Proceedings of ICMW 2023

Organized by

International and Inter University Centre for Nanoscience and Nanotechnology (IIUCNN), Mahatma Gandhi University, Kottayam, Kerala, India

PROCEEDINGS of ICMW 2023

Prof. Dr. Sabu Thomas, Dr. Hanna J Maria and Dr. Jince Thomas

Proceedings of

International Workshop and Conference on Membrane Assisted Water Purification Processes (ICMW 2023)

On
March 9-12, 2023
at Mahatma Gandhi University

In Association with

School of Energy Materials (SEM), Mahatma Gandhi University, Kottayam Kerala, India

&

Lund University, Sweden

&

National Research Centre, Egypt

Conference committee

Chairman:

Prof. Dr. Sabu Thomas
Mahatma Gandhi University

Co-Chairs:

Prof. Dr. Frank Lipnizki
Lund University, Sweden
&
Prof. Dr. Marwa Shalaby
National Research Centre, Egypt

Conveners

Dr. Sreekala M. S. (AvH& JSPS Fellow)
Associate Professor
School of Chemical Sciences,
Kerala, India.

Dr. Hanna J Maria
School of Energy Materials,
Kerala, India.

Editors:
Prof. Dr. Sabu Thomas
Dr. Hanna J Maria and
Dr. Jince Thomas

Conference website: www.membranes.macromol.in
Conference Email: membrane@macromol.in

Forward

The International and Inter University Center for Nanoscience and Nanotechnology (IIUCNN), along with the School of Energy Materials (SEM) at Mahatma Gandhi University in Kerala, India, collaborated with Lund University, Sweden and National Research Centre, Egypt, to host a four-day International Workshop and Conference on Membrane Assisted Water Purification Processes on 9, 10,11 and 12 March 2023.

The central theme of the conference was Membranes and Membrane Assisted Processes. This conference was extremely useful in the sense that it was attended by many Chemists, Physicists, Engineers, Education Experts, Social Scientists, Doctors, and Technologists, making it a truly interdisciplinary conference. More than 100 participants participated at ICMW 2023, including many delegates from abroad. There were several plenary lectures, keynote lectures, invited lectures, short invited lectures, and poster sessions. The conference was an ideal platform for researchers to present their work, compare notes, develop new interfaces, benchmark their work, exchange views, and widen the scope and range of their research activity through dynamic networking. During the final session on the first day, we had a hybrid brainstorming discussion on India – HORIZON EUROPE IS THE EUROPEAN UNION'S NEW AMBITIOUS RESEARCH AND INNOVATION PROGRAM THAT RUNS UNTIL 2027 WITH ROLLING 'CALLS FOR PROPOSALS. We also discussed other joint projects with India and the rest of the world through DST/DBT/UGC and INSA of India.

Prof. Sabu Thomas (India) — ***Prof. Dr. Frank Lipnizki (Sweden)***

Dr. Hanna J Maria (India) — ***Prof. Dr. Marwa Shalaby (Egypt)***

INAUGURAL FUNCTION OF ICMW 2023

Inaugural Ceremony of International Conference
1st Day of the Conference 10th March 2023
10 AM - 10.30 AM

Welcome Speech	:	*Dr. Hanna J Maria* *School of Energy Materials (SEM)* *Mahatma Gandhi University* *Kottayam, Kerala, India*
Introductory Remarks	:	*Prof. Sabu Thomas, Vice Chancellor* *Mahatma Gandhi University* *Kottayam, Kerala, India*
Opening Remarks	:	*Prof. Marwa Shalaby* *National Research Centre, Cairo, Egypt*
Guest of Address	:	*Prof. Frank Lipnizki* *Department of Chemical Engineering* *Lund University Sweden*
Vote of Thanks	:	*Silla George Raju* *Research student* *School of Energy Materials* *Mahatma Gandhi University,* *Kottayam, India*

TECHNICAL PROGRAMME SCHEDULE OF WORKSHOP

		Schedule of Workshop
		9th March 2023
		Hall 1
PL 1	**11.00- 12.00 (45 min talk + 15 min Discussion)**	**Prof. Frank Lipnizki** **Department of Chemical Engineering** **Lund University Sweden** **Topic:** " Membrane applications in biorefineries: Opportunities and challenges."
PL 2	**12.00- 13.00 (45 min talk + 15 min Discussion)**	**Prof. Marwa Shalaby** **National Research Centre, Cairo, Egypt**
	13.00-14.00	**Lunch Break**
PL 3	**14.00-15.00**	**Dr Viswanathan Swaminathan** **Researcher unique identifier** **Singapore**
PL 4	**15.00-16.00**	**Technical** **Dr. Jim Coulson of MICROBAC (UK) Ltd who is Director and Consultant of ABL Engineering will make the Technical presentation.** **Case studies:** **Joe Joseph, Managing Director will make the presentation on case studies with ongoing Contracts in Abu Dhabi with various technologies.** **QA session will be at the end of each session.**

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

TECHNICAL PROGRAMME SCHEDULE OF ICMW 2023

		TECHNICAL PROGRAMME SCHEDULE OF ICMW 2023	
		1st Day of the Conference 10th March 2023 **Hall 1**	
	9.30-10.00	**Registration**	
	10.00-10.30	**INAUGURATION AND INAUGURAL ADDRESS**	
	10.00-10.07	**Welcome Speech**	**Dr. Hanna J Maria** **School of Energy Materials (SEM)** **Mahatma Gandhi University** **Kottayam, Kerala, India**
	10.07-10.14	**Introductory Remarks**	**Prof. (Dr) Sabu Thomas** **Vice chancellor** **Mahatma Gandhi university**
	10.14-10.20	**Opening Remarks**	**Prof. Marwa Shalaby** **National Research Centre, Cairo, Egypt**
	10.20-10.25	**Guest of Address**	**Prof. Frank Lipnizki** **Department of Chemical Engineering** **Lund University Sweden**
	10.25-10.30	**Vote of Thanks**	**Silla George Raju** **Research student** **School of Energy Materials** **Mahatma Gandhi University, Kottayam, India**
	10.30-10.40	**Tea Break**	
		Hall 1	
		Plenary Lecture **Chairperson:** Dr. Sandeep S Ahankari Associate Professor Dept. of Manufacturing Engineering School of Mechanical Engineering VIT Vellore, INDIA	

PL 1	**10.40- 11.10 (25 min talk + 5 min Discussion)**	**Prof. Frank Lipnizki** **Department of Chemical Engineering** **Lund University Sweden** **Topic:** "Pilot studies of new concepts for water treatment."
PL 2	**11.10- 11.40 (25 min talk + 5 min Discussion)**	**Prof. Marwa Shalaby** **National Research Centre, Cairo, Egypt** **Topic:** "Sustainability and Circular Economy in Textile Wastewater Treatment using Membranes"
		Keynote Lecture **Chairperson:** Dr. S. Varadharajan Head and Associate Professor Civil Engineering Department JSS Academy of Technical education, Noida
KL 1	**11.40- 12.05 (20 min talk + 5 min Discussion)**	**Prof.Parimal Pal** **HAG Professor & Former Head of Chemical Engineering** **National Institute of Technology Durgapur** **Topic:** Process Intensification Through Membrane Technology Adoption: Possibilities and hurdles in Implementation
KL 2	**12.05-12.30 (20 min talk + 5 min Discussion)**	**Dr. Sandeep S Ahankari** **Associate Professor** **Dept. of Manufacturing Engineering** **School of Mechanical Engineering,VIT Vellore** **Topic:** Nanocellulose-based aerogels for water purification
		Chairperson: Dr. Kali Kishore Reddy Tetala Associate Professor Center for Bioseparation Technology (CBST) Vellore Institute of Technology (VIT), Vellore-Tamil Nadu, India
KL 3	**12.30-12.55 (20 min talk + 5 min Discussion)**	**Prof. (Dr.) S. H. Pawar** **Director** **Centre for Innovative and Applied Research (CIAR)** **Anekant Education Society,** **T.C.College campus, Baramati** **Topic:** Silk Fibroin Based Electrospun Nanofibrils for Next Generation Sustainable Water Purification
KL 4	**12.55-13.20 (15 min talk + 5 min Discussion)**	**Dr. S. Varadharajan** **Head and Associate Professor** **Civil Engineering Department** **JSS Academy of Technical education, Noida** **Topic** Utilization of artificial intelligence in nanomembrane technology for water purification and wastewater treatment: A review

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

	13.20-14.30	**Lunch Break**
		Invited Lecture **Chairperson:** Dr Alexandra Pulyalina Associate Professor Universitetskii pr.26, Petergof, Saint Petersburg, Russia
KL 5	**14.30-14.55** **(15 min talk** **+** **5 min** **Discussion)**	**Mourad AMARA** **Professor,** **LHCIM Laboratory,** **Faculty of Chemistry, USTHB, Bab Ezzouar 16111, Algeria** **Topic:** Insitu-functionalization of Membrane surface applied to water purification and liquid waste treatment
KL 6	**14.55-15.20** **(15 min talk** **+** **5 min** **Discussion)**	**Dr. Gopala Krishna Darbha** **Assoc. Professor** **Indian Institute of Science Education and Research Kolkata |** **Mohanpur, Nadia, West Bengal, India** **Topic:** ECO-FRIENDLY METHODOLOGIES FOR THE REMEDIATION OF ENVIRONMENTALLY PERSISTENT NANOPLSTICS FROM INDUSTRIAL EFFLUENTS AND WATER TREATMENT PLANTS
		Invited Lecture **Chairperson:** Dr. Soumyendu Roy Associate Professor Physics Department, School of Engineering and Applied Sciences Bennett University, Uttar Pradesh, India
IL 1	**15.20-15.40** **(15 min talk** **+** **5 min** **Discussion)**	**Dr. Kakali Priyam Goswami** **Assistant Engineer** **O/o the Executive Engineer (PHE), Mangaldai Division, Mangaldai** **Topic:** Separation of Glycerol from Biodiesel using Fly Ash-based Tubular Ceramic Membrane
IL 2	**15.40-16.00** **(15 min talk** **+** **5 min** **Discussion)**	**Pallavi Prashant Tatpate** **School of Chemical Engineering,** **Dr. Vishwanath Karad MIT World Peace University,** **Pune, Maharashtra** **Topic:** Enhanced Oil-Water Separation and Recovery using Composite Membranes, its Challenges and Future Scope: A Review
	16.00-16-10	**Tea Break**
		Chairperson: Tanushree Choudhury Associate Professor Chemistry Division,School of Advanced Sciences VIT Chennai

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

IL 3	16.10-16.30 (15 min talk + 5 min Discussion)	**Ms. Arya. V** **Assistant Professor** **Department of Civil Engineering** **Indian Institute of Technology, New Delhi** **Topic:** Fouling in Membrane Bioreactor: Effect of Pharmaceuticals in Wastewater
IL 4	16.30-16.50 (15 min talk + 5 min Discussion)	**Dae Woo Kim** **Professor** **Department of Chemical and Biomolecular Engineering,** **Yonsei University, Seoul Korea** **Topic:** Graphitic Materials for Energy-Efficient Membrane Separation
	16.50-18.00	**HORIZON EUROPE IS THE EUROPEAN UNION'S NEW AMBITIOUS RESEARCH AND INNOVATION PROGRAM THAT RUNS UNTIL 2027 WITH ROLLING 'CALLS FOR PROPOSALS** **Actively participate with one or two slide**

		2nd Day of the Conference 11th March 2023
		Hall 1
		Plenary Lecture **Chairperson** Sarathi Kundu Associate Professor IASST, Guwahati, Assam, India
PL 3	9.00- 9.30 (25 min talk +5 min Discussion)	**Prof Tribikram Gupta** **RVCollege of Engineering , Bangalore** **Topic:** Achieving highly efficient gas filters with the aid of click Chemistry
PL 4	9.30- 10.00 (25 min talk + 5 min Questions & Discussion)	**Akhilendra Bhushan Gupta** **Professor** **Civil Engineering Department, MNIT, JLN MARG Malviya nagar, Jaipur** **Topic:** Performance assessment community RO plants and reject management
	10.00-10.10	**Tea Break**
		Keynote Lecture **Chairperson** Dr. M. Seenivasan Associate Professor and Coordinator Department of Mathematics-DDE Annamalai University Annamalainagar
KL 7	10.10-10.35	**Tanushree Choudhury**

	(20 min talk + 5 min Questions & Discussion)	**Associate Professor** **Chemistry Division** **School of Advanced Sciences** **VIT Chennai** **Topic:** Clay Hybrid Materials: An Emerging Area in Membrane Assisted Wastewater Treatment Technology
KL 8	**10.35-11.00 (20 min talk + 5 min Questions & Discussion)**	**Dr. Soumyendu Roy** **Associate Professor,** **Physics Department, School of Engineering and Applied Sciences,Bennett University, Uttar Pradesh, India.** **Topic:** Ion-Selective Membrane Coated on Carbon Nanomaterials for Developing Wearable Sensors
		Invited Lecture **Chairperson** **Dr. B. Kiran Naik,** **Assistant Professor,** **Thermal Energy Systems Laboratory (STESL), Mechanical Engineering Department, NIT, Rourkela**
IL 5	**11.00-11.20 (15 min talk +5 min Questions & Discussion)**	**Pinaki Dey** **CSIR-Trivandrum** **Topic:** Assessmentof Membrane based Processes among existingEnvironmental remediation techniques for strategic separation and inactivation of viruses
IL 6	**11.20-11.40 (15 min talk +5 min Questions & Discussion)**	**Dr Kavitha N P** **Sri Venateswara College of Engineering Sriperumbudur Chennai** **Topic:** Development of various Advanced Oxidation Process integrated Membrane bioreactor in Industrial wastewater Treatment
		Invited Lecture **Chairperson** Akhilendra Bhushan Gupta Professor Civil Engineering Department, MNIT, Jaipur
IL 7	**11.40-12.00 (15 min talk +5 min Questions & Discussion)**	**Dr. Ramavatar Meena** **Senior Principal Scientist** **Central Salt & Marine Chemicals research Institute, G. B. Marg, Bhavnagar-364002, Gujarat, India** **Topic:** Seaweed-derived sustainable membrane for water purifications
IL 8	**12.00- 12.20 (15 min talk + 5 min Questions & Discussion)**	**Dr. Shivendra Kumar Jaiswal** **Assistant Professor** **Department of Physics** **National Institute of Technology Patna,Bihar** **Topic:** Sol-gel synthesis and characterization of zirconium-doped oxygen permeable$(Ba_{0.5}Sr_{0.5})(Fe_{1-x-y}Ce_xZr_y)O_{3-\delta}$ membranes

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

		Invited Lecture **Chairperson** Prof Tribikram Gupta RVCollege of Engineering , Bangalore
IL 9	**12. 20- 12.40 (15 min talk + 5 min Discussion)**	**Dr. M. Seenivasan** **Associate Professor and Coordinator** **Department of Mathematics-DDE** **Annamalai University** **Annamalainagar, Tamil Nadu** **Topic:** Zn leaching from sandy soil and its control using nano materials for prevention of water pollution and enhancing nutrient availability
IL 10	**12.40-13.00 (15 min talk + 5 min Discussion)**	**Kalpana Sharma** **Teaching cum Research** **Department of Physics, RIT, Bangalore** **Topic:** Effect of pore size on the rattling of Carbon di-oxide permeating through nanoporous Graphene membrane and its Infrared signature
IL 11	**13.00-13.20 (15 min talk +5 min Discussion)**	**Veereshgouda Naragund** **University Visvesvaraya College of engineering, Bengaluru** **Topic:** Fabrication and characterization of an electrospun nanofiber membrane - based face mask
	13.20-14.00	**Lunch Break**
		Invited Lecture **Chairperson** **Dr.R.Singaravel** **Professor/ Director** **Dept. of Soil Science and Agrl. Chemistry** **Annamalai University, Tamil Nadu**
IL 12	**14.00-14.20 (15 min talk +5 min Questions & Discussion)**	**Dr. Md. Mushfequr Rahman** **Helmholtz-Zentrum Hereon, Institute of Membrane Research, Max-Planck-Straße 1, 21502 Geesthacht, Germany** **Topic:** Charge and size selective thin film composite membranes having tannic acid – ferric ion network as selective layer
IL 13	**14.20-14.40 (15 min talk + 5 min Questions & Discussion)**	**Dr. Krishnakumar B** **Senior Principal Scientist** **Environmental Technology Division, CSIR-NIIST, Thiruvananthapuram Professor, Academy for Scientific and Innovative Research (AcSIR), Ghaziabad** **Topic:** Field demonstration of an integrated bio-physical process for generating drinking water from endocrine disrupting perchlorate contaminated ground water
		Invited Lecture **Chairperson** Dr. Gopala Krishna Darbha Assoc. Professor

