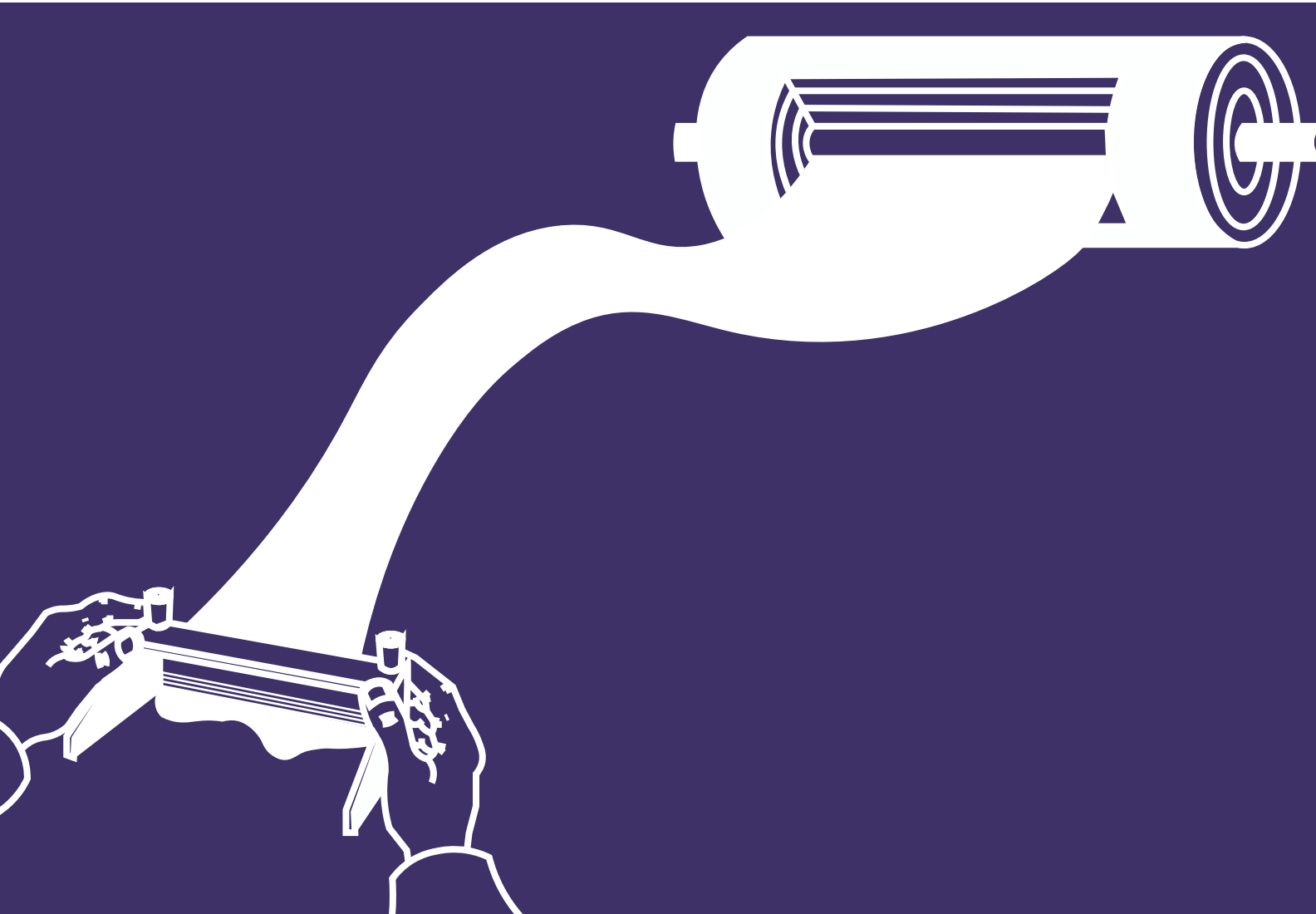




Syed Babar Ali  
School of Science and Engineering

# ICMS

**International Conference on Membrane Separations  
Lahore University of Management Sciences, Pakistan**







# WELCOME NOTE

Welcome to ICMS-2023!

