sometime, it has facing difficulties and spend much time to find the exact local optimum in the search space of the given test suites and complicated real world optimization problems. In such a situation, Local search (LS) techniques are very good tools to handle such issues by incorporating them in the framework of evolutionary algorithm frameworks in order to improve further their global search process. In this paper, we have incorporated the Broyden-Fletcher-Goldfarb-Shanno (BFGS) as local search optimizer in GA framework with hope to alleviate the issues related to optimality and convergence of the original GA. The performance of the suggested hybrid GA (HGA) have been examined by selecting eight test problems from the widely used benchmark functions. The suggested HGA have shown promising results for dealing with most of test problems compared to simple GA by implementing them in Matlab 2013 environment.

Keywords: Global optimization, Evolutionary Computation, Evolutionary Algorithms, Genetic Algorithm, Hybridization, BFGS.

Mineralogical Characterization and Evaluation of Phosphate Ore from Garhi Habib Ullah, District Mansehra, Khyber Pakhtunkwa, Pakistan

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ABSTRACT

Geological survey of Pakistan (GSP) conducted a detailed investigation in 1969 on the Dolola area of the Garhi Habib Ullah and reported the presence of about 0.9 million tons of phosphate ore. The content in the ore of P_2O_5 more or equal to 30% are consider as marketable. In order to evaluate and upgrade the phosphate ore, GHU, different mineralogical, chemical studies and beneficiation studies were carried out. In the first step mineralogical studies included the petrography, scanning electron microscope (SEM), X-Ray fluorescence (XRF), X-ray diffraction (XRD) to study phosphate ore. In the second step on the basis of mineralogy shaking table technique were used for the beneficiation of phosphate ore. It is concluded from mineralogy study that the apatite mineral is present with association of gangue mineral such as calcite, quartz and hematite. Petrography show that the phosphate rock are of dolomitized formation. SEM result show that the apatite mineral are locked between calcite and quartz, need optimum liberation. XRF result show that the apatite mineral were 22.85 %.XRD also show that the major gangue with ore mineral are quartz, calcite and hematite. Beneficiation techniques were used such as shaking table, which up-grade the phosphate ore mineral upto marketable grade 30.22% with average 58% recovery. It was proposed that the phosphate recovery could be increased if the shaking table tailings could be reprocessed using froth flotation and magnetic separation technique.

Keyword: Beneficiation, shaking table, Garhi Habib Ullah, apatite, recovery, grade.

Extaction of Niobium from Ore Deposits Occurring In KPK

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ABSTRACT

The aim of this project is to extract Niobium metal from ore samples collected from various regions of KP. Commercially Niobium has been separated and purified by solvent extraction in the presence of HF, however, because of environment problems alkali potash may be a suitable option for the separation and purification without presence of HF. The effect of different parameters such reaction temperature, reaction time, ore particle size, and alkali-to-ore mass ratio were investigated. It was found that reaction temperature was more significant compared to other parameters and reaction time has no significant effect. Niobium extraction was found to increase when ore particle size reduces.95% Niobium recovery was achieved at 280^0C reaction temperature, 90 minute reaction time while particle size was kept at 44µm and alkali to ore mass ratio (7:1).

Keywords: Extraction of niobium, Alkali Potash, Reaction Time, Reaction Temperature.

Numerical Simulation of Hollow Fiber Membrane Contactors for CO_2 Separation from Natural Gas

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ABSTRACT

CO_2 is the main unwanted component in natural gas. It reduces the heat value and its amount in 2 to 3% makes the gas unmarketable. The presence of CO_2 in natural gas increases its cost of transportation and corrodes the transportation lines. CO_2 removal is the necessary before using it for combustion or in process industry as it also causes corrosion of the process machinery. The technical methods for removing CH_4 uses the absorption columns, scrubbers etc. The operational engineers face many problems in process industry during operation of such devices. These problems include emulsion; flooding etc. To avoid these problems, a novel technique of hollow fiber membrane is an open option for the absorption of CO_2 in some absorbent during CO_2 separation from natural gas which provides non-dispersive contact between fluids. Several researchers have done experimental work on the removal of CO_2 from CH_4 but a limited work is available on simulation through computer software. In this research, a mathematical model has been developed for removal of CO_2 from CH_4 using distilled water as an absorbent. The post processing of the model was carried out to study the effects of operational and structural parameters on the separation process. Concentration profile, velocity profile, porosity to tortuosity ration effects, gas and liquid flow rates were studied to find the effects of these parameters on removal efficiency. It was found that hollow fiber membrane contactor is a good and economical option for CO_2 separation from natural gas. It was also found that distilled water is a suitable absorbent for CO_2 in HFMCs processes.

Keywords: Gas-Liquid separation processes, Hollow fiber membrane contactors, Modeling and simulation, Computational fluid dynamics.

Energetic and Exergetic Analysis of 2.97 MW Rice Husk Fired Steam Turbine Power Plant in an Existing Fertilizer Industry by Using Aspen HYSYS® V8.8

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ABSTRACT

The exergy analysis of rice husk fired steam power plant has been performed by using simulations in aspen hysy. Small portion of steam produced is used for paddy drying while major portion is used for operation of steam turbine for in-house electricity production Thermodynamic parameters are extracted from aspen hysys for calculations. Case studies are included to check the effect of different parameters on efficiency of equipment. Exergy analysis is carried out on running conditions of the plant and overall plant exergy efficiency calculated is 57.10%. Maximum exergy destruction was found in case of boiler, which is due to incomplete combustion processes & inappropriate insulation. Other parameters were determined that caused decrease in exergetic efficiency of the plant and remedial actions are suggested. Case studies are included to check the effect of different parameters on efficiency of equipment.

Keywords: Exergy Analysis,exergy efficiency, energy efficiency, exergy destruction, steam power plant, combustion.

Experimental Study of Dispersion of Pollutants in the Atmosphere

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ABSTRACT

This paper presents a study of atmospheric dispersion of Sulphur dioxide through a stack. Experimental investigation was carried out using a pilot stack by releasing controlled amounts of pollutant, i.e. Sulphur dioxide. The concentration of pollutant was measured at specified points away from the stack to determine the pattern of pollutant dispersion. Experimental data obtained may help in validating dispersion models.

Keywords: pollutant dispersion, experimental stack.