		Indian Institute of Science Education and Research Kolkata West Bengal, India
IL 14	**14.40-15.00 (15 min talk +5 min Questions & Discussion)**	**Subhankar Basu** **Assistant Professor** **Department of Applied Sciences and Humanities, NIAMT Ranchi Jharkhand** **Topic:** Metal organic framework (MOF)-MIL-96 filters with high performance for fluoride removal from wastewater
		Invited Lecture **Chairperson** Dr. Ramavatar Meena Senior Principal Scientist Central Salt & Marine Chemicals research Institute, G. B. Marg, Bhavnagar-364002, Gujarat, India
IL 15	**15.00-15.20 (15 min talk +5 min Questions & Discussion)**	**Dr. Subhashish Dey** **Assistant Professor in Civil Engineering Department, SR Gudlavalleru Engineering College, Andhra Pradesh, India** **Topic:** Measurements of Ground water Parameters and their remedies Elimination of Hardness removal from water by using various plant leafs Biosorbents
IL 16	**15.20-15.40 (15 min talk + 5 min Questions & Discussion)**	**A. Kozmai** **Kuban State University,Membrane Institute, Krasnodar, Russia** **Topic:** Properties of freshly prepared and stabilized anion-exchange membranes obtained by polypyrrole-based modification
	15.40-16.00	**Tea Break**
		Invited Lecture **Chairperson** Subhankar Basu Assistant Professor Department of Applied Sciences and Humanities, NIAMT Ranchi Jharkhand
IL 17	**16.00-16.20 (15 min talk +5 min Questions & Discussion)**	**Olesya Rybalkina** **Kuban State University, Krasnodar,Russia** **Topic:** Enhancement the performance of electrodialysis recovery of phosphates by modifying commercial membranes containing weakly basic fixed groups
IL 18	**16.20-16.40 (15 min talk +5 min Questions & Discussion)**	Dr Saurav Dixit Senior Researcher, Peter the Great St. Petersburg Polytechnic University, 195251 Saint Petersburg **Topic: will update soon**
		Invited Lecture **Chairperson** Dae Woo Kim Professor

		Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul Korea
IL 19	**16.40-17.00 (15 min talk +5 min Questions & Discussion)**	**Dr. Noel Jacob Kaleekkal** **Assistant Professor** **Department of Chemical Engineering** **National Institute of Technology Calicut** **KOZHIKODE, Kerala** **Topic:** Membrane Distillation as a Potential Technology for Water Recovery
IL 20	**17.00-17.20 (15 min talk +5 min Questions & Discussion)**	**Preeti Sunil Kulkarni** **Department of Chemistry MES AbasahebGarware College (Autonomous), Maharashtra, India** **Topic:** Chitosan and Alginate beads and membranes for sorption of heavy metals and dyes from wastewater: Mechanism through kinetic and thermodynamic models
	17.20-18.40	**Poster Session (online)**
P 1	**10 minute 5 slides**	**Mukesh Kumar** **PhD Scholar** **CNMS, Jain University** **Bangalore, Karnataka** **Topic:** Growth of mono-to-few layer MoS2 membranes for water desalination
P 2	**10 minute 3 slides**	**Akshay Khandagale,** **PG Student** **Post-graduate and Research Centre, Department of Chemistry, MES AbasahebGarware College, Pune, India** Topic: Synthesis of TiO_2 nanoparticles via ultrasonication: Immobilization in Biodegradable polymer membranes for photocatalytic degradation of dyes
P 3	**10 minute 5 slides**	**SHAIKH ARFA- AKMAL** **BEGUM AZIZUN NISA HALL,MEDICAL COLONY ,ALIGARH** **Topic:** Metal-organic frameworks (MOFs) as a promising avenue for water purification
P4	**10 minute 5 slides**	**Abhijit Phalke** **Post-Graduate and Research Centre, Department of Chemistry, MES Abasaheb Garware College, Pune, India.** **Topic:** Cadmium adsorption on novel Kaolinite-Alginate composite beads
P5	**10 minute 5 slides**	**Arun P** **Research Fellow** **Inter University Instrumentation Center** **Mahatma Gandhi University, Kottayam** **Topic:** A SYSTEMATIC INVESTIGATION INTO THE DEGRADATION OF DIETHYL PHTHALATE IN AQUEOUS MEDIUM USING A HIGH-FREQUENCY ULTRASOUND SYSTEM

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

P6	**10 minute 5 slides**	**Mikhail Porozhnyy** **Kuban State University, Krasnodar,Russia** **Topic:** Using fluorescent-tagged antiscalants to reduce scaling in electrodialysis system with homogeneous ion-exchange membranes
P7	**10 minute 5 slides**	**Dmitrii Butylskii** **Kuban State University, Krasnodar,Russia** **Topic:** Highly selective separation of singly charged ions by hybrid electro-baromembrane method
P8	**10 minute 5 slides**	**Chithra K R** **Department of Chemistry, Indian Institute of Space science and Technology , Trivandrum, Kerala, India** **Topic:** Removal of Ciprofloxacin from Water by Cu-Ru-BMOF Incorporated Mixed Matrix Membrane Based Filtration

		2nd Day of the Conference 11th March 2023
		Hall 2
		Short Invited Lecture Chairperson Pinaki Dey CSIR-Trivandrum
SIL 1	**10.00-10. 10 (8 min talk +2 min Discussion)**	**Abhishek Kumar** **Research Scholar,IIT Madras** **Topic:** SILICON NANOPOROUS MEMEBRANES: EXTRACTION OF EFFECTIVE DIFFUSIVITY USING SIMULATION
SIL 2	**10.10-10.20 (8 min talk +2 min Discussion)**	**Abhishek Soti** **Research Scholar,Civil Engineering Department, Nagar, Jaipur** **Topic:** Performance assessment community RO plants and reject management
SIL 3	**10.20-10.30 (8 min talk +2 min Discussion)**	**JENNY N** **Resesarcg scholar, Dept. of Chemical Engineering, NIT Calicut** **Topic:** MIL-53 (Al) impregnated PVDF-co-HFP/PDA Janus membrane for seawater desalination via membrane distillation
SIL 4	**10.30-10.40 (8 min talk +2 min Discussion)**	**Radhika Malhotra** **Student,National institute of Technology Calicut, Kerala** **Topic:** Development of High-Flux Thin Film Nanocomposite Membrane for Water Recovery using Forward Osmosis
SIL 5	**10.40-10.50 (8 min talk +2 min Discussion)**	**SMITHA V KAMATH** **Senior Research Fellow** **Centre for Nano and Material Sciences, Karnataka** **Topic:** Fabrication of MIL-88 (Fe)-Integrated Sugarcane Bagasse-derived Superhydrophilic Adsorptive Filters for Wastewater Cleanup
SIL 6	**10.50-11.00 (8 min talk**	**ATUL PATEL** **Department of Applied Chemistry Delhi Technological University,**

	+2 min Discussion)	**New Delhi** **Topic:** Separation of Rhodamine B using Nano-Filtration process
		Short Invited Lecture **Chairperson** Dr Kavitha N P Sri Venateswara College of Engineering Sriperumbudur Chennai
SIL 7	**11.00-11.10 (8 min talk +2 min Discussion)**	**Gajipara Disha Hareshbhai** **Department of Chemical Engineering, Sardar Vallabhbhai National Institute of Technology, Gujarat, India** **Topic:** Membrane fouling and performance study for salt removal using membrane distillation
SIL 8	**11.10-11.20 (8 min talk +2 min Discussion)**	**Subasini Shanmugam** **Research Scholar, Department of Chemistry,** **The Gandhigram Rural Institute - Deemed to be University** **Dindigul, Tamilnadu** **Topic:** High performance activated carbon impregnated sodium alginate membranefor the removal of organic pollutants
SIL 9	**11.20-11.30 (8 min talk +2 min Discussion)**	**Abhishek Mishra** **Student** **Topic:** Separation of Rhodamine B using Nano-Filtration process
SIL 10	**11.30-11.40 (8 min talk +2 min Discussion)**	**Manish Kumar** **Department of Chemistry, Indian Institute of Technology, Ropar, India** **Topic:** Ionic Liquid Functionalized Reduced Graphene Oxide Membrane for Water Desalination
SIL 11	**11.40-11.50 (8 min talk +2 min Discussion)**	**JAMJAGGALI C PRADEEP KUMAR,** **Research Scholar, Department of Chemistry, Fergusson College, Pune** **Topic:** Concurrences linked to Nano filtration vitally by membrane matrices
		Short Invited Lecture **Chairperson** **Dr. Kakali Priyam Goswami** **Assistant Engineer** **O/o the Executive Engineer (PHE), Mangaldai Division, Mangaldai**
SIL 12	**11.50-12.00 (8 min talk +2 min Discussion)**	**Nishita Sharma** **Research Scholar,Department of Chemistry** **Chaudhary Bansi Lal University, Bhiwani,Haryana, India** **Topic:** Adsorptive potential of *Saccharum munja* as a low-cost and eco-friendly biosorbent for the removal of Chrysoidine Y dye from aqueous solutions
SIL 13	**12.00-12.10 (8 min talk +2 min Discussion)**	**Ashwani Kumar Tiwari,** **PhD scholar,Department of Applied Chemistry, Delhi technological University, Delhi**

		Topic: The concentration of phenolic compounds using nano-filtration based membrane process
SIL 14	**12.10-12.20 (8 min talk +2 min Discussion)**	**Ananthi P** **Research Scholar,Department of Chemistry, The Gandhigram Rural Institute, Dindigul** **Topic:** Cellulose acetate based-membrane supported by Fe –MIL 88A for the removal of diclofenac and ciprofloxacin micropollutants
SIL 15	**12.20-12.30 (8 min talk +2 min Discussion)**	**ATHIRA VINCENT** **Chemical Engineering student,** **National Institute of Technology Calicut** **Topic:** Zinc Doped Fe_3O_4 Nanoparticles for Flux Enhancement in Membrane Distillation Processes
SIL 16	**12.30-12.40 (8 min talk +2 min Discussion)**	**Vaishnavi Murlidhar Bhoyar** **Student,School of Chemical Engineering, MIT World Peace University, Pune, Maharashtra** **Topic:** Application of nano fillers embedded membranes for dye separation to recycle and reuse water: A brief review
SIL 17	**12.40-12.50 (8 min talk +2 min Discussion)**	**Dharmveer Yadav** **Research Scholar, IIT Bombay, Mumbai** **Topic:** Anti-fouling Nanomagnetic-polymer Composite Membrane for Environmental Remediation
SIL 18	**12.50-13.00 (8 min talk +2 min Discussion)**	**Sandhya Katunga** **Student** **School of Chemical Engineering, MIT World Peace University, Pune, Maharashtra** **Topic:** A review on drug separation from wastewater using membranes incorporated with different nanoparticles
	13.00-14.00	**Lunch Break**
		Short Invited Lecture **Chairperson** Kalpana Sharma Teaching cum Research Department of Physics, RIT, Bangalore
SIL 19	**14.00-14.10 (8 min talk +2 min Discussion)**	**Ishika Bhatia** **Student** **Netaji Subhas University of Technology(NSUT), Dwarka,Delhi** **Topic:** NANOFILTRATION MEMBRANES FOR WATER PURIFICATION
SIL 20	**14.10-14.20 (8 min talk +2 min Discussion)**	**NIKITA JOSHI** **STUDENT** **SARASWATI HOSTEL,NETAJI SUBHAS UNIVERSITY OF TECHNOLOGY,DWARKAA** **Topic:** QUANTUM DOTS SYNTHESIZED MEMBRANE AS A POTENTIAL FOR WATER PURIFICATION
SIL 21	**14.20-14.30 (8 min talk**	**VarunaWatwe** **Ph.D. student**

	+2 min Discussion)	**Post-graduate and Research Centre, Department of Chemistry, MES AbasahebGarware College, Pune, India** **Topic:** Environment friendly Optical sensor for Cr(VI) in aqueous systems based on image analysis
SIL 22	**14.30-14.40 (8 min talk +2 min Discussion)**	**Aruna** **Research Scholar,Department of Chemistry** **Chaudhary Bansi Lal University, Bhiwani,Haryana** **Topic**: Self-cleaning membranes for water purification applications: A review
SIL 23	**14.40-14.50 (8 min talk +2 min Discussion)**	**ASHUTOSH DUBEY** **Research Scholar** **Central University of Gujarat Gandhinagar** **Topic:** Microwave assisted synthesized graphene oxide nanocomposites for remediation of toxic metal ions
SIL 24	**14.50-15.00 (8 min talk +2 min Discussion)**	**L. Rameesha** **Research scholar** **PG and Research department of chemistry, Alagappa government arts college, Karaikudi** **Topic:** Microwave assisted synthesized graphene oxide nanocomposites for remediation of toxic metal ions
		Short Invited Lecture **Chairperson** Dr Ashim Kr basumatary Assam Engineering College, Guwahati
SIL 25	**15.00-15.10 (8 min talk +2 min Discussion)**	**Hemkumar K** **Research Scholar** **Department of Chemistry, The Gandhigram Rural Institute, Gandhigram, Dindigul** **Topic:** Photocatalytic degradation of brilliant blue dye using CMC loaded with Co-MOF composite membrane
SIL 26	**15.10-15.20 (8 min talk +2 min Discussion)**	**E. Pasechnaya,** **Kuban State University,Membrane Institute, Krasnodar, Russia** **Topic:** Counteracting membrane fouling by polyphenols during electrodialysis stabilization of red wine
SIL 27	**15.20-15.30 (8 min talk +2 min Discussion)**	**Triparna Chakraborty** **[a]Department of Chemistry, School of Technology, Pandit Deendayal Energy University, Gujarat, India** **Topic:** Fabrication of PVDF-Montmorillonite-Cucurbit[6]uril/Zinc oxide mixed matrix multifunctional ultrafiltration membrane for industrial wastewater purification
SIL 28	**15.30-15.40 (8 min talk +2 min Discussion)**	**Rini Thresia** **Topic:** A study on the synthesis and characterisation of cellulose nanofibrils from lognocellulosic barks of Tilifolia plant
SIL 29	**15.40-15.50 (8 min talk**	**Deeksha Katiyar,** **Research Scholar**

	+2 min Discussion)	**Department of Chemical Engineering, Indian Institute of Technology Jodhpur, Jodhpur** **Topic:** Ultrafiltration membrane based water treatment
SIL 30	**15.50-16.00 (8 min talk +2 min Discussion)**	**Bavana Biddala** **Student** **Department of Chemical Engineering, IIT Jodhpur, Rajasthan** **Topic:** Molecular Modelling For Dye Removal Mechanism Using Colloidal Gas Aphrons Generated From Tween-20 Surfactant
	16.00-16.10	**Tea Break**
		Short Invited Lecture **Chairperson** Prof.Parimal Pal HAG Professor & Former Head of Chemical Engineering National Institute of Technology Durgapur
SIL 31	**16.10-16.20 (8 min talk +2 min Discussion)**	**Annoy Roy** **Delhi Technological University, Delhi** **Topic:** ANN-BASED MODELLING OF MEMBRANE-BASED ALIPHATIC AROMATIC SEPARATION
SIL 32	**16.20-16.30 (8 min talk +2 min Discussion)**	**Vineet Panwar** **Student** **Department of Chemistry, University Institute of Science, Chandigarh University, Punjab, India** **Topic:** Antibacterial application of green synthesized CuO Nanoparticles
SIL 33	**16.30-13.40 (8 min talk +2 min Discussion)**	**Sugandh Luthra** **Student** **Department of Applied Chemistry, Delhi Technological University, Delhi, India** **Topic:** Artificial Neural Network based modeling of the supported liquid membrane for simultaneous extraction and recovery of cadmium and lead from wastewater
SIL 34	**16.40-16.50 (8 min talk +2 min Discussion)**	**Shrikrushna Sopanrao Katpure** **student** **Department of Chemistry,** **Dr. D. Y. Patil ACS College, Akurdi, Pune** **Topic:** Modifications in water purification techniques for more selectivity & higher efficiency
SIL 35	**16.50-17.00 (8 min talk +2 min Discussion)**	**Mr.Saurabh Deepak Surve,** **Post Graduate Student,** **Department of Chemistry, Dr. D. Y. Patil ACS College, Pune** **Topic:**
SIL 36	**17.00-17.10 (8 min talk +2 min Discussion)**	**Rhea Idrin Fernandez ,** **Post Graduate Student,** **Department of Chemistry, Dr. D. Y. Patil ACS College, Pune** **Topic:** Recent progress in MOF based membranes for water filtration
		Short Invited Lecture