On behalf of the organizing and scientific committees, it is my great privilege and honor to welcome you to the 1st International Conference on Membrane Separations (ICMS2023). ICMS is a venture of the Department of Chemistry & Chemical Engineering, SBA School of Science & Engineering, Lahore University of Management Sciences (LUMS), and Laboratory of Advanced Membranes and Separations (LAMS).

The key themes for the conference span three major focus areas in the separation world:

1. Circular design and engineering of membranes for pressing separations.
2. Bridging the industry-academia gap in a post-COVID-19 world.
3. A tribute to Dr. Richard William Baker for his remarkable 60-year contribution in the field of separation sciences.

Within our key themes, the scientific program of the conference includes all the technical areas of membrane science and separations, including membrane fabrication and modification, transport phenomena modeling, and membrane applications in a broad variety of areas, such as water treatment, gas separation, and carbon capture. The conference will feature advances in membrane technology, from the latest innovations in synthesis, characterization, processing, and modeling to applications in health, energy, and sustainability, as well as future materials and devices.

ICMS 2023 brings together participants from around the world and provides a platform for scientific exchanges on new ideas and the latest research in membrane science and technology. A comprehensive technical program is in place that includes five plenary talks, keynote and invited speakers presenting their most recent and innovative work, and an evening poster session. With about 200 presenters and attendees, ICMS, therefore, brings together state-of-the-art research and industry progress to build a stimulating program that pushes the frontiers in membrane science and application. The participants include leading researchers from academia, the chemical industry, and the services industry.

We thank our numerous sponsors, distinguished invited speakers, and delegates for their participation and support, in what we expect to progress. We wish all the delegates a fantastic learning experience and a comfortable, enjoyable, and memorable stay at LUMS!

Faheem Hassan Akhtar  
Principal Organizer, ICMS2023



# PLENARY LECTURES

## MEMBRANE TECHNOLOGY AS A PARTIAL SOLUTION TO GLOBAL WARMING

### BIO

Dr. Richard Baker founded Membrane Technology and Research, Inc. (MTR) in 1982 and served as President for 25 years. In that time, MTR became a leading membrane research, development, engineering, and production company, concentrating on the development of membranes and membrane systems for industrially and environmentally significant separations. He is currently leading MTR's new development program for membrane-based biomass/biofuel ethanol separations. Dr. Baker is the author of more than 100 papers and over 100 patents, all in the membrane area. Three editions of his book, Membrane Technology and Applications, were published in 2000, 2004 and 2012. He serves on the editorial board of the Journal of Membrane Science, was previously on the editorial boards of Industrial and Engineering Chemistry Research, The Journal of Controlled Release and Separation and Purification Technology. He served as editor of the NAMS quarterly newsletter for several years. Dr. Baker is founder and past president of the International Controlled Release Society, and co-founder of the North American Membrane Society (NAMS). In 2002, he was recipient of the first NAMS Alan S. Michaels Award for Innovation in Membrane Science and Technology.

### **DR. RICHARD BAKER**

**Founder & Principal Scientist**  
**Membrane Technology and Research, Inc. (MTR)**



# PLENARY LECTURES

## POLYMERIC MATERIALS AND MEMBRANES FOR NANOFILTRATION

### ABSTRACT

Membrane technology has been highly successful in separations for applications such as desalination. In the transition to a sustainable economy, there is a need to substitute energy-intensive technologies in the chemical, pharmaceutical, and petrochemical industries. Membranes can play an important role and there is a need for better selectivities and stability to allow the precise separation of molecules in the nanofiltration range and in organic solvents. In our lab, membranes are being developed with high-performance polymers like polyketones and polytriazole using scalable methods of flat-sheet and hollow fiber fabrication by phase inversion and using a variety of new monomers for interfacial polymerization. An overview of recent achievements in this sector will be provided.

