

## Dr. MUHAMMAD SARFRAZ

B.Sc Engg., M.Sc Engg., Ph.D (KFUPM, KSA)

### Associate Professor

Department of Polymer and Process Engineering  
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### Career Positions

- Associate Professor at Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore- Pakistan (Feb 2022 - to date)
- Assistant Professor at Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore- Pakistan (Oct 2015 - Feb 2022)
- Lecturer B at King Fahd University of Petroleum and Minerals, Dhahran-KSA (Aug 2012 - Oct 2015)
- Resident Tutor at University of Engineering and Technology, Lahore-Pakistan (Jun 2011 - Aug 2012)
- Lecturer at Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore- Pakistan (Oct 2009 - Aug 2012)
- Laboratory Engineer at Diamond Polymer Industries Ltd., Lahore-Pakistan (Nov 2008 - Oct 2009)

### Academic Qualification

- Ph.D Chemical Engineering (2012-2015), King Fahd University of Petroleum and Minerals, Dhahran- KSA; *Dissertation Title: Development of Mixed-Matrix Membranes for Carbon Dioxide Separation*
- M.Sc Polymer Engineering (2009-2011), University of Engineering and Technology, Lahore- Pakistan; *Thesis Title: Alteration of Chemical Structure of Polymers*
- B.Sc Chemical Engineering (Polymer) (2004-2008), University of Engineering and Technology, Lahore- Pakistan; *Degree with Academic Honors*

### Professional Trainings/ Experience

- Certificate of Participation in *Research Capacity Building Program for PIs* (9-13 May, 2022), Higher Education Commission (HEC), Lahore-Pakistan
- Certificate of Attendance in *Research Management with IEEE Xplore-Tips and Practices* (11 May, 2022), IEEE
- Certificate of Participation in *1<sup>st</sup> Conference on Sustainable Process Systems Engineering (SPSE-2021)* and *1<sup>st</sup> Pakistan Congress on*

- *Membrane Processes (PCOM-2021)* (20-21 July, 2021), Pakistan Membrane Society (PMS), PAF IAST, Haripur- Pakistan
- Certificate of Attendance in *HEC Digital Library Collections For Your Next Scholarly Research* (14 Oct, 2020), ProQuest Education in partnership with Higher Education Commission (HEC)
- Certificate of Participation in Webinar on *Covalent Organic Frameworks Based Next Generation Membrane Systems for Industrial Applications* (28 Sep, 2020), Pakistan Membrane Society (PMS)
- Certificate of Participation in *1<sup>st</sup> International Conference on Membrane Science & Technology, ICM 2020* (20-22 July, 2020), Pakistan Membrane Society (PMS), Lahore- Pakistan
- Certificate of Achievement in *PVC Formulating, Compounding, Fabrication & Testing* (6-12 May, 2008), Engro Polymer & Chemicals Ltd., Lahore- Pakistan
- Internship Training (5-19 July, 2007), Fibre Craft Industries, Lahore- Pakistan
- *Department of Polymer & Process Engineering, University of Engineering and Technology, Lahore- Pakistan*
  - Led the design, local fabrication and procurement of “Gas Permeation Setup” at laboratory scale.
  - Involved in development of the curricula and Self-Assessment Reports of B.Sc Polymer Engineering and M.Sc Polymer & Process Engineering.
  - Participated in laboratories development program at Polymer & Process Engineering that includes the design conception and tender specifications of different labs.

### Courses Developed and Taught

- Advanced Membrane Technology (M.Sc Engg., Ph.D)
- Polymeric Membrane Design and Applications (M.Sc Engg., Ph.D)
- Membrane Science and Technology (M.S Tech.)
- Advanced Separation Processes (M.Sc Engg.)
- Polymer Product Design and Engineering (B.Sc Engg.)
- Final Year Project-I (B.Sc Engg.)
- Final Year Project-II (B.Sc Engg.)
- Process Plant Design (B.Sc Engg.)
- Environmental and Safety Engineering (B.Sc Engg.)
- Polymer Composites (B.Sc Engg.)
- Polymer Materials and Synthesis (M.S Tech.)
- Polymer Structures and Synthesis (B.Sc Engg.)
- Physical and Mechanical Properties of Materials (M.S Tech.)
- Engineering and Polymeric Materials (B.Sc Engg.)
- Advanced Polymer Rheology (M.Sc Engg.)
- Polymer Processing Operations (B.Sc Engg.)
- Polymer Rheology and Viscoelasticity (M.Sc Engg., Ph.D)