		Chairperson **Ram Naresh Bharagava** **Department of Environmental Microbiology** **Babasaheb Bhimrao Ambedkar University (A Central University)** **Lucknow**
SIL 37	**17.10-17.20 (8 min talk +2 min Discussion)**	**Ananya Singh** **Student** **Delhi Technological University,New Delhi** **Topic:** Artificial Neural Network Based Modeling of Membrane Based Process in the Sugar Separation
SIL 38	**17.20-17.30 (8 min talk +2 min Discussion)**	**NIDHI SHUKLA** **Chemical Engg. Department, H.B.T.U. Kanpur** **Topic: Water absorption behavior of banana fiber reinforced composites**
SIL 39	**17.30-17.40 (8 min talk +2 min Discussion)**	**Rutuja Bhoje** **Research scholer** **Departmembt of chemical engineering, Institute of Chemical Technology, Mumbai** **Topic: Graphene Oxide as a functional material embedded in Polyamide-polysulfone Thin-film Nanocomposite Reverse Osmosis membranes for Desalination**
		Short Invited Lecture **Chairperson** **Dr. M. JEROLD** **Assistant Professor,** **Department of Biotechnology,** **National Institute of Technology Warangal**
SIL 40	**17.40-17.50 (8 min talk +2 min Discussion)**	**SHERIN PETER** **Centre RAPSODEE-CNRS UMR 5302- IMT Mines Albi Campus Jarlard,81013 ALBI CT CEDEX 9,France** **Topic:** Bio-based sustainable nanocomposites for wastewater treatment
SIL 41	**17.50-18.00 (8 min talk +2 min Discussion)**	**Dr Rehana P Ummer** **Assistant Professor (Ad. hoc)** **School of Nano Science and Nano Technology** **Mahatma Gandhi University, Kottayam** **Topic:** Magnetic nanoparticle assisted systems for water purification: A comparative study of Dye degradation efficiency of different photocatalysts
SIL 42	**18.00-18.10 (8 min talk +2 min Discussion)**	**Dr Shanthi Prabha V** **Science Research Scientist** **Advanced Centre for Environmental Studies and sustainable Development (ACESSD)** **Mahatma Gandhi University, Kottayam, India** **Topic:** Biochar based nanocomposites for waste water treatment from an environmentally sustainable prespective

		3rd Day of the Conference 12th March 2023
		Hall 1
		Plenary Lecture **Chairperson** **Prof. (Dr.) S. H. Pawar** **Director** **Centre for Innovative and Applied Research (CIAR)** **Anekant Education Society,** **T.C.College campus, Baramati**
PL 5	**9.00-9.30 (25 min talk + 5 min Questions & Discussion)**	**Dr Alexandra Pulyalina** **Associate Professor** **Universitetskii pr.26, Petergof, Saint Petersburg, Russia** **Topic:** APPLICATION OF COPOLYHYDRAZIDEIMIDE AND ITS METAL-POLYMER COMPLEX FOR MEMBRANE SEPATATION OF ORGANIC MIXTURES
PL 6	**9.30-10.00 (25 min talk + 5 min Questions & Discussion)**	**Dr. Kali Kishore Reddy Tetala (Ph.D)** **Associate Professor** **Center for Bioseparation Technology (CBST)** **Vellore Institute of Technology (VIT), Vellore** **Topic:** Development of mixed matrix membranes for metal-ion removal from aqueous solution and its future applications
	10.00-10.10	**Tea Break**
		Keynote Lecture **Chairperson** Dr. Md. Mushfequr Rahman Helmholtz-Zentrum Hereon, Institute of Membrane Research, Max-Planck-Straße 1, 21502 Geesthacht, Germany
KL 9	**10.10-10.35 (20 min talk +5 min Questions & Discussion)**	**Sarathi Kundu** **Associate Professor** **IASST, Guwahati, Assam, India** **Topic:** Nanohybrid decorated nanocellulose-polymer membranes for ultrafiltration
KL 10	**10.35-11.00 (20 min talk +5 min Questions & Discussion)**	**MIMOUNE SCHEHERAZADE** **Laboratory of Macromolecular and Thioorganic Macromolecular Synthesis, Faculty of Chemistry, Algeria** **Topic:** Poly(acrylonitrile) based ultrafiltration membranes: Synthesis and use
KL 11	**11.00-11.25 (20 min talk + 5 min Questions & Discussion)**	**Dr.R.Singaravel** **Professor/ Director** **Dept. of Soil Science and Agrl. Chemistry** **Annamalai University, Tamil Nadu** **Topic:** Zn leaching from sandy soil and its control using nano materials for prevention of water pollution and enhancing nutrient availability

PL–Plenary Lecture, KL-Keynote Lecture IL–Invited Lecture, SIL–Short Invited Lecture & P–Poster

		Invited Lecture **Chairperson** Akshay Modi Department of Chemical Engineering, Indian Institute of Science Education and Research Bhopal, India
IL 21	**11.25-11.45 (15 min talk + 5 min Questions & Discussion)**	**Anshul Yadav** **Scientist** **Membrane Science and Separation Technology CSIR-Central Salt and Marine Chemicals Research Institute,** **Bhavnagar - 364002, Gujarat.** **Topic:** Optimization of fouling resistant membranes for high flux distillation
IL 22	**11.45-12.05 (15 min talk + 5 min Questions & Discussion)**	**Dr. Md PalashuddinSk** **Assistant Professor** **Department of Chemistry** **Aligarh Muslim University, Aligarh, India** **Topic:** Biomass-derived Superhydrophobic Carbon Dots for Efficient and Comprehensive Cleaning of Oil Spillages
IL 23	**12.05 -12.25 (15 min talk +5 min Questions & Discussion)**	**Dr. Alberto Figoli** **Director Institute on Membrane Technology (ITM-CNR) Via P. Bucci,** **Cubo 17c 87036 Rende (CS), ITALY** **Topic:** Innovative membranes for water treatment and desalination application
		Invited Lecture **Chairperson** **E. Pasechnaya,** **Kuban State University,Membrane Institute, Krasnodar, Russia**
IL 24	**12.25 -12.45 (15 min talk +5 min Questions & Discussion)**	**Dmitrii Butylskii** **Kuban State University, Krasnodar,Russia** **Topic:** Application of hybrid electro-baromembrane process for selective separation of Li/Co-ions
IL 25	**12.45 -13.05 (15 min talk +5 min Questions & Discussion)**	**Rimmy Singh** **DPG Institute of Technology and Management, Gurugram, Haryana, India** **Topic:** Water pollutant remediation through application of Metal OrganicFramework membranes
	13.05 – 14.00	**Lunch Break**
		Invited Lecture **Chairperson** **Dr. Subhashish Dey** **Assistant Professor in Civil Engineering Department, SR Gudlavalleru Engineering College, Andhra Pradesh, India**
IL 26	**14.00- 14.20 (15 min talk**	**Dr. B. Kiran Naik,** **Assistant Professor,**

	+ 5 min Questions & Discussion)	**Thermal Energy Systems Laboratory (STESL), Mechanical Engineering Department, NIT Rourkela, Rourkela** **Topic:** Parametric Investigation of Membrane Based Liquid Desiccant Regeneration cum Desalination System Employing ANFIS-AI Tool
IL 27	**14.20- 14.40 (15 min talk +5 min Questions & Discussion)**	**Dr. Dasari Ayodhya** **Department of Chemistry,Osmania University, Hyderabad** **Topic:** Construction of Ag/CuO@gCN heterojunction composite membrane with competent photocatalytic degradation of 4-hydroxybenzoic acid and 3-phenoxybenzoic acid for wastewater treatment
IL 28	**14.40- 15.00 (15 min talk + 5 min Questions & Discussion)**	**Andrey Kislyi** **Kuban State University, Krasnodar,Russia** **Topic:** Application of Ti4O7 anode from pressed granules for anodic oxidation of organic pollutants in water treatment
		Invited Lecture **Chairperson** **Yusuf Wibisono** **Department of Bioprocess Engineering, Universitas Brawijaya, Indonesia**
IL 29	**15.00-15.20 (15 min talk +5 min Questions & Discussion)**	**Dr Ashim Kr basumatary** **Assam Engineering College, Guwahati** **Topic:** Purification and treatment of industrial wastewater with inexpensive inorganic tubular membrane
IL 30	**15.20-15.40 (15 min talk +5 min Questions & Discussion)**	**Ram Naresh Bharagava*** **Department of Environmental Microbiology** **Babasaheb Bhimrao Ambedkar University** **Lucknow (U.P.), India** **Topic: Water pollution and it's minimization approaches**
	15.40-16.00	**Tea Break**
		Invited Lecture **Chairperson** **AissatMiloud** **Faculty of Sciences and Technology, Tissemsilt University, Algeria**
IL 31	**16.00-16.20 (15 min talk + 5 min Questions & Discussion)**	**Dr. M. JEROLD** **Assistant Professor,** **Department of Biotechnology,** **National Institute of Technology Warangal,** **Warangal - Telangana State, INDIA** **Topic:** Evaluation of Alginate Biopolymer Stabilized Pickering Emulsion Liquid Membrane for Methylene Blue Extraction from Aqueous solutions
IL 32	**16.20-16.40**	**Akshay Modi**

	(15 min talk +5 min Questions & Discussion)	**Department of Chemical Engineering, Indian Institute of Science Education and Research Bhopal, Bhopal** **Topic:** Case Study of Nanoparticle-Loaded Polyacrylonitrile Membrane for Micellar-Enhanced Ultrafiltration of Nitrate from Contaminated Groundwater
		Invited Lecture **Chairperson** **MIMOUNE SCHEHERAZADE** **Laboratory of Macromolecular and Thioorganic Macromolecular Synthesis, Faculty of Chemistry, Algeria**
IL 33	**16.40-17.00 (15 min talk +5 min Questions & Discussion)**	**AissatMiloud** **University of Tissemsilt** **Faculty of Sciences and Technology, Tissemsilt University, Tissemsilt 38000, Algeria** **Topic:** Enhancing Anionic Dye Removal from Aqueous Solutions using Kaolin-based Membranes coated with Sol-Gel Salt Chloride films
IL 34	**17.20-17.40 (15 min talk + 5 min Questions & Discussion)**	**Yusuf Wibisono** **Department of Bioprocess Engineering, Universitas Brawijaya, Jl. Veteran Malang 65145 Indonesia** **Topic:** Taguchi Analysis of Natural Phenolic Compound Impregnated Polymeric Membranes for Biofouling Restriction

	17.40-18.00	**Closing Ceremony** **Panel Discussion**
	Chair	**Prof. Frank Lipnizki** **Prof. Marwa Shalaby**
		Panel Members
		Yusuf Wibisono, Indonesia
		Aissat Miloud,Algeria
		Andrey Kislyi, Russia
		Dmitrii Butylskii, Russia
		Alberto Figoli , ITALY
		MIMOUNE SCHEHERAZADE, Algeria
		Violetta Gil, Russia
		Olesya Rybalkina, Russia
		A. Kozmai, Russia
		Alexandra Pulyalina, Russia
		E. Pasechnaya, Russia

		Md. Mushfequr Rahman, Germany
		Alexandra Pulyalina, Russia
		Comments from Audience
		Vote of Thanks and Concluding Remarks
		Prof. Sabu Thomas **Vice Chancellor** **Mahatma Gandhi University,** **Kottayam, Kerala, India**

ABSTARCTS OF ICMW 2023

Plenary Lectures

PL 1

Prof. Frank Lipnizki
Department of Chemical Engineering, Lund University, Box 124, 221 00, Lund, Sweden

Topic: Pilot studies of new concepts for water treatment.

Two new membrane concepts have been piloted have been piloted in in recent years at Lund University in Sweden – namely (1) direct membrane filtration (DMF) and (2) water harvesting. Both concepts use submerged membranes as the established membrane bioreactor (MBR) concept but they exclude a biological treatment. This presentation will showcase the latest developments and experiences with these two new concepts.

The DMF concept operates abiotically and offers an interesting alternative for municipal wastewater treatment. In this approach, municipal wastewater undergoes physico-chemical pretreatment, including coagulation, flocculation, and microsieving, prior to membrane treatment. With its high carbon rejection, the DMF concept can significantly boost biogas production, resulting in a potentially energy-neutral or positive wastewater treatment process. Additionally, the DMF process requires a smaller footprint compared to conventional wastewater treatment technologies. Three pilot installations in Sweden and Norway have demonstrated the potential of this concept.

The water harvesting concept aims to upgrade storm- and rainwater collected from various sources, such as stormwater ponds, house roofs, and parking lots, for reuse in non-drinking applications like toilet flushing and garden watering. In this case, the water undergoes pre-screening and polishing with submerged membrane modules to remove micropollutants and microplastics. Results from a pilot installation in Sweden connected to a stormwater pond will highlight the capacity of this concept.Overall, this presentation will highlight the potential of submerged membrane modules in two new concepts beyond the widely established used in MBRs.

Acknowledgements

The research is partly funded by the REWAISE "Resilient Water Innovation for Smart Economy" project under European Horizone 2020 programme, project No. 869496.

PL 2

Prof. Marwa Shalaby

National Research Centre, Cairo, Egypt

Topic: Sustainability and Circular Economy in Textile Wastewater Treatment using Membranes

Textile industry is securing the demands of growing population from clothes worldwide, and thus resulting in higher consumption and pollution of water. Furthermore, for environmental protection issues and reuse purposes, it will require extensive treatment. Primary treatment, secondary treatment, and tertiary treatment are the three major phases of textile wastewater treatment. However, biological treatment is not fully capable of treating water according to discharge/reuse standards. Hence, tertiary treatment is used to remove final contaminants from the wastewater. Though membrane filtration is an efficient promising process, but the cost of operation limits its application. The presence of cost-effective membrane-based process will be a great opportunity for textile wastewater and resource recovery. Treatment of complicated, high- strength textile wastewater depending on pollutant load will be more successful if physical, chemical, and biological approaches are used in tandem. Enforcement of stringent environmental regulation policies, increasing costs and demand for freshwater, and the rising costs and difficulties as- sociated with wastewater disposal are accelerating efforts toward achieving ZLD. Additionally, research into methods for extracting useful materials using bio-inspired chemicals from wastewater has blossomed in recent years. Polyvinyl alcohol (PVA), the major constituent of desizing water constituting 45% of the total BOD load has a significant environmental impact owing to its poor biodegradability. In order to prevent PVA from being discharged by the effluent stream, modern textile industries opt for membrane based separation techniques using ultrafiltration so that the recovery and recycle of PVA in tandem could be achieved. However, the process of ultrafiltration is still not widely accepted as expected due to the well-known non-idealities of concentration polarization and pore blockage. As such, the purpose of this review may hasten the transition to more sustainable textile wastewater management using bio-inspired membranes having antifouling property.

PL 3

Prof. Tribikram Gupta

RV College of Engineering, Bangalore

Topic: Effect of pore size on the rattling of Carbon di-oxide permeating through nanoporous Graphenemolecule and its Infrared signature

	We have studied the separation of a mixture of hydrogen and methane gases, taken in equal proportions, using a thin film (nano-membrane) comprised of 10 layers of nano particles deposited layer-wise. The deposition of the particles is done using our "two-point sticking algorithm" which simulates controlled agglomeration of such nanoparticles. We simulate the process of gas separation using a molecular dynamics package called LAMMPS. We have studied the scenario where nanoparticles act like hard spheres, maintaining their shape and size, similar to what has been demonstrated by experiments involving self-assembled nanoparticle thin films. We consider pressure dependence of the results by working at 3 different initial pressures pegged at one-tenth, half and unity times Po, where Po is the atmospheric pressure. Three different diameters of the nanoparticles namely 3 nm, 6 nm and 9 nm are considered, and therefore the overall thickness of the membranes used ranges from 30 nm to 90 nm. We obtained perm-selectivity values that are significantly higher than the Robeson line for hydrogen-methane gas separation indicating the novelty and therefore the significant applications of this work. We find that while the permeance of hydrogen remains more or less steady with a ten-fold increase of pressure, the corresponding fall in methane's permeance is very sharp. The sharpness is more if the size of the nanoparticles is smaller, thereby giving higher selectivity at higher pressure.
PL 4	**Akhilendra Bhushan Gupta** Professor, Civil Engineering Department, MNIT, JLN MARG Malviya nagar, Jaipur Topic: Performance assessment of community RO plants and reject management Water has much broader influences on health and wellbeing and issues such as the quantity and quality of the water supplied are crucial in determining the health of individuals and whole communities. The health of the population significantly affects both social development and economic progress. It is essential to ensure equitable access to community RO plant services by identifying priority areas and ensuring improvements in the quality of water of the community RO plants. Therefore, a study of fifteen community-based RO plants installed in Bharatpur districts of the state of Rajasthan was taken up to evaluate the performance of community RO system in terms of removal of chemical contaminants. Questionnaire surveys were used to assess the adequacy of maintenance systems and derive information on the acceptability of these systems among the beneficiary population to judge the long-term sustainability. Factors such as issues of reject disposal was identified as the major areas that needed interventions for enhancing the performance of community RO plants and minimizing the adverse environmental impacts over their life span to ensure long-term sustainability. This paper describes the broad findings of the study for both technology as well as social issues and suggests possible interventions to circumvent the same. **Keyword:** Reverse osmosis; Sustainability; Reject management
PL 5	**Dr Alexandra Pulyalina** Associate Professor, Universitetskii pr.26, Petergof, Saint Petersburg, Russia

Topic: Application of Copolyhydrazideimide and its Metal-Polymer Complex for Membrane Sepatation of Organic Mixtures

Pervaporation is known to be one of the most promising membrane technologies for separation of liquid mixtures. The advantages of this membrane technique include low energy consumption, resource saving, as well as ability to separate close-boiling liquids and azeotropic mixtures. In particular, separation of such organic systems as methanol – dimethyl carbonate (DMC) and benzene – isopropanol (IPA) is of great industrial significance, since the individual components are widely used in chemical and pharmaceutical industries as solvents, precursors for organic synthesis, entrainers, fuel additives, etc. However, both of said mixtures have azeotropic points, which make it difficult to separate them by means of conventional distillation. Pervaporation can be an effective approach to solve this problem.