### PROF. SUZANA NUNES

Vice Provost for Faculty and Academic Affairs  
King Abdullah University of Science and  
Technology (KAUST)

Professor Nunes serves as the Vice Provost for Faculty and Academic Affairs, along with her duties as a full Professor of Chemical and Environmental Science and Engineering. Her research interests are new polymeric materials for membrane manufacture, characterization and application, particularly for nanofiltration, pervaporation and gas separation.



# PLENARY LECTURES

## MEMBRANE HIGHLIGHTS OVER DECADES

### ABSTRACT

Today polymeric membranes play an important role for our well-being. They produce clean drinking water, they protect the environment and recover valuable compounds, they separate gases, save energy, generate electricity (fuel cells), and they save numerous lives (e.g. hemodialysis, artificial lung). I will show some of the highlights in membrane development during the last decades. 1. Multilayer membranes. Two low-selective membranes can be combined to form a highly selective membrane. This 40-year-old invention is important for large-scale industrial applications. Also, this one: a third layer can be added to a two-layer composite membrane, and the flux is increased drastically. We apply this “trick” frequently in our company GMT. 2. Interfacial polymerization (IP). Since the work of Cadotte IP is known as a powerful technique for fabricating superior reverse osmosis membranes. Organic solvent nanofiltration is an emerging membrane technology, and interfacially polymerized membranes will be important in this field. 3. The “magic” of silicone. Silicone rubber is a simple polymer with moderate selectivities. But for some applications it is hard to beat. I will explain why.

### PROF. KLAUS VIKTOR PEINEMANN

**Professor (Adjunct), Chemical and Biological Engineering**

**Founder, GMT Membrantechnik GmbH, Germany**

Since 1995, Prof. Peinemann is the founder of GMT Membrantechnik, a global leader in the development and manufacturing of innovative membranes and modules. He also serves as an adjunct faculty at KAUST where his research focuses on the development of multicomponent polymer-based membranes and adsorbents.



## **SUSTAINABLE NANOMATERIALS FOR CO<sub>2</sub> CAPTURE AND CONVERSION: THE ROAD TO CIRCULAR ECONOMY FOR A RAPID CLIMATE RECOVERY**

### **ABSTRACT**

The natural carbon cycle needs large-scale CO<sub>2</sub> capture, storage, and conversion to accommodate the excess emissions. We studied effective carbon capture strategies and built over 200 sustainable nanoporous polymers with ranging functionalities. To increase CO<sub>2</sub> binding and the purity of the captured CO<sub>2</sub>, we investigated high amine loading structures and found that moist CO<sub>2</sub> is even more favorable in carbon capture with amines, and there is a unique wrapping mechanism. In dry reforming of methane, we developed a Ni-Mo-MgO nanocatalyst that runs over 850 hours of continuous activity, a record for non-noble catalysts without coking or sintering. We identified a novel mechanism that requires nanocatalysts to be on single-crystal edges (NOSCE). For the non-redox CO<sub>2</sub> fixation into cyclic carbonates, we developed a new imidazolium catalyst forming a Lewis acid/base pair that catalyzes even ambient pressure CO<sub>2</sub> without any need for solvents, co-catalysts or metals.

### **PROF. CAFER YAVUZ**

**Professor, Chemistry**  
**King Abdullah University of Science and Technology (KAUST)**

Cafer T. Yavuz received his Ph.D. from Rice University in 2008 with a Welch scholarship and was a postdoc at UCSB (2008–2010). He worked at KAIST from 2010–2020. Currently, he is a professor of chemistry at KAUST with a research focus on nano and porous materials design and synthesis for applications in the environment, particularly for CO<sub>2</sub> capture and conversion.





# PLENARY LECTURES

## **POLYMER-BASED MEMBRANES: FROM FUNDAMENTAL UNDERSTANDING TO UPSCALING**

### **ABSTRACT**

An overview will be given of the membrane development work performed at the Membrane Technology Group of KU Leuven. It will start from attempts to deeper understand membrane formation processes using microfluidics and confocal fluorescence microscopy. At the other side of the spectrum, pilot-scale upscaling will be discussed and all hurdles met on that way. Case-studies will involve PVDF-crosslinked and UV-cured PSf membranes for solvent-resistant and solvent-tolerant NF, as well as corrugated PSF and PVDF membranes for vibrating membrane bioreactors for water treatment and algae harvesting.