- Polymer and Process Industries (B.Sc Engg.)
- Petroleum Refining and Petrochemical Engineering (B.Sc Engg.)
- Advanced Process and Machine Design (B.Sc Engg.)
- Introduction to Polymer Science and Engineering (B.Sc Engg.)
- Fundamentals of Polymer Engineering (B.Sc Engg.)
- Polymer Reaction Engineering (B.Sc Engg.)
- Polymer Reactor Design (M.Sc Engg.)
- Mass Transfer (B.Sc Engg.)
- Fluid Flow (B.Sc Engg.)
- Transport Phenomena (B.Sc Engg.)
- Instrumentation and Control (B.Sc Engg.)
- Engineering Management and Laws (B.Sc Engg.)
- Process Engineering Economics (B.Sc Engg.)
- Process Engineering Mathematics (B.Sc Engg.)

### Research Interests

- Membrane technology for separation applications
- Polymer processing and characterization
- Climate change and environmental sustainability

### Research Publications

- Javeria Khalid, Zainab Tariq, **Muhammad Sarfraz**, K.H. Mahmoud, Nida Abid, Pilot scale trialing of multi-leaf spiral-wound polymer membrane modules for efficient carbon capture, *Arabian Journal for Science and Engineering* (Accepted: Feb 2024).
- Sidra Nawaz, **Muhammad Sarfraz**, Asif Ali Qaiser, Muneerah Alomar, Soumaya Gouadria, Amal Ali BaQais, Quest for high performance carbon capture membranes: Fabrication of SAPO-34 and CNTs-doped polyethersulfone-based mixed-matrix membranes, *Journal of Applied Polymer Science* (Published Online: Dec 2023). DOI: 10.1002/app.54971.
- Sadia Sagar, Aqib Riaz, Bassam Hasanain, Ali Bahadar, **Muhammad Sarfraz**, Department Tuning of Polymeric Gas Separation Membranes: ZIF-L/PES Nanocomposite, *Arabian Journal for Science and Engineering* (Published Online: Dec 2023). DOI: 10.1007/s13369-023-08522-0.
- Muhammad Wasif, **Muhammad Sarfraz**, Zaman Tahir, Sidra Nawaz, Pursuit of high-performance carbon capture membranes: fabrication of nickel oxide-doped polyethersulfone-based mixed matrix membranes, *Polymer Bulletin* (Published Online: Sep 2023). DOI: 10.1007/s00289-023-04981-5.
- Amir Sohail, **Muhammad Sarfraz**, Sidra Nawaz and Zaman Tahir, Enhancing carbon capture efficiency of zeolite-embedded polyether

- sulfone mixed-matrix membranes via annealing process, *Journal of Cleaner Production* 399 (May 2023) 136617. DOI: 10.1016/j.jclepro.2023.136617.
- **Muhammad Sarfraz**, Waqas A Liaqat, Mohsin Ali and Asif A Qaiser, Graphene-integrated thermoplastic vulcanizates: Effects of in-situ vulcanization on structural, thermal, mechanical and electrical properties, *Progress in Rubber, Plastics and Recycling Technology* 39(2) (May 2023) 181-194. DOI: 10.1177/14777606221147928.
  - Hamid Raza, Farhat Yasmeen, **Muhammad Sarfraz**, Muhammad Salman Habib, Mohammad Ba-Shammakh, Khurram S. Munawar and Nazir Ahmad, Carbon capture via novel Cu(II)-DDA metal-organic frameworks-based hybrid membranes, *Journal of Applied Polymer Science* 139(23) (June 2022) 52309. DOI: 10.1002/app.52309.
  - **Muhammad Sarfraz**, Aqash Arshad, Mohammed Ba-Shammakh, Predicting Gas Permeability through Mixed-matrix Membranes Filled with Nanofillers of Different Shapes, *Arabian Journal for Science and Engineering* 47(5) (May 2022) 6167-6179. DOI: 10.1007/s13369-021-05996-8.
  - Muhammad Ahmad, **Muhammad Sarfraz**, Mohammed Ba-Shammakh, Kashaf Naseer, Mirza A. Ahmed, Optimizing membrane synthesis parameters via Taguchi method: An approach to prepare high performance mixed-matrix membranes for carbon capture applications, *The Canadian Journal of Chemical Engineering* 2022;100:143-155. DOI: 10.1002/cjce.24052.
  - **Muhammad Sarfraz**, Recent trends in membrane processes for water purification of brackish water. In: Zhang Z., Zhang W., Chehimi M.M. (eds) Membrane Technology Enhancement for Environmental Protection and Sustainable Industrial Growth. *Advances in Science, Technology & Innovation (IEREK Interdisciplinary Series for Sustainable Development)*. Springer Cham 47 (2021) 39-57. DOI: 10.1007/978-3-030-41295-1\_4.
  - **Muhammad Sarfraz**, Carbon Capture via Mixed-Matrix Membranes Containing Nanomaterials and Metal-Organic Frameworks. In: Zhang Z., Zhang W., Lichtfouse E. (eds) Membranes for Environmental Applications. *Environmental Chemistry for a Sustainable World*, Springer Cham 42 (2020) 45-94. DOI: 10.1007/978-3-030-33978-4\_2.
  - **Muhammad Sarfraz**, Zia ur Rehman M. Ba-Shammakh, Pursuit of electroconducting thermoplastic vulcanizates: activated charcoal-filled polypropylene/ethylene-propylene-diene monomer blends with upgraded electrical, mechanical and thermal properties, *Polymer Bulletin* 76(4) (April 2019) 2005-2020. DOI: 10.1007/s00289-018-2482-z.
  - **Muhammad Sarfraz**, M. Ba-Shammakh, ZIF-Based Water-Stable Mixed-Matrix Membranes for Effective CO<sub>2</sub> Separation from Humid Flue Gas, *The Canadian Journal of Chemical Engineering* 96(11) (Nov 2018) 2475-2483. DOI: 10.1002/cjce.24052.