It is known that successful realization of the pervaporation separation strongly depends on the correct choice of a membrane material. Membranes based on polyheteroarylenes have attracted much attention due to their high level of chemical and mechanical stability as well as the ability to control their morphology by introducing various structural fragments and changing the flexibility of polymer chains.

Therefore, this work is aimed at providing novel membrane materials based on poly(biquinoline dicarbohydrazide)-*co*-(bistrimelliteimide) (PHI) and its metal–polymer complex PHI-Cu(I) containing several types of functional groups (hydrazide, carboxyl, amide, and imide fragments).

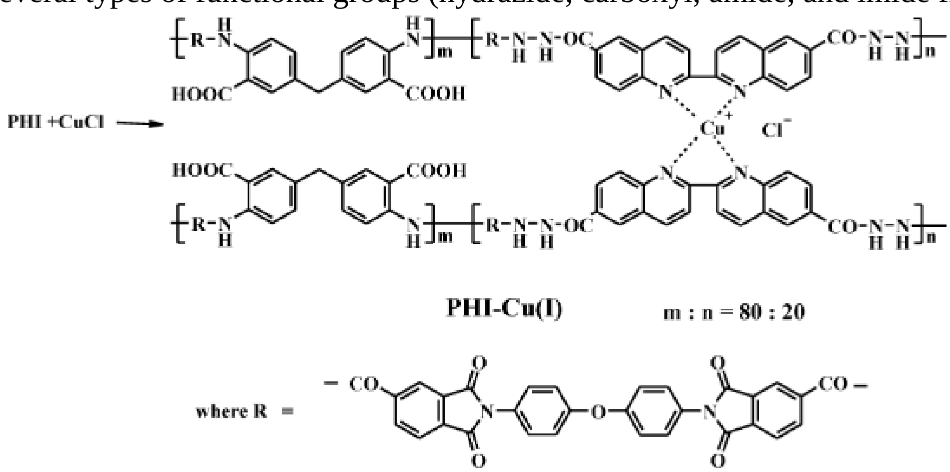

Fig. 1. Structure of PHI-Cu(I).

The goals of the work included preparation of dense membranes based on PHI and PHI-Cu(I) and further comprehensive studies of their structure, physical and mechanical properties involving scanning electron microscopy, energy dispersive and thermogravimetric analyses as well as computational methods. Transport properties of the membranes were studied in pervaporation of methanol – DMC and benzene – IPA mixtures. It was found that both the developed materials were methanol- and benzene-selective, whilst the formation of the metal-polymer complex led to a change in morphology and improved performance of the membrane.

Acknowledgments: This research was supported by the Russian Science Foundation (RSF), grant number 18-79-10116.

PL 6	**Dr. Kali Kishore Reddy Tetala (Ph.D)** Associate Professor, Center for Bioseparation Technology (CBST), Vellore Institute of Technology (VIT), Vellore Topic: Development of mixed matrix membranes for metal-ion removal from aqueous solution and its future applications In this presentation, the application of mixed matrix membrane (MMM; [1-3]) as an efficient matrix will be discussed to adsorb metal-ions from aqueous solutions. The developed flat sheet MMM, comprises of a chitosan based beads (20-40 µm) incorporated within the porous network of ethylene vinyl alcohol (EVAL) polymer. Copper ions (Cu^{2+}) were used as a model system for proof-of-concept. The audience will be presented with the evolution of mixed matrix membrane technology, its fabrication and advantage over conventional chromatography beads. This will be followed-up with synthesis of chitosan beads 20-40 µm) and how to successfully incorporate them within a polymer matrix. Subsequently, the studies involving Cu^{2+} ion adsorption with and without chitosan bead incorporation, dynamic adsorption studies and comparison with static adsorption will be presented. Also, the reusability of the MMM technology for different cycles will be discussed. Finally, the further potential of this technology in separation science will showcased. **References** 1. M.E. Avramescu, Z. Borneman, M. Wessling, Mixed-matrix membraneadsorbers for protein separation, J. Chromatogr. A 1006 (2003) 171–183. 2. M.E. Avramescu, Z. Borneman, M. Wessling, Particle-loaded hollow-fibermembrane adsorbers for lysozyme separation, J. Membr. Sci. 322 (2008)306–313. 3. M.E. Avramescu, M. Girones, Z. Borneman, M. Wessling, Preparation of mixedmatrix adsorber membranes for protein recovery, J. Membr. Sci. 218 (2003)219–233.
	Keynote Lectures
KL 1	**Prof. Parimal Pal** HAG Professor & Former Head of Chemical Engineering, National Institute of Technology Durgapur Topic: Process Intensification Through Membrane Technology Adoption: Possibilities and hurdles in Implementation With growing environmental concerns, chemical and allied process industries known for huge environmental pollution, need to quickly adopt green technologies for sustainable business. Membrane-based technologies offer great opportunities to move towards sustainable business as such technologies not only permit chemical production in green environment but also have the

	potential to bring a turnaround even in the sick industries through process intensification. Though process intensification can happen through other better designs of systems and equipment in the production process, the membrane technology-based process intensification offers a plethora of avenues of turning the production system more compact, flexible, safe, eco-friendly with marked enhancement of product quality and yield. All these eventually get reflected in reduced price, better product, safer working environment and much better profit margin. Energy efficiency is the most significant aspect of such membrane technology-based process intensification. However, implementation of membrane-based technologies still remains very limited in the developing vast economies. Prospects of membrane-based technologies in process intensification and hurdles in implantation are discussed with some case studies. **Keywords:** Membrane Technology; Green Production; Sustainable business; Process intensification; Membrane technology adoption
KL 2	**Dr. Sandeep S Ahankari** Associate Professor, Dept. of Manufacturing Engineering, School of Mechanical Engineering, VIT Vellore Topic: Nanocellulose-based aerogels for water purification Membrane-based purification is the most widelyused method for water decontamination due to its simplicity, cost-effectiveness andefficiency. Adsorption is the primary mechanism used in the membranes for the removal ofpollutants. The highlyporous (>95%) 3D structure, ultra-low density (upto300 mg/cm^3), and very high surfacearea of aerogels make it the most promising structure due to their unmatched adsorptionperformance. The availability of a large number of functional groups, surface tunability,hydrophilicity, tensile strength and flexibility of nanocellulose (NC) makes it a potentialcandidate for aerogel preparation. This talk discusses thepreparation and employment of NC-based aerogels in the removal of dyes, metal ions andoils/organic solvents. It also offers recent updates on the effect of various parameters thatenhance the adsorption performance.
KL 3	**Prof. (Dr.) S. H. Pawar** Director, Centre for Innovative and Applied Research (CIAR) Anekant Education Society, T.C.College campus, Baramati Topic: Silk Fibroin Based Electrospun Nanofibrils for Next Generation Sustainable Water Purification
KL 4	**Dr. S. Varadharajan** Head and Associate Professor, Civil Engineering Department, JSS Academy of Technical education, Noida Topic: Utilization of artificial intelligence in nanomembrane technology for water purification and wastewater treatment: A review

Artificial intelligence (AI) is a rapidly developing, innovative technology that can simulate complex real-world issues. The automation of these facilities produced simple, inexpensive operations as well as a notable decrease in the incidence of human mistake, making the modelling capabilities of AI techniques highly helpful in the processes of water purification and wastewater treatment. Multi-linear or non-linear interactions, as well as non-linear process dynamics, are all present in AI technologies, making it often unfeasible to model them using traditional methods. This review provides a thorough summary of recent developments and discoveries in a variety of AI technologies applied to source water quality determination, coagulation/flocculation, disinfection, membrane filtration, desalination, modelling wastewater treatment plants, membrane fouling prediction, removal of heavy metals, and monitoring of biological oxygen demand (BOD) and chemical oxygen demand (COD) levels. This review's investigation of the effectiveness of various AI technologies shows that these technologies have been successfully integrated into applications connected to water treatment. It also draws attention to the drawbacks that prevent their use in actual water treatment systems.
Keywords : Artificial intelligence, Nanotechnology, Nanostructure, Nanomembrane

Introduction

Nanomembrane technology is a fast-expanding field with applications in water purification, gas separation, energy storage, and medicinal devices. Nanomembrane technology has demonstrated considerable potential for wastewater treatment due to its excellent selectivity, high flux, and variable pore size. Here is some recent research on the application of nanomembrane technology to wastewater treatment. Lin et al. (2022) studied nanomembrane-based treatment systems for water purification. This review article presents an overview of nanomembranes' applications in water purification, including wastewater treatment. The article addresses the numerous types of nanomembranes used in wastewater treatment, including ceramic, polymeric, and metal-organic framework (MOF) nanomembranes, as well as their advantages and drawbacks. Cigane et al. (2021) gives a complete overview of the usage of nanomembranes for wastewater treatment, including their use for municipal, industrial, and agricultural wastewater [1]. The review also covers the barriers to commercialization and future prospects for nanomembrane-based wastewater treatment technology. Lin et al (2022) reviewed nanomembrane-based filtration for wastewater treatment and presented an overview of the usage of nanomembranes for wastewater treatment, with an emphasis on filtering applications. The authors examined the numerous types of filtration nanomembranes, such as ceramic, polymeric, and graphene oxide nanomembranes, as well as their benefits and drawbacks [2]. Qadir et al. (2022) present an overview of the usage of nanomembranes for wastewater treatment, with an emphasis on their prospective uses in the treatment of several types of wastewater, including textile, pharmaceutical, and oil and gas wastewater. The review also covers the barriers to commercialization and future prospects for nanomembrane-based wastewater treatment technology. Generally, the research indicates that nanomembrane technology offers high efficiency and selectivity for wastewater treatment. While obstacles such as scalability and cost-effectiveness remain, nanomembrane-based wastewater treatment methods show promise for the future [3].

2. Literature survey

Several industries, including nanotechnology, have the potential to be transformed by artificial intelligence (AI). AI may be used specifically to develop and optimise nanomembranes, which are tiny sheets of material that can be utilised in a variety of applications such as water filtration, energy conversion, and biosensing [4-12]. One of the primary benefits of employing AI in nanomembrane design is that it may assist researchers in swiftly identifying the optimal materials and configurations for a certain application. This is because AI can examine massive volumes of data and uncover patterns that human researchers do not instantly see. For example, AI may be used to mimic the behaviour of many types of nanomembranes in different situations and then find which ones are most successful at filtering toxins from water or absorbing energy from sunlight. Researchers may also utilise AI to improve the shape and content of nanomembranes, allowing them to be tailored to specific purposes. AI may be used to regulate the behaviour of nanomembranes in real time, in addition to design and optimization [13-16]. This is especially crucial in applications such as medication delivery, where drug release from nanomembranes must be controlled over time. Researchers can ensure that medications are distributed in a regulated and targeted manner by utilizing AI to manage the behaviour of nanomembranes [20-23]. Overall, the combination of AI with nanomembranes has the potential to revolutionise a wide range of sectors, including medical, energy, and environmental research. As AI technologies continue to progress, it is probable that we will see many more intriguing uses of this technology in the years to come [6-9]. The different techniques of manufacturing of nanomembranes have been shown in Figure 1 -3.

3. Use of artificial intelligence in nanomembrane technology

Munoz et al. (2020) conducted extensive research on nanomembranes for energy and environmental applications, offering a comprehensive analysis of nanomembranes' applications in the energy and environmental sectors, including water purification, gas separation, and energy storage [5]. Several reserachers conducted research on nanomembrane-based separation technology, focusing on the use of nanomembranes in separation technologies such as gas separation, water purification, and protein separation [6]. Similarly, some authors provided an overview of the various manufacturing methods used to manufacture nanomembranes, including top-down and bottom-up techniques [7]. Very few authors have conducted a thorough investigation of nanomembrane-based sensors for biomedical applications and investigated the use of nanomembranes in the development of sensors for biomedical applications such as glucose sensors and drug delivery systems. Kailasa and Ali Aldalbahi (2020) provided a comprehensive examination of the use of nanomembranes in water purification, including the many types of nanomembranes used and their performance in removing contaminants from water [8-15]. Several researchers have reported the use of nanomembranes in gas separation, addressing the various types of nanomembranes and their gas separation performance [16-27]. Some researchers conducted an exhaustive study overview of the uses of nanomembranes in energy storage devices such as batteries and supercapacitors. Overall, nanomembrane technology has a broad variety of potential applications and is a rapidly expanding field with active research [28-29]. Yadav et al. (2022) investigate the use of nanomembranes for water treatment, including the advantages of nanomembranes over traditional filtering methods, the many types of nanomembranes used, and recent improvements in their fabrication and performance [30]. Ji and Liu (2020) address recent advancements in the use of nanomembranes for gas separation, including the usage of new materials and production techniques, as well as barriers and future commercialization potential [31]. Mariana Medina-Sánchez and Schmidt (2020) discussed the use of nanomembranes for sensing applications like as biosensors, chemical sensors, and environmental monitoring, as well as current design and performance advances [32]. Xiwen Zhang et al. (2000) give a comprehensive examination of the usage of nanomembranes for energy storage, including applications in batteries, supercapacitors, and other electrochemical devices, as well as current developments in their fabrication and performance [33]. Similar results were reported in other research works [33-50]. Ali Seyfoddin et al. (2019) investigate the use of nanomembranes for drug administration, including the benefits of nanomembranes over standard drug delivery systems, the many types of nanomembranes used, and recent improvements in their design and operation [51]. The summary of the literature review shows that nanomembrane technology is a rapidly developing field with several applications in water treatment, gas separation, sensing, energy storage, and drug delivery. The literature includes discusses recent breakthroughs in nanomembrane design, fabrication, and performance, as well as challenges and prospective commercialization opportunities [52-55].

4. Conclusions

The application of artificial intelligence (AI) in nanomembrane technology has the potential to enable the creation of innovative materials with distinct characteristics and capabilities. AI algorithms may be used to design, model, and optimize the characteristics of nanomembranes, drastically accelerating the development process and lowering expenses. The creation of sensors and gadgets for healthcare and biological purposes is one possible use of AI in nanomembrane technology. To deliver individualised insights into an individual's health and well-being, AI may be used to evaluate vast datasets generated by these devices, such as wearable sensors or implanted devices. Another possible use of artificial intelligence in nanomembrane technology is the creation of neuromorphic computer systems, which imitate the structure and function of the human brain. Ferroelectric field-effect transistors (FeFETs) based on HZO/-Ga2O3 have been proved to be durable synaptic devices for high-temperature artificial intelligence applications. Additionally, bio-inspired nanomembranes observed in nature may be used to inspire the construction of artificial nanomembranes with customised features for use in nanophotonics, plasmonics, and metamaterials. By merging AI with nanomembrane technology, it is feasible to design and produce materials with unique optical and mechanical characteristics for numerous applications. Overall, the use of AI in nanomembrane technology shows enormous potential for the creation of improved materials and technologies for use in healthcare, computing, and other fields.