Epoxide-chemistry will be introduced as a new platform chemistry to prepare NF-membranes with exceptional pH and hypochlorite stability. For CO<sub>2</sub>-selective gas separations, record-performing novel mixed matrix membranes will be presented that largely surpass the Robeson-limits for removal form CH<sub>4</sub> and N<sub>2</sub>, while keeping mechanical stability and thermal resistance.

### **PROF. IVO VANKELECOM**

**Professor, Faculty of Bio-Science Engineering  
Katholieke Universiteit Leuven (KU Leuven)**

Prof Ivo Vankelecom obtained his PhD in Applied Biological Sciences from the Department of Interphase Chemistry in 1994. He subsequently worked at KU Leuven as postdoc on membrane catalysis. Since 2002, he is a professor at KU Leuven where his research revolves around various aspects of membrane technology such as solvent-resistant membranes nanofiltration, RO, gas separations, membrane bioreactors, redox flow batteries and water electrolysis.



# EVENT SCHEDULE

**FEBRUARY 27**

**RECEPTION & REGISTRATION**

**8:00 - 9:00**  
AM AM

**INAUGURATION CEREMONY**

*MODERATOR: Ms. Arwa Batool*

**9:00 - 9:30**  
AM AM

9:00 AM - 9:10 AM

**ICMS INTRODUCTION**

Dr. Faheem Hassan Akhtar  
*Principal Organizer & Assistant Professor, LUMS*

9:10 AM - 9:20 AM

**WELCOME ADDRESS**

Dr. Tariq Jadoon  
*Vice Provost, LUMS*

9:20 AM - 9:30 AM

**INAUGURAL ADDRESS**

Dr. Arshad Ahmad  
*Vice Chancellor, LUMS*

**PLENARY TALK 1**

*SESSION CHAIR: Prof. Klaus-Viktor Pienemann*

**9:30 - 10:10**  
AM AM

*Membrane Technology as a Partial Solution to Global Warming*

*Dr. Richard Baker (MTR, USA)*

**MODERATOR: Dr. Faheem Hassan Akhtar**

10:10 PM - 10:25 PM

**TEXTILE INDUSTRIES: SEPARATION TECHNOLOGIES CHALLENGES & POTENTIAL**  
Mr. Fauz ul Azeem  
*Interloop Limited, Pakistan*

**5**  
MIN  
GROUP  
PHOTO

+

**15**  
MIN  
TEA  
BREAK

**KEYNOTE SESSIONS**

*SESSION CHAIR: Dr. Asif Ali Qaiser*

**11:00 - 12:40**  
AM AM

11:00 AM - 11:20 AM

**MATHEMATICAL MODELLING OF GAS PERMEATION IN MEMBRANES**

Dr. Muhammad Arshad  
*PAF-IAST, Pakistan*

11:20 AM - 11:40 AM

**CELLULOSE ACETATE-BASED MIXED MATRIX MEMBRANES FOR CO<sub>2</sub> CAPTURE**

Dr. Zaib Jahan  
*SCME NUST, Islamabad, Pakistan*

11:40 AM - 12:00 PM

**UPCYCLING PET TO FABRICATE MEMBRANES FOR DESALINATION**

Muhammad Hafi Wadgama  
*LUMS, Pakistan*

12:00 PM - 12:20 PM

**EXPLORING THE POTENTIAL OF BACTERIAL CELLULOSE MEMBRANES FOR AIR/GAS FILTRATION**

Arooj Fatima  
*Universidade NOVA de Lisboa, Portugal*

12:20 PM - 12:40 PM

**NEXT-GENERATION MEMBRANES THROUGH GREEN MANUFACTURING TECHNOLOGY**

Dr. Sungil Jeon  
*MEMBRARE, South Korea*

**PLENARY TALK 2**

*SESSION CHAIR: Prof. Ivo Vankelecom*

**12:40 - 1:20**  
PM PM

*Polymeric materials and membranes for nanofiltration*

*Prof. Suzana Nunes (KAUST, KSA)*

1:30 PM - 2:30 PM

**Lunch Break**

**PLENARY TALK 3**

*SESSION CHAIR: Prof. Irshad Hussain*

**2:30 - 3:10**  
PM PM

*Sustainable nanomaterials for CO<sub>2</sub> capture and conversion: The road to circular carbon economy for a rapid climate recovery*