- **Muhammad Sarfraz**, M. Ba-Shammakh, Pursuit of efficient CO<sub>2</sub>-capture membranes: graphene oxide- and MOF-integrated Ultrason<sup>®</sup> membranes, *Polymer Bulletin* 75(11) (Nov 2018) 5039-5059. DOI: 10.1007/s00289-018-2301-6.
- **Muhammad Sarfraz**, M. Ba-Shammakh, Water-stable ZIF-300/Ultrason<sup>®</sup> mixed-matrix membranes for selective CO<sub>2</sub> capture from humid post combustion flue gas, *Chinese Journal of Chemical Engineering* 26(5) (May 2018) 1012-1021. DOI: 10.1016/j.cjche.2017.11.007.
- **Muhammad Sarfraz**, M. Ba-Shammakh, Harmonious interaction of incorporating CNTs and zeolitic imidazole frameworks into polysulfone to prepare high performance MMMs for CO<sub>2</sub> separation from humidified post combustion gases, *Brazilian Journal of Chemical Engineering*, 5(1) (January-March 2018) 217-228. DOI: 10.1590/0104-6632.20180351s20150595.
- **Muhammad Sarfraz**, Quest for electroconducting structural polymers: CNTs/Polybond nanocomposites with improved electrical and mechanical properties, *Journal of Polymer Engineering*, 37(6) (July 2017) 599-606. DOI: 10.1515/polyeng-2016-0314.
- **Muhammad Sarfraz**, M. Ba-Shammakh, Synergistic effect of adding graphene oxide and ZIF-301 to polysulfone to develop high performance mixed matrix membranes for selective carbon dioxide separation from post combustion flue gas, *Journal of Membrane Science* 514 (Sep 2016) 35-43. DOI: 10.1016/j.memsci.2016.04.029.
- **Muhammad Sarfraz**, M. Ba-Shammakh, A novel zeolitic imidazolate framework based mixed-matrix membrane for efficient CO<sub>2</sub> separation under wet conditions, *Journal of the Taiwan Institute of Chemical Engineers* 65 (Aug 2016) 427-436. DOI: 10.1016/j.jtice.2016.04.033.
- **Muhammad Sarfraz**, M. Ba-Shammakh, Combined Effect of CNTs with ZIF-302 into Polysulfone to Fabricate MMMs for Enhanced CO<sub>2</sub> Separation from Flue Gases, *Arabian Journal for Science and Engineering* 41 (July 2016) 2573-2582. DOI: 10.1007/s13369-016-2096-4.
- **Muhammad Sarfraz**, M. Ba-Shammakh, Synergistic effect of incorporating ZIF-302 and graphene oxide to polysulfone to develop highly selective mixed-matrix membranes for carbon dioxide separation from wet post-combustion flue gases, *Journal of Industrial and Engineering Chemistry* 36 (April 2016) 154-162. DOI: 10.1016/j.jiec.2016.01.032.
- **Muhammad Sarfraz**, Upgrading Electrical, Mechanical, and Chemical Properties of CNTs/Polybond, Nanocomposites: Pursuit of Electroconductive Structural Polymer Nanocomplexes, *International Journal of Polymer Science* 2016 (2016) 1-8. DOI: 10.1155/2016/2396817.
- **Muhammad Sarfraz**, Mughis Asghar, G.M Mamoor, A.A Qaisar, Effects of particle surface area on free radical grafting of low density