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LIST OF FIGURES

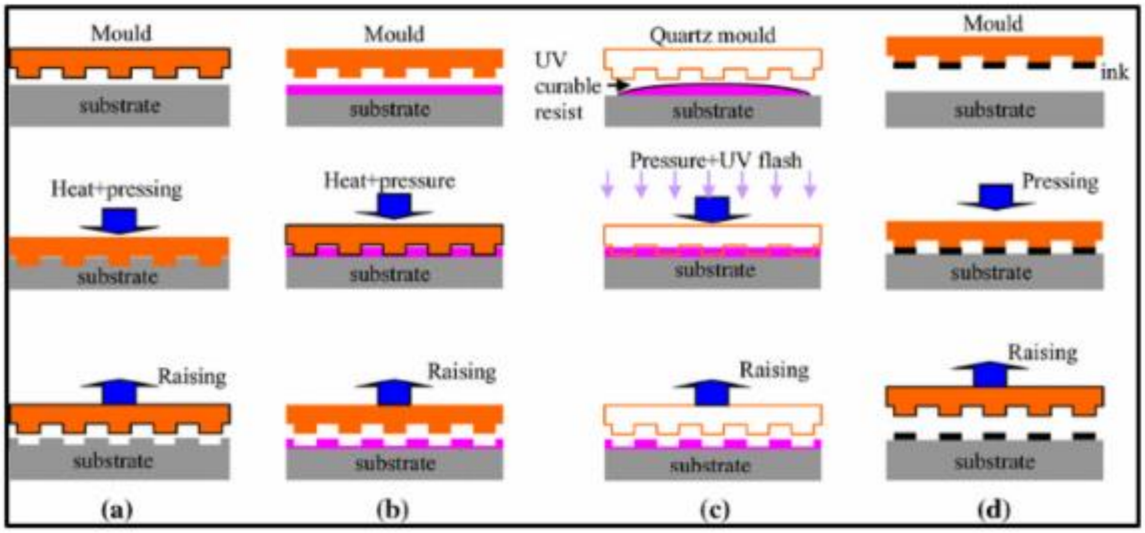

Figure 1 : The basic phases of a) Nano hot-embossing imprint lithography, b) Nano-UV-imprint lithography, c) Photolithography, and d) E-beam lithography is shown schematically [56]

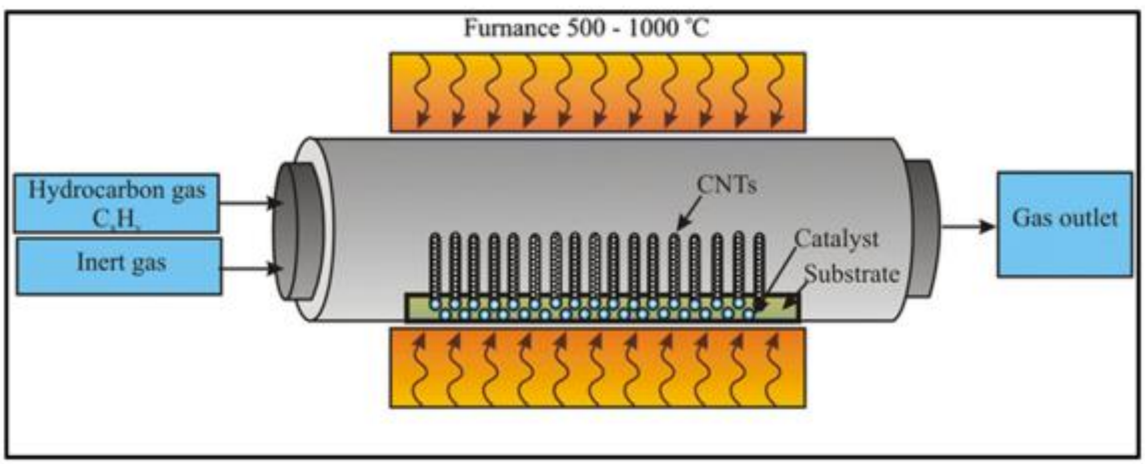

Figure 2 : Chemical vapour deposition [57]].

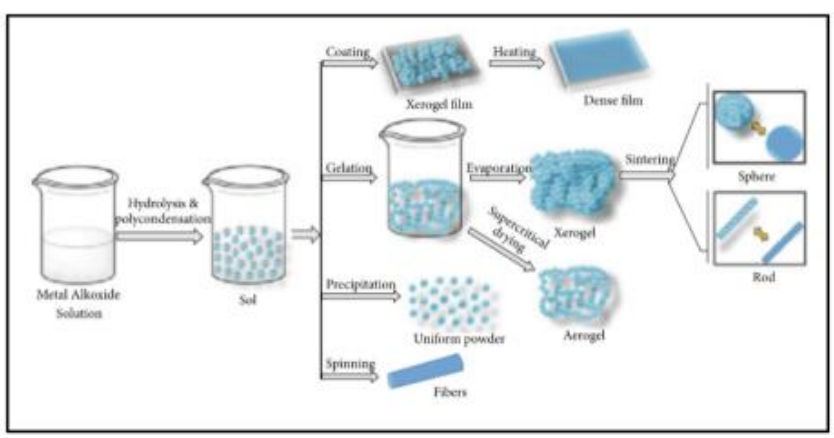

Figure 3 : Sol gel Method [58]

KL 5	**Mourad AMARA** Professor, LHCIM Laboratory, Faculty of Chemistry, USTHB, Bab Ezzouar 16111, Algeria Topic: Insitu-functionalization of Membrane surface applied to water purification and liquid waste treatment Water scarcity representing reduction of fresh water due to pollution, climate change, decrease of reserves and population's growth constitute one of the main motivation to the development of membrane filtration technology. Numerous international reports emphasize the importance of people's access to the water resource in sufficient quantity and in clean and safe quality. For these purposes, the use of membrane separation process allows a better way to solve each of above cited problems. Membrane technique is based on transference of species under chemical, electrochemical or barometric gradients forces. Also, the nature of external surface, porosity and hydrophilic/hydrophobic ratio can play an important role on the improvement of properties. In this presentation, a new method for embedding silica on a polyethersulfone (PES) membrane surface was successfully developed. Reaction of hydrolysis/condensation of tetraethylorthosilicate (TEOS) as a precursor was performed in situ, followed by coating as a thin-film composite (TFC) via interfacial polymerization. Phase inversion procedure was selected for the synthesis of PES membranes N-methyl-pyrrolidone (NMP) solution. Rejection rate obtained for respectively $MgSO_4$ and Na_2SO_4 were higher than 85 and 94%. Two hours of dialysis was sufficient to the removal of more than 43 and 31% of Pb and Cd respectively from synthetic solution. Introduction of thio tri-methyl silica give a rise to the separation selectivity for heavy metals.
KL 6	**Dr. Gopala Krishna Darbha** Assoc. Professor, Indian Institute of Science Education and Research Kolkata | , Mohanpur, Nadia, West Bengal, India Topic: Eco-Friendly Methodologies for the Remediation of Environmentally Persistent Nanoplstics from Industrial Effluents and Water Treatment Plants Nanoplastics are those which are in size range of <100 nm. Their presence in the environment can be due to the direct release of industrial effluents (such as sewage treatment plants, textile industries etc.) or the degradation of large-sized plastic debris. Due to their smaller size, they are susceptible to getting ingested by aquatic species, thus entering into the food chain. Nanoplastics are known to cause several ailments, including cancer. The recent reports showed that the conventional water and wastewater treatment methods could not remove the nanoplastics and contribute to the release of bulk mass into the water bodies.This warrants the scientific community tofind an efficient alternative methodology for their removal from the aqueous environments.

We have attempted to remove nanoplastics using synthetic (layer double hydroxides(LDH) and natural substrates (biochar) from various water samples. LDH showed the highest removal efficiency (q_{max}) of 162.6 mg/g for freshwater[1]. However, the hardwater (at 2 mM of SO_4^{2-} and PO_4^{3-}), q_{max}decreased to 53 mg/g. Also, the material showed a limitation for removal at alkaline pH (9) conditions. We later applied biochar (prepared from sugarcane bagasse) and observed that biochar, when pyrolyzed at 750^0C (compared to those that are pyrolyzed at a lower temperature),showed 99% nanoplastic removal (44.9 mg/g) within 5 min but the removal was decreased by 25% with the high humic acid concentrations[2]. Finally, when biochar is modified with iron nanoparticles, we noticed an ultrafast elimination of nanoplastics exceeding the efficiency limits to 290 mg/g. Moreover, the minimal impact of environmental parameters in complex aqueous matrices on nanoplastic removal justified the composites' excellent reusable adsorbent for large-scale environmental applicability[3].

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KL 7

Dr. Tanushree Choudhury
Associate Professor, Chemistry Division, School of Advanced Sciences, VIT Chennai

Topic: Clay Hybrid Materials: An Emerging Area in Membrane Assisted Wastewater Treatment Technology

Most of NF membranes which are developed recently are composite membranes, whose support layer is covered with an active layer. Among different ceramic support materials that are currently used as support layer, α-alumina supports are integral part of the membrane which is made of artificial materials like alumina and thus adds to the high price of the membrane. This draws our attention in making low cost support material of natural clay which aims to be an excellent membrane support as it possesses high mechanical strength, high permeability, narrow pore size distribution and low manufacturing cost. Titania as active layer for ceramic membrane is preferred over Al_2O_3 membranes due to a slew of benefits ranging from its small crystallite size, self-cleaning property, to its being a highly efficient photocatalytic material. It has been observed that if Titania is immobilized on to clay support, its photocatalytic action increases tremendously. One of the problems encountered when photocatalysts are immobilized on support is the detachment of the microparticles from the support for high flow rates of liquid effluent. This can be overcome by using

	Montmorillonite clay as support material as it has extremely good binding capacity. Not enough effort has been made in literature to evaluate the specific features of these catalysts in relation to practical use and to optimize their design in relation to these characteristics. Thus optimization of such catalyst reactor may be helpful in separation of heavy metal ions from wastewater and also recover ions such as Pb^{2+} and Cd^{2+} which latch onto clay composite membranes Keywords: nano clay, titania, photocatalyst, dye degradation, heavy metal,
KL 8	**Dr. Soumyendu Roy** Associate Professor, Physics Department, School of Engineering and Applied Sciences, Bennett University, Uttar Pradesh, India. Topic: Ion-Selective Membrane Coated on Carbon Nanomaterials for Developing Wearable Sensors Wearable sensors enable real-time and continuous health monitoring and have a wide range of applications. One problem that they can address is analysis of sweat. Sweat contains markers for various diseases like cystic fibrosis, dehydration, osteoporosis, drug abuse, etc. However, it is not used in conventional medical diagnosis owing to technical difficulties in collection and testing. Ion-selective membrane (ISM) integrated with flexible wearable electrodes and portable electronics provide a way to solve these technical difficulties. ISM was prepared in this study by doping plasticized poly(vinyl chloride) (PVC) with an appropriate ionophore and ion exchanger.When ISM is coated onto a conducting electrode, the combination is referred to as ion selective electrode (ISE). Electrode arrays consisting of carbon nanotube (CNT) [1] or laser induced graphene (LIG) [2] films on flexible substrates like polydimethylsiloxane (PDMS) and polyimide(Kapton) were used to make the ISEs.Solid-state ISEs, sensitive to Na^{+} ions, were prepared by drop coating ISM dissolved in tetrahydrofuran on CNT electrodes. Porous nature of the carbon nanomaterial films allowed percolation of ISM solution, forming strongerattachment than that achieved with planar Pt, Au and carbon electrodes.Concentration of the ISM solution used for coating was found to affect the performance of the sensor. Best sensitivity to Na+ ions achieved with aqueous test solutions was close to theoretically predicted value (~ 59 mV/decade).Response time was of the order of 1 min. To achieve truly wearable sensors, it is also necessary to develop solid-state reference electrodes (REs). CNT filmswere coated with colloidal dispersion of Ag/AgCl, agarose hydrogel containing 0.5 M NaCl and a final passivation layer of PVC doped with NaCl to make the solid REs.The sensitivity of CNT-based REstoward the NaCl solution was lower (-1.7 ± 1.2 mV/decade) than commonly reported electrodes like bare Ag/ AgCl, metals, carbon, and CNT films [1].Short-term stability and Lower limit of detection of the system were tested. A portable voltmeter was assembled using ICL7106 integrated circuit chip and integrated with the flexible ISEs to demonstrate viability for future wearable technology.

	Acknowledgements Author acknowledges the financial support from DST, India, via the DST INSPIRE Faculty Award (No. DST/INSPIRE/04/2015/002287). **References** 1. S. Roy et al, Carbon Nanotube Based Ion Selective Sensors for Wearable Applications, *ACS Applied Materials & Interfaces*, 9, 35169 - 35177, 2017. 2. S. Choudhury, S. Roy et al, Potentiometric Ion-Selective Sensors based on UV-Ozone Irradiated Laser-Induced Graphene Electrode, *Electrochimica Acta*, 387, 138341, 2021.
KL 9	**Sarathi Kundu** Associate Professor, IASST, Guwahati, Assam, India Topic: Nanohybrid decorated nanocellulose-polymer membranes for ultrafiltration The development of synthetic membranes has progressively advanced in the recent years. A synthetic membrane forms an interface between two adjacent phases. These synthetic membranes been extensively used in different areas which include nano filtration, energy conservation system or in food packaging technology. In the recent past, the use of cellulose nanofibers in the development of membranes have gained considerable interest amongst the researchers. The current prodigy of research in membrane technology is mainly implied on the modification of cellulose nanofibers by using other nanomaterials and utilization of some bulk polymers as support. In this venture, we have developed a synthetic membrane of cellulose nanofiber decorated with ZnO/TiO_2 nanohybrid which is supported on a bulk polymer surface. This membrane can be effectively utilized in the treatment of waste water or polluted water from industries.
KL 10	**MIMOUNE SCHEHERAZADE** Laboratory of Macromolecular and Thioorganic Macromolecular Synthesis, Faculty of Chemistry, Algeria Topic: Poly(acrylonitrile) based ultrafiltration membranes: Synthesis and use Poly(acrylonitrile) homopolymer, PAN, poly(acrylonitrile-co-hydroxyethyl methacrylate) copolymers, AH1 and AH3, and poly(acrylonitrile-co-hydroxyethyl methacrylate-co-sodium styrenesulfonate) terpolymers, AH1S2, AH1.5S1.5 and AH2S1 were synthesized to obtain materials of various compositions used to prepare ultrafiltration membranes by classical phase-inversion method. The PAN-based membranes were used in a laboratory scale study to ultrafilter carboxymethylcellulose, CMC, solutions acting as synthetic textile sizing agents. Before use, the membranes were characterised by means of FTIR, to verify the occurring of the copolymerisation, and TGA, to examine thermal properties of the polymers.

	The membranes AH1, AH3, and AH2S1 exhibit the better comportment, regarding to the separation ability and the solvent flux regeneration after use, which indicate promising durability during practical uses. Keywords: Ultrafiltration; Membrane; Poly(acrylonitrile); Carboxymethylcellulose; Textile sizing agents.
KL 11	**Dr.R.Singaravel** Professor/ Director. Dept. of Soil Science and Agrl. Chemistry, Annamalai University, TamilNadu Topic: Zn leaching from sandy soil and its control using nano materials for prevention of water pollution and enhancing nutrient availability Zinc is considered to be a key element for plant and animal health. In India around 48 % of the soils are Zn deficient, which is causing considerable yield loss. Zinc is essential for several biochemical processes such as synthesis and enzyme activation, chlorophyll production, seed and straw production. Nearly 50% of the cereal-grown areas in the world have deficient plant available Zn leading to poor yields and low nutritional quality. In regions with Zn-deficient soils, Zn deficiency in human beings is widespread. However excessive amount of Zn can be toxic not only to plants and animals but also to human. Zinc is relatively mobile in soils and leaching of Zn can contribute to the enrichment of Zn in surface runoff, subsequently deteriorating the quality. The movement of heavy metals in soil profiles has received considerable attention, due to increased content of heavy metals in the groundwater. In sandy soils characterized by light texture, low clay and organic matter and exchange capacity, the loss of applied Zn through leaching is high. To assess the leaching loss of Zn from sandy soils, a column experiment was carried out in a PVC column of 45 cm length and 3 inch dia. The treatments were T_1- control, T_2- NPK + $ZnSO_4$@25 kg ha^{-1}, T_3- NPK + $ZnSO_4$ + Clay @ 20 t ha^{-1} T_4- NPK + $ZnSO_4$ + Clay + humic acid @ 20 kg ha^{-1} and T_5- NPK + $ZnSO_4$ + Clay + FYM @ 12.5 t ha^{-1}. All the treatments were replicated four times in a completely Randomised Design. Calculated quantity of deionised water was added and leachate was collected in a plastic container at an interval of 15 days for 5 total leaching. The leachate was analysed for the content of Zinc. The post column soil was analysed of DTPA-Zn. The results of the study indicated that application of NPK + $ZnSO_4$ + Clay + humic acid @ 20 kg ha^{-1} resulted in recording the lowest cumulative Zn leaching of 1.73 mg l^{-1} as compared to 2.67 mg l^{-1} in control. A pot experiment was conducted to evaluate the effect of Biochar and Zeolite based Zn nano particles for increasing the Zn availability and uptake by rice. The following treatments namely, T_1 - RDF (Control), T_2 - RDF + $ZnSO_4$ @ 25 kg ha^{-1}, T_3 - RDF + Nano ZnO foliar @ 500 ppm, T_4 - RDF + Nano Zeolite @ 1g kg^{-1}, T_5 - RDF + Nano Biochar @ 1g kg^{-1} were studied in Completely Randomized Design in three replications with rice variety ADT 43. The experimental results showed that the application of recommended dose of fertilizers + Nano Biochar @ 1g kg^{-1} proved its superiority over other treatments in increasing the Zinc availability and uptake by rice (Grain, 22.4 mg kg^{-1} and straw, 49.2 mg kg^{-1}).The increased availability of DTPA-Zn content of 0.77 mg kg^{-1} in soil proved the decreased leaching loss and increased efficiency.