*Prof. Cafer Yavuz (KAUST, KSA)*

**POSTER SESSION**

*SESSION CHAIR: Prof. Naveed Ramzan & Dr. Ghayoor Abbas*

**3:15 - 5:00**  
PM PM

**FEBRUARY 28**

**RECEPTION & REGISTRATION**

**8:00 - 9:00**  
AM AM

**PLENARY TALK 4**

*SESSION CHAIR: Dr. Faheem Hassan Akhtar*

**9:00 - 9:40**  
AM AM

**Membrane highlights over decades**  
*Prof. Klaus-Viktor Peinemann (GMT Membranetechnik)*

**KEYNOTE SESSIONS**

*SESSION CHAIR: Dr. Rahma Tamime*

**9:40 - 1:00**  
AM PM

9:40 AM - 10:10 AM

**ENGINEERING HIERARCHIAL NANOCHANNELS AND CHEMISTRIES IN GRAPHENE OXIDE MEMBRANES FOR HIGHLY EFFICIENT DYE DESALINATION**  
**Prof. Haiqing Lin**  
*SUNY Buffalo, USA*

10:10 AM - 10:40 AM

**NANOFIBERS MEMBRANES: MASS PRODUCTION AND COMMERCIAL USES**  
**Dr. Zeeshan Khatri**  
*Mehran University Jamshoro, Pakistan*

10:40 AM - 10:50 AM

**Tea Break**

10:50 AM - 11:10 AM

**MICROSCOPY IN MEMBRANES**  
**Prof Delaver Anjum**  
*Khalifa University, UAE*

11:10 AM - 11:40 AM

**EFFICIENT HYDROGEN EVOLUTION ELECTRO-CATALYST ON POROUS POLYMER SUPPORT**  
**Dr. Javeed Mahmood**  
*KAUST, KSA*

11:40 AM - 12:00 PM

**FABRICATION & MODIFICATION OF GRAPHENE AND 2D MATERIALS HETERO-STRUCTURE**  
**Dr. Rashid Jalil**  
*UET Lahore, Pakistan*

12:00 PM - 12:20 PM

**FABRICATION OF PHENYLALANINE IMPRINTED COMPOSITE MEMBRANES FOR ULTRAFILTRATION APPLICATIONS**  
**Dr. Nasrullah Shah**  
*Abdul Wali Khan University, Pakistan*

12:20 PM - 12:40 PM

**OPPORTUNITIES AND CHALLENGES IN GEOPOLYMER MEMBRANE SYNTHESIS**  
**Dr. Saeed Gul**  
*UET Peshawar, Pakistan*

12:40 PM - 1:00 PM

**FUNCTIONAL POLYMERS FOR SUSTAINABLE WATER SEPARATION & ENVIRONMENTALLY FRIENDLY TREATMENT SYSTEMS**  
**Dr. Nasir M. Ahmad**  
*NUST SCME Islamabad, Pakistan*

1:00 PM - 2:00 PM

**Lunch Break**

**PLENARY TALK 5**

*SESSION CHAIR: Dr. Shazia Ilyas*

**2:10 - 2:50**  
PM PM

**Polymer-based membranes: From fundamental understanding to upscaling**  
*Prof. Ivo Vankelecom (KU Leuven, Belgium)*

**KEYNOTE SESSIONS**

*SESSION CHAIR: Dr. Shazad Maqsood Khan*

**2:50 - 4:00**  
PM PM

2:50 PM - 3:10 PM

**SUSTAINABLE MEMBRANE FABRICATION FOR POROUS LIQUIDS FOR EXCELLENT PERFORMANCE**  
**Dr. Asim Laeeq Khan**  
*COMSATS Lahore, Pakistan*