polyethylene, *Journal of Pakistan Institute of Chemical Engineers, Pakistan* XXXVIII (Dec 2011) 9-15.

- M. Shahzad Kamal, G. M. Mamoor, Nida Qamar, Muhammad Farooq, **Muhammad Sarfraz**, Free radical graft modification of polyethylene with methacrylic acid and styrene monomers, *Chemical Engineering Research Bulletin, Bangladesh* 15(1) (Aug 2011) 34-38. DOI: 10.1177/14777606221147928.

### Conferences/ Workshops/ Seminar

- **Muhammad Sarfraz**, Carbon capture via high performance ZIF-302/PSF interfacial composite membranes, *AMS13 Singapore*, (July 2022)
- **Muhammad Sarfraz**, “Development of mixed-matrix membrane separation system for carbon capture from industrially-simulated post-combustion flue gases originating from various fuel sources” *PMS Conference on Membranes and Membrane Processes (PCOM-2022)* (24 October, 2022), Pakistan Membrane Society (PMS), UET, Lahore-Pakistan

### Competitive Research Grants

- **Muhammad Sarfraz**, Asim Laeeq Khan, “Capturing valuable feedstock gases from industrial combustion effluents rendering green environment via membrane technology” TDF-2023 awarded by HEC Pakistan, Rs. 11.8 Million (April 2024 - April 2026)
- **Muhammad Sarfraz**, Muhammad Asif Jamil, “Pilot-scale manufacturing of nanomaterials-filled polymer membranes for fabricating spiral-wound modules” RTTG-2023 awarded by HEC Pakistan, Rs. 13.6 Million (March 2024 - Sep 2024)
- Asif Ali Qaiser, **Muhammad Sarfraz**, “Indigenous Development of Vapor-Permeation Membrane Technology to Remove VOCs and NO<sub>x</sub>/SO<sub>x</sub> from Industrial Emissions for Smog Mitigation” Competitive Research Program awarded by PSF Pakistan, Rs. 14.99 Million (2024 - 2025)
- **Muhammad Sarfraz**, Asif Ali Qaiser, “Development of mixed-matrix membrane separation system for carbon capture from industrially-simulated post-combustion flue gases originating from various fuel sources” NRPU-2020 awarded by HEC Pakistan, Rs. 9.34 Million (Jan 2021 - Dec 2023)
- **Muhammad Sarfraz**, Asif Ali Qaiser, “Development of mixed matrix membrane for carbon dioxide separation” Faculty Research Projects awarded by UET Lahore, Rs. 0.7 Million (April 2019 - March 2020)

### Working Group amid PhD Program

- Professor Dr. Mohamed A. Habib, Director Technology Innovation Center - Carbon Capture & Sequestration (TIC-CCS) KACST, King Fahd University of Petroleum & Minerals (KFUPM), Dhahran- Saudi Arabia; email: [mahabib@kfupm.edu.sa](mailto:mahabib@kfupm.edu.sa)

- Prof. Dr. Mohammed S. Ba-Shammakh, Chemical Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran-Saudi Arabia; email: [shammakh@kfupm.edu.sa](mailto:shammakh@kfupm.edu.sa)
- Dr. Bassem Al-Maythaly, Research Scientist, Technology Innovation Center - Capron Capture and Sequestration (TIC-CCS), King Fahd University of Petroleum and Minerals, Dhahran- Saudi Arabia; email: [bmayth@kfupm.edu.sa](mailto:bmayth@kfupm.edu.sa)
- Engr. Muhammad Sarfraz, Ph.D Student, Technology Innovation Center - Capron Capture and Sequestration (TIC-CCS), King Fahd University of Petroleum and Minerals, Dhahran- Saudi Arabia; email: [msarfraz@kfupm.edu.sa](mailto:msarfraz@kfupm.edu.sa)
- Engr. Binash Imteyaz, M.Sc Student, Technology Innovation Center - Capron Capture and Sequestration (TIC-CCS), King Fahd University of Petroleum and Minerals, Dhahran- Saudi Arabia; email: [binashahmad@kfupm.edu.sa](mailto:binashahmad@kfupm.edu.sa)