	keywords: Zn leaching, Nano materials, Sandy soils.
	Invited Lectures
IL 1	**Dr. Kakali Priyam Goswami** Executive Engineer (PHE), Mangaldai Division, Mangaldai, Assam Topic: Separation of Glycerol from Biodiesel using Fly Ash-based Tubular Ceramic Membrane Fabrication and application of low-cost ceramic membranes in different separation processes is one of the most discussed topics in recent times due to their outstanding thermal, chemical and mechanical properties. Among the various low-cost precursors, fly ash is getting vast importance as it also addresses the major concern over improper dumping of fly ash, which may otherwise cause severe health consequences. Observing this fact, this work focuses on fabrication of fly ash-based tubular ceramic membrane using 75% fly ash, 20% quartz, 5% calcium carbonate. The fabricated membrane possesses an average pore size of 0.133 μm and porosity of 40.17%, along with outstanding chemical and mechanical strength. The separation efficiency of the membrane was further tested by conducting microfiltration of biodiesel emulsion with a glycerol content of 8.33 wt.%, at different applied pressures lying between 207 and 483 kPa. Experiments revealed that microfiltration was successful in bringing down the glycerol content of biodiesel and the permeate obtained in the pressure range of 207-345 kPa contained even less than 0.02 wt.% free glycerol, thus satisfying the norms prescribed by ASTM D6751 and EN14214. Therefore, it can be concluded that the fabricated fly ash-based tubular ceramic membrane has every potential to be used industrially for separation of glycerol from biodiesel.
IL 2	**Pallavi Mahajan-Tatpate** School of Chemical Engineering, Dr. Vishwanath Karad MIT World Peace University, Pune, Maharashtra Topic: Enhanced Oil-Water Separation and Recovery using Composite Membranes, its Challenges and Future Scope: A Review Oil-water separation is necessary to prevent environmental pollution and protect natural resources. The release of oil into the environment has significant impacts on aquatic ecosystems, wildlife, and human health. Oil can harm fish and other aquatic life by clogging their gills or damaging their reproductive systems. It can also impact shorelines, making them unsuitable for recreation or wildlife habitat. Also, it affects the soil quality and crop production. In addition to environmental impacts, oil-water mixtures can also impact the efficiency of industrial processes. For example, if oil is present in water used for cooling, it can reduce the efficiency of heat transfer and increase the energy needed for the process. This constituent is found in the form of oil-in-water emulsions,

	hydrocarbons, fats, and petroleum fractions like kerosene, gasoline, and diesel oil. The sources of oil and water mixture are due to oil spills, leaks from oil and gas production sites, or discharge from industrial processes *viz.* petrochemical, pharmaceutical, food, metal processing industries etc. Various traditional technologies and advanced membrane techniques were documented, and the benefits and drawbacks were discussed in this manuscript.Yet, as technology advances, enhancement of the purification process, and value additions approach give new possibilities for improvement. The commercialization of these solutions, their global reach, and their dependability to lower the system's maintenance and operating costs are just a few of the challenges that still need to be addressed despite these recent trends in development of environmentally friendly methods. The review will discuss the different mixed matrix membranes composedof different nano filleradditives and its interaction with polymer. The membrane selectivity, morphologyand transport characteristics were discussed. This review will help researchersin several logical directions to create sustainable, durable, andcost-effective membranes for oil–water separation.
IL 3	**Ms. Arya. V** Assistant Professor, Department of Civil Engineering, Indian Institute of Technology, New Delhi Topic: Fouling in Membrane Bioreactor: Effect of Pharmaceuticals in Wastewater
IL 4	**Prof. Dae Woo Kim** Professor, Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul, Korea Topic: Graphitic Materials for Energy-Efficient Membrane Separation Recently, nanosheet materials have been utilized for the preparation of high-performance membranes for both liquid and gas separation. Graphene oxide, MXene, graphene nanoribbons, MOFs & zeolite nanosheets are some of the materials. The fast expansion of membrane technology and science-based on 2D materials can be attributed to several reasons. First, precise molecular sieving or selective molecular transport can be achieved by the interlayer spacing of stacked nanosheets or by the crystalline pore structure. And abundant surface functional groups can interact with penetrating molecules affecting the solubility and diffusivity. Second, the large aspect ratio, excellent mechanical and chemical stability of the nanosheet easily allow the fabrication of defect-free ultrathin film (thickness of nanometer scale) on porous support enhancing the flux of solvents or gas molecules. In this talk, various applications of the graphene-based membrane will be presented including water purification, organic solvent nanofiltration, and ion separation. Also, the scale-up of the graphene-based membrane will be discussed.
IL 5	**Dr. Pinaki Dey** Sr. Scientist, MPTD Division, CSIR-NIIST, Trivandrum Topic: Assessment of Membrane-based Processes among existing environmental remediation techniques for strategic separation and inactivation of viruses

	The prevalence of virus-infected diseases in the form of global epidemics and pandemics has become a significant threat to the normal form of human life. Recently, SARS-CoV-2and its different variants mediated global pandemichas not only raised the human mortality rates but, at the same time, largely affected the global economy. So the present condition necessitiesrigorous evaluation of the merits and demerits of existing virus treatment processes for not only to enhance the stabilityof human life against such infections but at the same time to identify the scope for developing mature technologies formaximal elimination of viral infections in coming days. As far as virus elimination from various sources are concern, membrane filtration technology has received enormous attention as the most prospective, cost-effective and energy-efficient tool among existing physicochemical treatment approaches. Based on sizeexclusion, electrostatic or hydrophobic interactions, and entrapment mechanisms, membrane-based methods holda wide range of virus removal and disinfection capacity. In the membrane separation field, electro-spun nanofibrous membranes have largely emerged as the most prospective membranes for selective capturing of viruses. Naturally available and most abundant polymeric material like cellulose got significant attention as the most potent membrane material for selective interaction and inactivation of viruses. Incorporating metal oxide nanoparticles in such materials further enhances the interaction properties and commercial viability of developed membranes.
IL 6	**Dr Kavitha N P** Sri Venateswara College of Engineering Sriperumbudur, Chennai Topic: Development of various Advanced Oxidation Process integrated Membrane bioreactor in Industrial wastewater Treatment Dr Kavitha ‘s research team mainly focuses on the elimination of impediments associated with membrane bioreactors (MBRs). The irreversible fouling was found to be immensely reduced by integrating advanced oxidation processes (AOPs) with MBR. The water parameters such as Chemical Oxygen Demand (COD) and Total Dissolved Solids (TDS) evaluated in the case of electro-oxidation membrane bioreactor (EOMBR) and photo-fenton integrated membrane bioreactor (PFMBR) in both batch and continuous mode and there is a significant removal of organic and inorganic pollutants in pharmaceutical effluent which is also proved through instrumental analysis such as Gas chromatography (GC) , UV- Vis spectroscopy and SEM -EDX. Hermia modelling was also performed and it clearly indicated that there was a minimal internal and external fouling by adopting these pretreatments and showed good agreement with SEM analysis. The most eminent result obtained in this study were the efficacy of the aforementioned AOPs to operate without the issue of filamentous bulking and implied that our pretreatments might play the key factors for the success of fouling mitigation in Hybrid systems.

IL 7	**Dr. Ramavatar Meena** Senior Principal Scientist, Central Salt & Marine Chemicals research Institute, G. B. Marg, Bhavnagar-364002, Gujarat, India Topic: Seaweed-derived sustainable membrane for water purifications India has ~7500 km long coastline that is accessible for seaweed activities including seaweed cultivation. Seaweeds represent one of the most significant and auspicious sources for numerous natural products including gelling polymers. Moreover, seaweed polymers have been widely used as a key ingredient in pharmaceutical, food, cosmetics and dairy industries as stabiliser. In recent, CSIR-CSMCRI has developed green processes for the production of these seaweed polymers under value addition programme of Indian seaweed biomass. In the recent years, synthesis of biodegradable polymeric membranes using seaweed-derived polymers for potential separation applications is demanding research in modern era. These seaweed polymer-derived biodegradable membranes are of great importance owing to their desired porosity, biodegradability, high flux rate, and recyclability. In this direction, my group has developed green and eco-friendly methods for the preparation of seaweed polymer based biodegradable membranes for potential uses such as separation of oil-water separation, emulsion separation, organic-water separation as well as waste oil separation from contaminant water. These developed biodegradable membranes are characterized using advanced analytical tools such as SEM, XPS, XRD, IR, TGA. In this talk I will provides a comprehensive review on eco-friendly process technologies for the synthesis of seaweed polymer-based membranes and their potential uses in separations.
IL 8	**Dr. Shivendra Kumar Jaiswal** Assistant Professor, Department of Physics, National Institute of Technology Patna, Bihar Topic: Sol-gel synthesis and characterization of zirconium-doped oxygen permeable $(Ba_{0.5}Sr_{0.5})(Fe_{1-x-y}CexZry)O_{3-\delta}$ membranes Perovskite-type $ABO_{3-\delta}$ (A - rare earth element, B - 3d transition metal, and δ - anion deficiency) oxides have attracted attention due to their potential applications in ceramic membranes for oxygen separation from air, gas sensors, fuel cells, solar cells, hydrogen storage, multi-ferroics, etc. [1-5]. For the first time, zirconium-doped $(Ba_{0.5}Sr_{0.5})(Fe_{1-x-y}Ce_xZr_y)O_{3-\delta}$ (x = 0 – 0.10, y = 0.10 – 0.90) oxygen-permeable membranes were synthesized using an oxalate-based sol-gel route. It shows cubic to cubic phase transformation for x = 0, y = 0 to x = 0.10, y = 0.90 via cubic + orthorhombic phases for x = 0.10, y = 0 to x = 0.10, y = 0.70 and confirmed by Rietveld refinement, performed under the space group Pm3m for cubic and Pnma for orthorhombic phases. X-ray photoelectron spectra depict the presence of (i) Ba3d, Sr3d, Fe2p, Ce3d, Zr3d, and O1s elements, (ii) iron and cerium in different oxidation states, and (iii) lattice and adsorbed oxygen at ~ 528.7 and 531.2 eV, respectively. The oxygen permeation of disc membranes (diameter ~ 10 mm, thickness ~ 1.5 mm) increases with temperature and lies in the range of 1.432 - 1.539

ml/cm^2.min for x = 0.10, y = 0.20–0.60 at 950 ^{o}C.These materials are suitable for oxygen permeation membrane (OPMs) applications.

Acknowledgements

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IL 9

Dr. M. Seenivasan

Associate Professor and Coordinator, Department of Mathematics-DDE, Annamalai University, Annamalainagar, Tamil Nadu

Topic: Zn leaching from sandy soil and its control using nano materials for prevention of water pollution and enhancing nutrient availability

IL 10

Kalpana Sharma

Teaching cum Research, Department of Physics, RIT, Bangalore

Topic: Effect of pore size on the rattling of Carbon di-oxide permeating through nanoporous Graphene membrane and its Infrared signature

A single CO2 molecule, which is assumed to be linear, is positioned in the plane of a nanoporous Graphene sheet. The single point energy (SPE) of the CO2 molecule is calculated as a function of the orientation angle (θ), keeping the central C atom fixed to the centre of the nanopore. The above study is performed for different sizes of the pore etched in nanoporous Graphene. We have used Density Functional Theory using the B3LYP/ 6-31++G(d,p) basis set for our above studies. A careful analysis of the SPE variation with θ reveals that the gas molecule exhibits very high frequency (THz) range angular oscillations. The frequency varies sharply with the size of the nanopore and is found to decrease as the nanopore size increases. Further, we report, for the first time, an empirical support of this high frequency rattling motion of the CO2 molecule in the Infrared spectrum of the nanoporous Graphene sheet in the form of a pronounced spike in the absorption intensity of the C-H bonds, which hem the boundary of the nanopore, due to functionalization of the terminated C-C bonds caused due to the creation of the nanopore by deletion of the C atoms.

IL 11

Veereshgouda Naragund

Materials Science Division, CSIR – National Aerospace Laboratories, Old Airport Road, Bengaluru-560017, India

Topic: Fabrication and characterization of an electrospun nanofiber membrane - based face mask

This work reports a comprehensive study of performance parameters of a nanofiber membrane-based face mask such as bacterial filtration efficiency (BFE), particulate filtration efficiency (PFE), blood splash resistance and differential pressure. Polyacrylonitrile (PAN) was used for face mask fabrication due to its commercial availability and ease of electrospinning.

	Initially, PAN nanofiber membrane of thickness ~200µm was prepared over polypropylene (PP) support material by electrospinning of 12 w/v % PAN in DMF solution to form a three-layer filter media i.e. PP- PAN-PP. This membrane was tested for BFE as per American society of testing and materials (ASTM) F2101. The BFE test on the filter media showed complete reduction (> 99.9%) of bacterial aerosols. This membrane material was used for fabrication of face masks which were characterized for PFE, blood splash resistance and thedifferential pressure across the face mask. The face mask has shown 97.86 % PFE in reducing 0.3µm particles, passed the blood splash resistance test at 160 mmHg, and exhibited differential pressure of 59.548 Pa/cm^{2}as per ASTM F2299, ASTM F1862 and EN 14683:2019 respectively. The above results suggest that 3-layered PP-PAN -PP fabric can be used for fabrication of N95/medical grade face masks.
IL 12	**Dr. Md. Mushfequr Rahman** Helmholtz-Zentrum Hereon, Institute of Membrane Research, Max-Planck-Straße 1, 21502 Geesthacht, Germany Topic: Charge and size selective thin film composite membranes having tannic acid – ferric ion network as selective layer Most of the commercial nanofiltration membranes are thin film composite (TFC) membranes containinga crosslinked polyamide selective layer prepared by *in-situ* interfacial polymerization. The use of toxic organic solvents and acid chlorides in interfacial polymerization is a concern for the environment. The coordination complex of metals and polyphenolshave been developed in the last decade as an alternative strategy to prepare the selective layer of the nanofiltration membranes. The metal polyphenolic network (MPN) based selective layer is fabricated in a green method as no toxic solvents are involved. Tannic acid (TA) andferric ion (Fe^{3+}) is the most popular choice to prepare the MPN layer containing membranes.So far the separation mechanisms of this class of membranes remains largely unexplored. We prepared the TA-Fe^{3+} selective layer having approximately 10 nm thickness on top of a microporous polyacrylonitrile support using aqueous solutions. The morphological, chemical and physical properties of the membranes were investigated. The dye separation performance of the membranes was analyzed using dead end stirred cell filtration. We aimed to describe the transport of aqueous solutions of dyes through these membranesusing the transport parameters of the Spiegler–Kedem–Katchalsky (SKK) model. The reflection coefficient (σ) and solute permeability (P_S) of the considered TA–Fe^{3+} membranes were estimated from the non-linear model equations to predict the retention of solutes. The coefficients σ and $P_S$depended on the porous medium and dye molecular size as well as the charge. The simulated rejections were in good agreement with the experimental findings. The model was further validated at low permeate fluxes as well as at various feed concentrations. Discrepancies between the observed and simulated data were observed at low fluxes and diluted feed solutions due to limitations of the SKK model. This work provides insights into the mass transport mechanism of dye solutions and allows the prediction of dye rejection by the TFC membranes containing a TA–Fe^{3+} selective layer