3:10 PM - 3:30 PM

**INTERFACIAL ENGINEERING & PORE DESIGN OF METAL HOLLOW FIBER MEMBRANES**  
**Dr. Muhammad Mubashir**  
*KAUST, KSA*

3:30 PM - 4:00 PM

**RECONCENTRATION AND REUSE OF TEXTILE DYES FROM USING TETRAETHYL AMMONIUM BROMIDE DRAWN FORWARD OSMOSIS**  
**Dr. Sher Jamal**  
*NUST SCME Islamabad, Pakistan*

**AWARDS AND CLOSING CEREMONY**

*SESSION CHAIR: Dr. Shahid M. Baig (Chairman, Pakistan Science Foundation)*

**4:00 - 5:00**  
PM PM

## POSTER PRESENTERS

- P1** The Influence of Interfacial Tension on Rejection of Oil Drops Using Slit Pore Microfiltration  
*Qazi Muhammad Ali (UET Peshawar)*
- P2** Development of Citric Acid-incorporated Polyether Sulfone Nanofiltration Membrane for Desalination Technology  
*Hassna Eman (UET Lahore)*
- P3** Development of Polymer membranes for Bioethanol enrichment through pervaporation  
*Nimra Ikram (UET Lahore)*
- P4** Bioethanol 2.0: Optimizing Water Removal with Cutting-Edge Ionic Liquids based Pervaporation Membranes  
*Ilza Amjad (COMSATS Lahore)*
- P5** Titania PEG-Alginate Bionanocomposites for Treatment of Hazardous Pollutants: Bioinspired synergic solution for wastewater treatment  
*Muhammad Asjad (COMSATS Lahore)*
- P6** Green Revolution in Water Purification: A Pioneering Approach using Plant-based Nanomaterials in Mixed Matrix Membranes  
*Nusrat Bashir (COMSATS Lahore)*
- P7** Next-Gen Membrane Separation: The Potential of Porous Liquid MOF-based Mixed Matrix Membranes for Exceptional Ethanol Recovery  
*Amna Kasuri (COMSATS Lahore)*
- P8** Development of an optimized interfacial polymerization process for heavy metal removal in thin film composite nanofiltration  
*Tooba Idrees (University of Central Punjab)*
- P9** The Next Generation of Membrane Technology: Lignin-enhanced Mixed Matrix Membranes for Wastewater Treatment  
*Azqa Ahsan (COMSATS Lahore)*
- P10** Task-Specific Polymeric Membranes for Efficient Gas-Liquid Mass Transfer  
*Muhammad Tayyab Khalid (COMSATS Lahore)*
- P11** Water treatment using cellulose acetate (CA) membranes filled with ferrites: synthesis, characterization and application  
*Alveena Shahid (Lahore College for Women University)*
- P12** A novel theoretical method to estimate and compare specific energy consumption of pressure driven (RO) and osmotic driven (FO) membrane separation processes  
*Yasir Hussain (UET Peshawar)*
- P13** Evaluation of different cell entrapping beads and aeration intensity to improve performance of Quorum Quenching Membrane Bioreactors  
*Zia Aslam (FC College Lahore)*
- P14** Upcycling Poly(ethylene terephthalate) to fabricate membranes for water desalination  
*Muhammad Hafi Wadgama (LUMS)*