### Current Working Group

- Professor Dr. Asif Ali Qaiser, Chairman, Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore-Pakistan; email: [asifaliqaiser@uet.edu.pk](mailto:asifaliqaiser@uet.edu.pk)
- Dr. Muhammad Sarfraz Associate Professor, Polymer & Process Engineering Department, University of Engineering and Technology, Lahore- Pakistan; email: [msarfraz@uet.edu.pk](mailto:msarfraz@uet.edu.pk)
- Dr. Muhammad Aamir Shehzad, Assistant Professor, Polymer & Process Engineering Department, University of Engineering and Technology, Lahore- Pakistan; email: [aamirshehzad@uet.edu.pk](mailto:aamirshehzad@uet.edu.pk)
- Dr. Zaman Tahir, Assistant Professor, Polymer & Process Engineering Department, University of Engineering and Technology, Lahore-Pakistan; email: [zaman.tahir@uet.edu.pk](mailto:zaman.tahir@uet.edu.pk)
- Engr. Nida Abid, Lecturer, Polymer & Process Engineering Department, University of Engineering and Technology, Lahore- Pakistan; email: [nidaabidmalik@gmail.com](mailto:nidaabidmalik@gmail.com)
- Miss Hafiza Sidra Nawaz, Ph.D Student & Research Assistant, Polymer & Process Engineering Department, University of Engineering and Technology, Lahore- Pakistan; email: [sidranawaz32@gmail.com](mailto:sidranawaz32@gmail.com)

### Students Supervision

- Capturing CO<sub>2</sub> from post-combustion flue gas via polysulfone membranes containing mesoporous nanomaterials (Ph.D Thesis Project)
- Development of Polymer-based membrane module for the separation of CO<sub>2</sub> from N<sub>2</sub> (B.Sc Thesis Project)
- Assessing the effect of preparation conditions on permeation performance of polymer membranes (M.Phil Thesis Project)
- Carbon capture via MOFs- and nanomaterials-filled mixed-matrix membranes (M.S Thesis Project)

- High performance mixed matrix membranes for carbon capture from post combustion processes (M.S Thesis Project)
- Development of mixed-matrix membranes for carbon dioxide separation (B.Sc Thesis Project)
- Development and characterization of polymer-based membranes for natural gas sweetening (B.Sc Thesis Project)
- Predicting gas permeation through mixed matrix membranes (M.Sc Thesis Project)
- Development of graphene-filled electroconductive polypropylene/ethylene propylene diene monomer-based thermoplastic vulcanizates (M.Sc Thesis Project)
- To Study the Effect of Activated Carbon Filler on Electrical Properties of Polypropylene (PP) and Ethylene Propylene Diene monomer (EPDM) Blend (M.Sc Thesis Project)

### Reviewing Assignments

- ACS Applied Materials and Interfaces
- Arabian Journal of Chemistry
- Asia-Pacific Journal of Chemical Engineering
- Emergent Materials
- Energy & Fuels
- Energy Technology
- Environmental Chemistry for a Sustainable World- Springer Nature
- Environmental Science and Pollution Research
- Journal of Elastomers and Plastics
- Journal of Environmental Chemical Engineering
- Journal of Solid State Electrochemistry
- Pakistan Journal of Scientific and Industrial Research
- Polymer Bulletin

### Academic Membership/ Appointments

- Pakistan Journal of Scientific and Industrial Research
- Modern Materials Science and Technology
- Pakistan Membrane Society
- Pakistan Engineering Council
- Board of Studies, Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore- Pakistan
- Postgraduate Research Committee, Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore- Pakistan
- Academic Council, University of Engineering and Technology, Lahore- Pakistan



## **Equipment Design and Fabrication**

- Membrane Manufacturing and Module Fabrication Line
- Oxyfuel Combustion System
- Membrane Gas Separation System
- Gas Permeation Setup

## **References**

- Professor Dr. Asif Ali Qaiser, Chairman, Department of Polymer and Process Engineering, University of Engineering and Technology, Lahore-Pakistan  
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- Prof. Dr. Mohammed S. Ba-Shammakh, Chemical Engineering Department, King Fahd University of Petroleum and Minerals, Dhahran-Saudi Arabia  
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