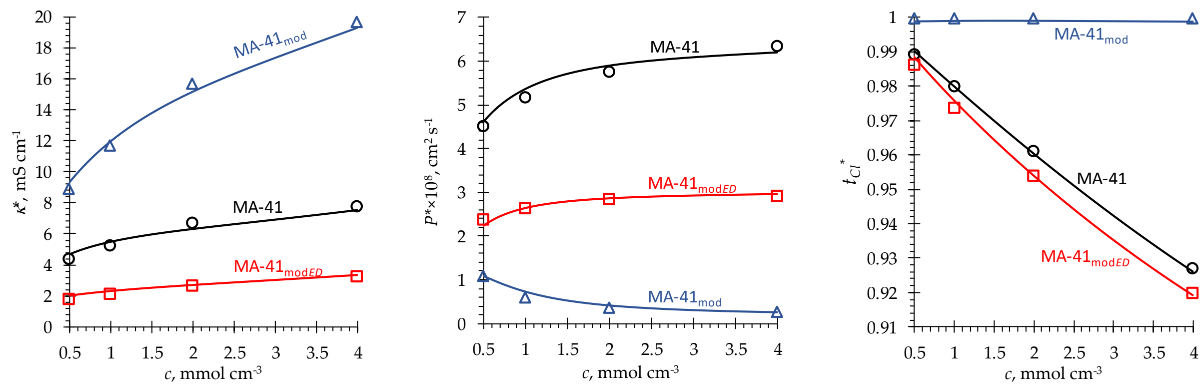
	using an SKK model.This work paves a way for eco-friendly membrane synthesis for diverse applications in water and wastewater treatment.[1] Reference [1] H.H. Kinfu, M.M. Rahman, N. Cevallos-Cueva, V. Abetz, Mass Transport of Dye Solutions through Porous Membrane Containing Tannic Acid/Fe^{3+} Selective Layer, Membranes, 12 (2022) 1216.
IL 13	**Dr. Krishnakumar B** Senior Principal Scientist, Environmental Technology Division, CSIR-NIIST, Thiruvananthapuram Professor and Academy for Scientific and Innovative Research (AcSIR), Ghaziabad Topic: Field demonstration of an integrated bio-physical process for generating drinking water from endocrine disrupting perchlorate contaminated groundwater
IL 14	**Dr. Subhankar Basu** Assistant Professor, Department of Applied Sciences and Humanities, NIAMT Ranchi, Jharkhand Topic: Metal organic framework (MOF)-MIL-96 filters with high performance for fluoride removal from wastewater Iron and steel manufacturing industries generate huge volumes of wastewater (cooling, dust suppression, cleaning, heat control, transport of waste, etc.). The wastewater contains 150-500 mg/L of fluoride, which is added (e.g. hydrofluoric acid) during the steel processing. The existing common effluent treatment methods are inefficient for removing fluoride from the wastewater. On the other hand, the fluoride-contaminated wastewater generated in the processing plants may be recovered at its source. The most effective technology could be the selective adsorption of fluoride from waste streams. Metal organic frameworks (MOFs) are a new class of crystalline materials characterised by high surface area, large pores, and tuneable pore channels and are suitable adsorbents. This study reports the efficiency of MOF MIL-96 for the recovery of fluoride from the wastewater of Tata Steel Ltd., Jamshedpur. Wastewater was collected from the blast furnace (170 mg/L) and coke plant (130 mg/L). The study was conducted with synthetic wastewater (10-150 mg/L F concentration) and industrial wastewater. MIL-96 showed 90% fluoride recovery at low F concentrations (10-20 mg/L) with 1 g MIL-96/L of fluoride solution and 98% fluoride recovery at high F concentrations (130-150 mg/L) with 4 g MIL-96/L of fluoride solution. For real wastewater, 95-97% fluoride recovery was obtained with a similar dose of MIL-96 adsorbent within 1 hour of the study period at ambient temperature. The characteristics of the wastewater before and after adsorption shows that phosphate is the competing ion with fluoride for the same adsorption sites. MOF MIL-96 was used to prepare MOF-filters for scale-up to an industrial scale. The MOF filter also showed high fluoride uptake; this indicates that the MOF filters could be used for multiple adsorption-desorption processes.

IL 15	**Dr. Subhashish Dey** Assistant Professor in Civil Engineering Department, SR Gudlavalleru Engineering College, Andhra Pradesh, India Topic: Measurements of Ground water Parameters and their remedies Elimination of Hardness removal from water by using various plant leafs Biosorbents
IL 16	**A. Kozmai** Kuban State University, Membrane Institute, Krasnodar, Russia Topic: Properties of freshly prepared and stabilized anion-exchange membranes obtained by polypyrrole-based modification In spite of wide variety of commercial ion-exchange membranes, their characteristics, in particular, electrical conductivity and counterion permselectivity, are unsatisfactory for some applications, such as electrolyte solution concentration. This study is aimed at obtaining an anion-exchange membrane (AEM) of high performance in concentrated solutions by using a polypyrrole (PPy)-based modification. **1. Introduction** The literature shows that PPy-based modification is mainly used to obtain mono-valent-ion-selective membranes [[i],]. As far as we know, only the papers of Salmer-on-Sanchez et al. were aimed at improving membrane conductivity via PPy-based modification and successfully solved this task for relatively dilute NaCl solutions (up to 0.04 M). Note that the authors used the microheterogeneous model (MHM) to interpret their results. This model suggests that IEM can be considered as a two-phase system consisting of a microporous gel phase and a solution that fills the intergel spaces. **2. Material and Methods** In this work, we compare the properties of anion-exchange membranes MA-41(Schekinoazot, Russia) and CJMA-3(Hefei ChemJoy Polymer Materials Co., China) with their PPy-based modifications MA-41$_{mod}$, MA-41$_{modED}$ and CJMA-3$_{mod}$. The MA-41$_{mod}$ membrane is a membrane freshly obtained after modification; the MA-41$_{modED}$ membrane is an MA-41$_{mod}$ one used in an ED process; the CJMA-3$_{mod}$ membrane is a membrane subjected to a gradient modification with PPy, and has undergone an ED process. We developed a new version of the MHM , which takes into account the presence of PPy in macro- and mesopores via its equivalent volume in dry form and its exchange capacity. This MHM version also accounts for the loss of water by the membrane with an increase in the bathing solution concentration and associated decrease in the swelling degree.

Membrane conductivity and diffusion permeability were measured at 25°C.

3. Results and Discussion

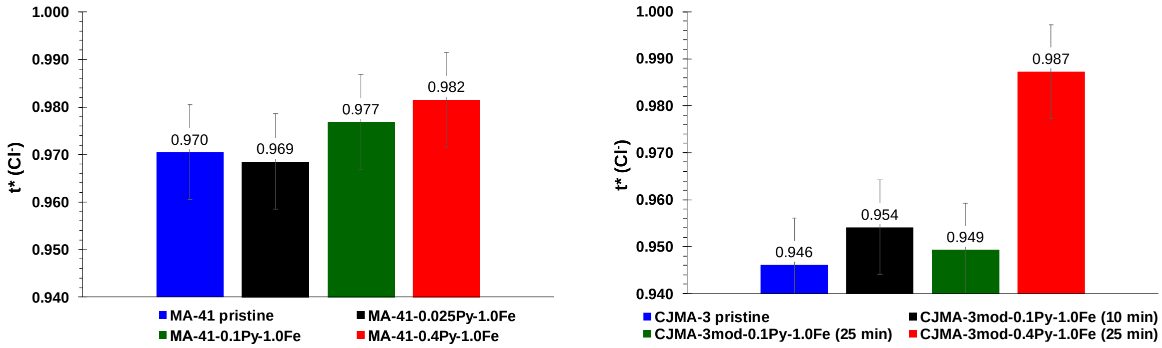
The concentration dependences of the membrane electrical conductivity, diffusion permeability and transport numbers of Cl^- ions for the pristine and volumetrically modified MA-41 membrane immediately after modification (index "mod") and after processing during electrodialysis (ED, index "modED") are shown in Figure 1 .



a b c

Figure 1. Experimental (markers) and simulated (solid lines) concentration dependencies of (a) electric conductivity, (b) diffusion permeability, (c) counterion, Cl^-, transport number of MA-41, MA-41$_{mod}$ and MA-41$_{modED}$ membranes.

At first glance, it seems that a very high conductivity of the MA-41$_{mod}$ membrane contradicts the fact that its diffusion permeability is very low (Figure 1). However, the model explains this effect by a very low effective mobility of coions in the macropores occupied by PPy. We show that a PPy-based modification of an AEM can lead to a membrane of exceptional performance. Its conductivity reaches almost 20 mS/cm and the Cl^- transport number t_{Cl}^*> 0.99 in 4 M NaCl. Although PPy as a modifier makes it possible to obtain a membrane with extraordinary performance (when the membrane with PPy is freshly prepared), this polymer is not stable. It degrades, in particular, under attacks of OH^- ions, which can be a product of water splitting at the membrane/solution interface due to a relatively high catalytic activity of PPy relative to water splitting.In order to suppress the effect of water splitting, a gradient modification of MA-41 and CJMA-3 membranes with PPy was carried out. In this case, as Figure 2 shows, the transport number of Cl^- ion in the membrane equilibrated with a relatively concentrated NaCl solution (2 M) reaches 0.982 for the sample obtained on the basis of the MA-41 membrane and 0.987 for the sample obtained on the basis of the CJMA-3 membrane, while for the pristine membranes, this value is 0.970 and 0.946, respectively.



a b

Figure 2. Transport numbers of counterion (Cl^-) in 2.0 M NaCl solution for pristine MA-41 (a) and CJMA-3 (b) membranes and their gradient modifications. Concentrations of Py and $FeCl_3$ used in the modification procedure are indicated in the figure legend (for example, MA-41-0.1Py-1.0Fe means 0.1 M of Py and 1.0 M $FeCl_3$).

It should be noted that the greatest increase in selectivity was achieved for the CJMA-3 membrane due to the fact that the fraction of macropores in its structure is higher than that in the MA-41 membrane.

The increase in conductivity and counterion selectivity for both membranes is achieved due to filling the non-selective macropores with PPy, which is in an ion-conductive oxidized form, where thecharged groups are positive polarons stabilized by Cl^- anions.

IL 17

Olesya Rybalkina
Kuban State University, Krasnodar, Russia

Topic: Enhancement the performance of electrodialysis recovery of phosphates by modifying commercial membranes containing weakly basic fixed groups

The electrodialysis recovery of phosphates from various effluents is promising as part of a nutrient circular economy. The performance of electrodialysis can be increased by modifying anion exchange membranes that contain weakly basic fixed groups. Shelding of these groups with a modifier leads to an increase in the phosphate current efficiency at given energy consumption compared to the original commercial membranes.

Introduction

The annually increasing amount of phosphate-containing industrial and agricultural wastewater causes eutrophication of water bodies. In addition, the world's natural phosphate-bearing minerals are expected to be depleted in the coming decades [1]. The solution to these problems is the recovery of phosphates from wastewater and their return to production.Electrodialysis (ED) is a technique that allows not only the selective recovery of phosphates, but also their concentration to commercially attractive values. In addition, many people pay attention to the low current efficiency and high energy consumption in ED treatment of solutions containing phosphates.

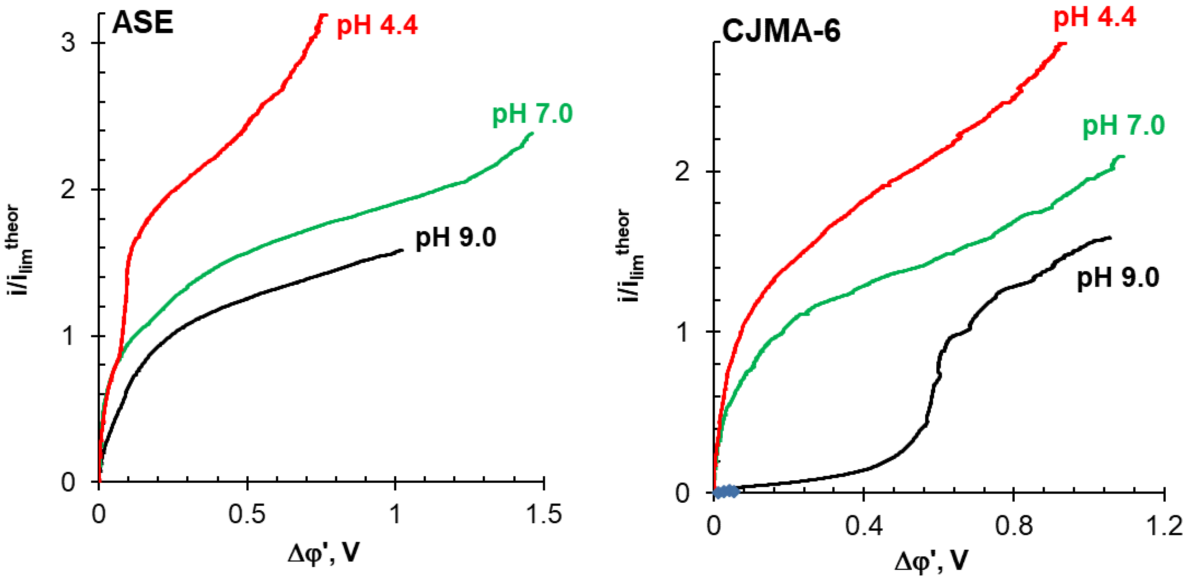
We have shown experimentally and using mathematical modeling that one of the reasons for low current efficiency is a mechanism that we called “acid dissociation” [2]. Getting into the anion exchange membrane (AEM), singly charged anions of phosphoric acid participate in protonation-deprotonation reactions. The protons formed in these reactions are excluded from the AEM by Donnanmechnism acidifying the desalted solution. Doubly charged anions of phosphoric acid are accumulated and transported Inside the AEM.Another reason for low current efficiency, which is discussed in the scientific literature, is "steric hindrance" in the transport of highly hydrated multiply charged phosphoric acid anions, as well as the sorption of these ions inside the AEM. Our work is focused on studying the influence of the composition of fixed groups of anion-exchange membranes on their electrochemical behavior in phosphate-containing solutions, as well as on the search for methods for modifying anion-exchange membranes to increase the current efficiency and decrease energy consumption during the ED recovery of phosphates.

Material and Methods

Homogeneous anion exchange membrane produced by Hefei Chemjoy Polymer Materials Co. Ltd., China (CJMA-2, CJMA-3, CJMA-6, CJMA-7), as well as from Astom, Japan (AMX, ASE) were studied in NaCl and $Na_{(3-x)}H_xPO_4$ solutions using IR spectroscopy , voltammetry and electrochemical impedance spectroscopy.In addition, desalting of a 0.03 M NaH_2PO_4 solution (pH 4.4) was carried out in a laboratory ED cell containing the studied AEMs.The transport numbers of singly, doubly, and triply charged phosphoric acid anions through these membranes were determined by the method described in [2].Some of the AEMs were modified layer-by-layer metod using polyquaternium-22 (PQ-22) and polystyrenesulfonic acid (PSS) or bulk modified using PQ-22.

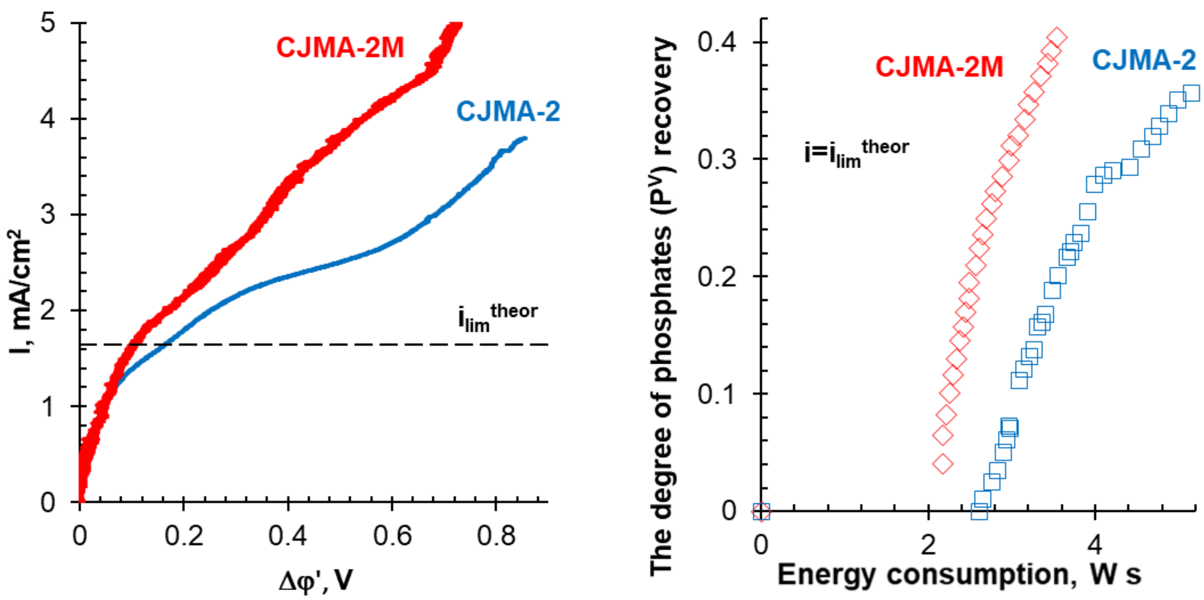
Results and Discussion

The influence of the pH of the feed solution on the shape of the current-voltage characteristics (CVCs) of membranes that contain only quaternary ammonium groups (Figure 1a) can be easily explained if the "acid dissociation" mechanism is taken into account. At pH 4.4, the first CVC plateau near $i=i_{lim}^{theor}$ corresponds to the depletion of the electrolyte concentration at the AEM/depleted solution interface.The subsequent increase in current is caused by the conversion of $H_2PO_4^-$ anions into HPO_4^{2-} inside the AEM and the ejection of protons into the depleted solution. The second CVC plateau near $i=2i_{lim}^{theor}$corresponds to the saturation of AEM with doubly charged HPO_4^{2-} anions.In the case of pH 9.0, both the solution and the AEM contain mainly only HPO_4^{2-} anions. The “acid dissociation” mechanism has almost no effect on the CVC shape. Therefore, the curve has a shape characteristic of substances that do not participate in protonation-deprotonation reactions (NaCl). The CVC for a solution with pH 7 has an intermediate form.In the case of AEMs containing a significant amount of weakly basic fixed groups, the limiting currents, determined from the sloped CVCs plateaus, decrease (pH 4.4 and 7.0). In solutions with pH 9.0, the CVC takes on a shape characteristic of bipolar membranes (Figure 1b).The reasons for the observed changes are the chemical and electrostatic interactions of secondary and primary amines (fixed groups) with multiply charged phosphoric acid anions.



a b

Figure 1 Current-voltage curves of ASE (a) and CJMA-6 (b) membranes in 0.02 M $Na_{(3-x)}H_xPO_4$ solutions with pH from 4.4 to 9.0. The current density is normalized to the theoretical limiting current calculated according to the modified Leveque equation



a b

Figure 2 Current-voltage curves of AEMs in 0.02 M NaH_2PO_4 solution at pH 4.4 (a) and the degree of phosphate recovery vs energy consumption during batch ED desalination of 0.03 M NaH_2PO_4 solution (pH 4.4)

Changing the surface characteristics of such AEMs by layer-by-layer modification does not lead to a noticeable improvement in ED performance when desalting phosphate-containing solutions. On the contrary, bulk modification using PQ-22 leads to a decrease in the recorded potential drop at given current density (Figure 2a), to a decrease in the proton generation rate, and to a decrease in energy consumption to achieve a given degree of phosphates recovery from a desalted solution (Figure 2b) compared to the original commercial membrane.