## POSTER PRESENTERS

- P15** Effect of different ultraviolet strengths on photolytic quorum quenching in lab-scale MBRs  
*Aqsa Mubeen (FC College Lahore)*
- P16** Renewable hydrogen-based power system for social housing decarbonization through AEM electrolyzer and PEM fuel cell hybridization  
*Victor Manuel Maestre (Universidad de Cantabria, Spain)*
- P17** Nitrate and Nitrite removal by catalytic polymeric hollow fiber membrane contactors  
*Alfredo Ortiz (Universidad de Cantabria, Spain)*
- P18** Development of Hybrid Ni/Co Bimetallic MOF based mixed matrix membranes to enhance CO<sub>2</sub> separation  
*Iqra Yasmeen (GIK Institute)*
- P19** Environmental treatment and remediation using h-BN based smart and hybrid membrane  
*Zarrar Salahuddin (NUST Islamabad)*
- P20** Green synthesis of zinc oxide nanoparticles as a filler in mixed matrix membrane for water purification  
*Ghulam Muhammad (University of Baltistan, Skardu)*
- P21** Nickle Oxide Based Mixed Matrix Membranes for Effective Carbon Capture  
*Muhammad Wasif (UET Lahore)*
- P22** Optimization of Quorum Quenching Bacteria Concentration in Cell Entrapping Beads to control Biofouling in MBR  
*Jennifer Rose (FC College Lahore)*
- P23** A Quantum Leap in Water Purification: The Breakthrough of Titanium Dioxide Nanotubes in PES Membranes  
*Ayesha Bilal (COMSATS Lahore)*
- P24** Synthesis of Polysulfone-based ZnO-GO-NiO MMMs for the Adsorptive Removal of Lead and Cadmium Heavy Metal Ions from their contaminated solutions  
*Arslan Maqbool (NUST Islamabad)*
- P25** A Breakthrough in Sustainable Membrane Technology: The Use of Biodegradable Deep Eutectic Solvents in TFC-RO Membrane Fabrication  
*Farwah Hassan (Lahore School of Economics)*
- P26** Novel Polydopamine and MIL-100 Thin-film Nano-composite Reverse Osmosis membrane for enhanced Water flux and Salt Rejection  
*Maimoona Nazar (Lahore School of Economics)*
- P27** From Polluted to Pure: A Novel Approach to Water Purification Using MOF-Embedded Mixed Matrix Membranes  
*Ameena Kiran (COMSATS Lahore)*

## POSTER PRESENTERS

- P28** Unlocking the Potential of MIL-101(Cr) MOF in Water Purification: A Thin Film Nanocomposite Forward Osmosis Membrane  
*Sana Kiran (COMSATS Lahore)*
- P29** Sustainable Biofuels: Harnessing the Power of Ionic Liquids based Membranes for Efficient Separation  
*Zakawat Ali (COMSATS Lahore)*
- P30** A Computational Investigation of Hydrophobic Deep Eutectic Solvents for Bioethanol Separation using DFT and COSMO-RS Model  
*Palwasha Khan (COMSATS Lahore)*
- P31** Development of an optimized interfacial polymerization process for heavy metal removal in thin film composite nanofiltration  
*Tooba Sahar (Lahore School of Economics)*
- P32** Sustainability Meets Efficiency: Upcycling PET Bottles for Pervaporation of Bioethanol  
*Babar Saeed (COMSATS Lahore)*
- P33** Porous Liquids in Mixed Matrix Membranes: The Key to Unlocking Large-Scale Bioethanol Production  
*Hira Naveed (COMSATS Lahore)*
- P34** Surface-initiated ATRP Polymer-grafted Modification of Activated Carbon and its Effects on PES Membrane Performance for Textile Wastewater Treatment  
*Imran Ahmad Khan (NUST Islamabad)*
- P35** Enhancing carbon capture efficiency of zeolite-embedded polyether sulfone mixed-matrix membranes via annealing process  
*Hafiza Sidra Nawaz (UET Lahore)*
- P36** Modification of Geopolymeric Membranes for Hydrophobicity  
*Naeem Ahmad (UET Peshawar)*
- P37** Electronic and structural modification of self-supported transition metal-based electrocatalysts for water electrolysis  
*Aleena Tahir (LUMS)*
- P38** Machine Learning as an Aid for Evaluating Membrane Separation Performance for Water Desalination  
*Danish Barque (LUMS)*
- P39** Removal of dyes from industrial waste water using composite membranes  
*Haider Iqbal & Sajawal Masood (LUMS)*
- P40** Porous composite cyclodextrin membrane for advanced molecular separations.  
*Arooj Gul (LUMS)*

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