Conclusions

Weakly basic fixed groups in AEMs negatively affect ED performance when desalting phosphate-containing solutions. Modification of such membranes with polyelectrolytes that shield these groups allows solving this problem.

Acknowledgements

The Russian Science Foundation, project No. 21-19-00087, funded this study.

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IL 18

Dr. Noel Jacob Kaleekkal
Assistant Professor, Department of Chemical Engineering, National Institute of Technology Calicut, Kerala

Topic: Membrane Distillation as a Potential Technology for Water Recovery

Membrane Distillation (MD) is an emerging technology operating at modest temperatures and is useful in seawater desalination and water recovery. In our work, hydrophobic Polyvinylidene fluoride (PVDF) and its copolymers (PVDF-HFP) were used to fabricate microporous membranes using phase inversion and electrospinning techniques. The effect of

(i) membrane fabrication conditions, (ii) concentration or molecular weight of pore formers,

(iii) post-fabrication treatment such as hot pressing, (iv) surface modification using fluoroalkyl silanes (such as 1H,1H,2H,2H per fluorooctyl triethoxysilane (PFOTES,) 1H,1H,2H,2H perfluorodecyl triethoxysilane, etc.) and (v) nanomaterials- ZIF-8, MCF-5, SBA-15, etc. were investigated in great detail. The performance of the prepared membranes was evaluated in terms of (a) operating parameters – feed/permeate flow rates, temperature gradient, (b) solute concentration, (c) presence of organic foulants- sodium alginate, humic acid, (d) surfactant concentration.

	PVDF-HFP phase inversion membranes surface modified using 10 wt./vol % hydrophobic ZIF-8, and PFOTES exhibited a WCA of ~ 122° with an excellent anti-wetting ability for up to 240 minutes when challenged with 0.1mM sodium dodecyl sulfate and proved to be stable for > 10 h for direct seawater desalination in the direct contact membrane distillation mode. Dual-layered PVDF electrospun nanofibrous membranes containing a modified MCF-5 (top layer) displayed a WCA of ~ 142°, with an average flux of 6 LMH and NaCl rejection >99.98%.These membranes could remove > 95 % of pharmaceutical contaminants present in wastewaterand could withstand upto 1.5mM surfactant (CTAB) in the feedwater. When integrated with pre-treatment techniques such as nanofiltration (NF), electrospun membranes in DCMD showed potential to treat saline oily wastewater with excellent rejectionof oil/surfactant emulsion (>98%) and inorganic salts (100%). The reusability of the fouled membrane was also investigated after backwashing. Keywords: Membrane distillation; desalination; phase inversion; electrospinning; fluoroalkylsilane;
IL 19	**Preeti Sunil Kulkarni** Department of Chemistry MES AbasahebGarware College (Autonomous), Maharashtra, India Topic: Chitosan and Alginate beads and membranes for sorption of heavy metals and dyes from wastewater: Mechanism through kinetic and thermodynamic models
IL 20	**Anshul Yadav** Scientist, Membrane Science and Separation Technology CSIR-Central Salt and Marine Chemicals Research Institute, Bhavnagar - 364002, Gujarat. Topic: Optimization of fouling resistant membranes for high flux distillation
IL 21	**Dr. Md PalashuddinSk** Assistant Professor, Department of Chemistry, Aligarh Muslim University, Aligarh, India Topic: Biomass-derived Superhydrophobic Carbon Dots for Efficient and Comprehensive Cleaning of Oil Spillages
IL 22	**Dr. Alberto Figoli** Director Institute on Membrane Technology (ITM-CNR) Via P. Bucci, Cubo 17c 87036 Rende (CS), ITALY Topic: Innovative membranes for water treatment and desalination application Membrane distillation (MD) has been proved to be a process able to desalt highly saline waters. However there is still a lack of membranes produced at large scale for this technology and approaches for determining the temperature polarization. In this direction, the presentation is

focusing on two innovative approaches: *i)* polymeric membrane preparation tailored for MD applications; *ii)* innovative mapping temperature polarization in MD. In the first case, UV-curable perfluoropolyether (PFPE) hydrophobic compounds (Fluorolink®) are successfully employed as surface modifier via coating technique of commercial microfiltration hydrophilic membranes [1]. The produced coated membranes consist of a thin hydrophobic porous active layer overlying the hydrophilic commercial membrane support. In this way, the supported membrane with the right morphology can be selected "a priori" because after coating the membrane keep their native properties by acquiring new features. Membrane performance was tested in direct contact membrane distillation (DCMD) configuration, using deionized water and salty solution (0.6 M), obtaining a salt rejection of ~99.95% during prolonged test (158 h). The second approach consists in the use of temperature sensitive luminescent probe (tris (1, 10-phenanthroline) ruthenium (II) chloride (Ru(phen)3), immobilized in flat poly (vinylidene fluoride) electrospun nanofibers membrane (PVDF ENM) [2]. In this way, the luminophore allowed us to non-invasively map the temperature on the membrane surfaces during the DCMD experiments. The bulk temperature of the water streams was monitored using an IR-camera while the luminophore allowed monitoring on-line the temperature of the membrane during the DCMD process. Thanks to the information obtained by the IR camera and luminophore, is possible to study how several effects such temperature and feed velocity affected the performance of the process.

Keywords: Luminescent molecular probes; thermal polarization; PFPE Fluorolink® coating; desalination.

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IL 23

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Kuban State University, Krasnodar, Russia

Topic: Application of hybrid electro-baromembrane process for selective separation of Li/Co-ions

New processes for recycling valuable materials from used lithium-ion batteries (LIBs) need to be developed. This is critical to both meeting growing global demand and mitigating the e-waste crisis. Currently, material resource and energy-intensive pyro- and hydrometallurgy are used for this on commercial plants. In contrast to the use of non-environmentally friendly processes, this work shows the results of testing a hybrid electrobaromembrane method for the selective separation of Li^{+} and Co^{2+} ions.

1. Introduction

The literature shows that membrane methods can be as good as traditional reagent-based methods in the selective extraction of lithium from primary (natural waters) and secondary sources (extracts of spent LIBs) [1,2]. However, well-developed electrically and pressure-driven membrane methods make it possible to selectively separate single and multiply charged ions of the same charge sign [1]. At the same time, the separation of ions of the same charge value is practically impossible using membrane methods.

The separation of such ions can be realized using the countercurrent electromigration method, which is also known as counter-current electrophoresis or hybrid electrobaromembrane (EBM) method. In recent works in EBM devices, it was possible to achieve impressive results in the separation of Li^+/K^+ ions, which simplify the composition of natural waters [3–5]. It was shown that the selective permeability coefficient for the Li^+/K^+ ions can vary from 59 [3] to 150 [4,5]. For the Li+/Na+ pair, the selective permeability coefficient is somewhat lower and reaches 30 [4]. However, the EBM method has not yet been tested in the recovery of lithium from secondary sources represented by concentrates or liquors of spent LIBs.

2. Material and Methods

In this work, we use a track-etched membrane (TEM #811), which was produced from a polyethylene terephthalate (PET) film at Joint Institute for Nuclear Research, (Dubna, Russia). The properties of the TEM are previously described in the Ref. [3]. The average pore diameter of the membrane is 35 nm. Left and right, the TEM is surrounded by auxiliary anion-exchange (AOM) MA-41 heterogeneous membranes (JCC Shchekinoazot, Russia) to form flow chambers. Solutions of the same composition are pumped through these chambers to the left and right of the TEM. They contain 0.1M Li_2SO_4 and 0.05M $CoSO_4$, which simplifies the composition of the spent LIBs leachate (Fig. 1).

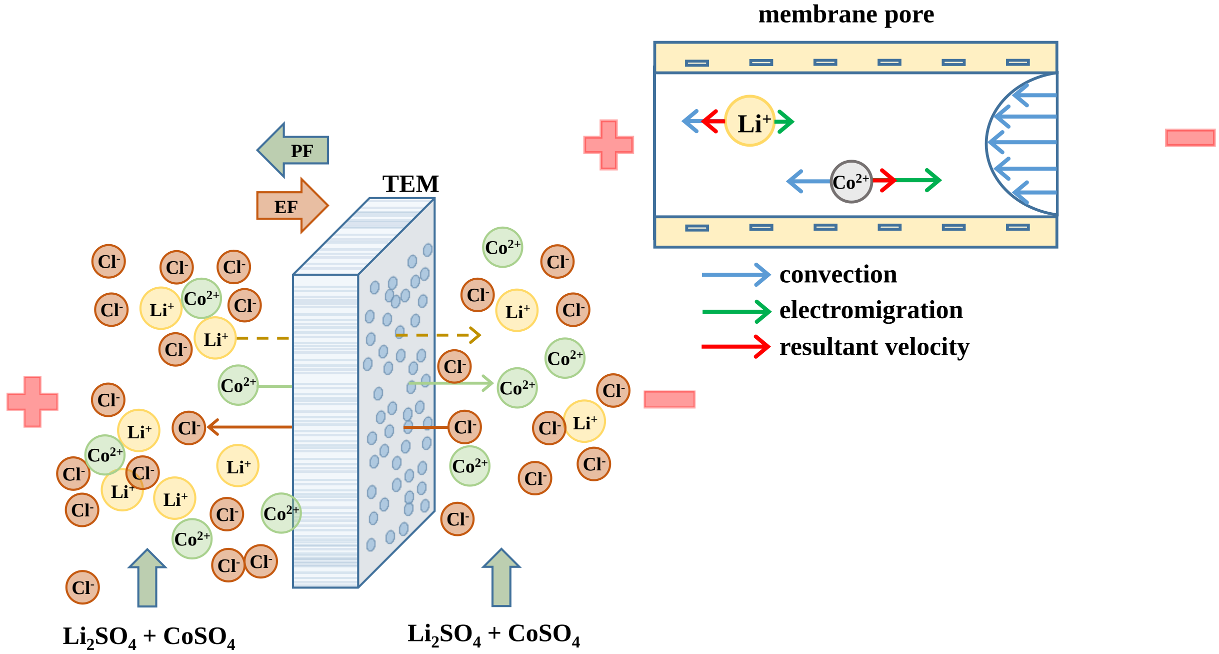

Figure 1. Scheme of ion separation by hybrid electrobaromembrane method (a) and ion fluxes in the pore of the TEM #811 track-etched membrane (b). The velocity of electromigration (green arrows) is proportional to the ion mobility; the velocity of convective transfer (blue arrows) is the same for both ions, the resulting velocities (red arrows) can be directed in different sides

3. Results and Discussion

Separated ions of the same charge sign move in an electric field through the pores of a non-selective porous TEM to the corresponding electrode, while a commensurate counter convective flow is created in the pores. The selectivity of separation is achieved due to the difference in the mobility of the ions being separated in an electric field (Fig. 1).

Figure 2 shows flux densities of Li^+ and Co^{2+} ions (circles) through the TEM #811 membrane. When a pressure drop (0.3 bar) is set in the system, and the current is small (50 A/m^2), the ions do not have enough electromigration component to overcome the counter convective flow in the wide pores of the membrane. With increasing the current in the system both the lithium and the cobalt fluxes reach zero. However, due to the different mobility of the ions being separated, this occurs at different current values.

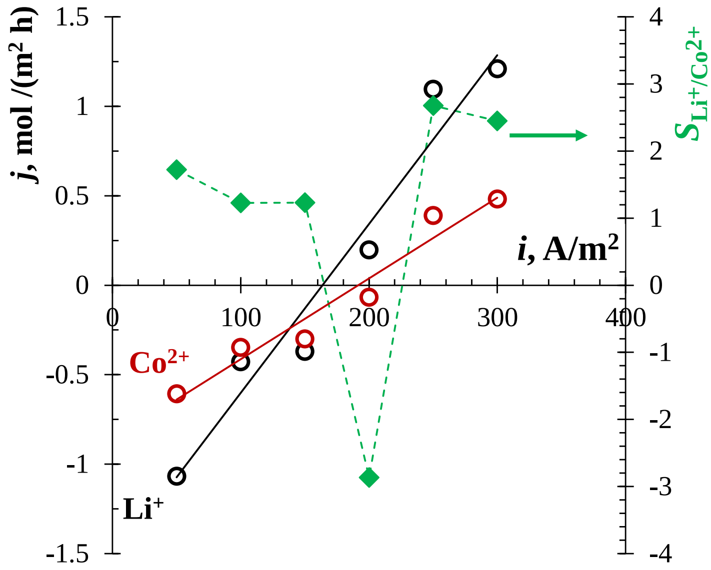

Figure 2. Flux densities of Li^+ and Co^{2+} ions (circles) through the TEM #811 membrane, as well as the selective permeability coefficient *S* (diamonds) vs. settable current in the EBM system at a constant differential pressure of 0.3 bar. The solid and dashed lines for the dependencies are given to lead the eye.

For selective separation of Li^+ and Co^{2+} ions the options at 200 A/m^2 are of interest. The separation parameters can be chosen so that the cobalt flux is still controlled by the convective flow, while the lithium flux is determined by the electromigration component. The fluxes of separated ions are directed in different directions. The ions can be concentrated in different chambers adjacent to the TEM. We are currently working on refining the fluxes of ions to be separated in this situation and increasing the separation selectivity when using other options [1].

4. Conclusions

The hybrid electro-baromembrane method can become a reagentless alternative to traditional processes for extracting lithium from primary and secondary sources. It has been established that the use of two oppositely directed driving forces makes it possible to achieve selective separation of ions due to their different mobility in an electric field. It seems that this is the only membrane method in which the fluxes of ions of the same charge sign can be directed in different directions. Lithium and cobalt the products can be obtained from different sides of the track-etched membrane used for separation.

Acknowledgements

This study was funded by the Russian Science Foundation, project № 22-79-00178, https://rscf.ru/project/22-79-00178/

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IL 24

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DPG Institute of Technology and Management, Gurugram, Haryana, India

Topic: Water pollutant remediation through application of Metal OrganicFramework membranes

It has been increasingly evident that climate change and industrialization has impacted the lives and health of millions of people especially in terms of food security, water- and water-borne diseases. Apprehending to the human rights to access safe and clean drinking water, it's the need of the hour to consider more evidence based, systemic and scaled-up implementations. It was reported that worldwide annually, approximately two million preventable deaths were due to meagre water and sanitation with majority of burden falling on the children who were under the age of five. In the face of polluted water, adaptation of novel and advanced technologies has become obligatory. The presented paper exhibits the reviews of different and researchers and summarizes that how membrane technology has come up with different faces to tackle the water related issues. Metal Organic Framework (MOF) membranes have come across a long way to be an efficient and reliable separation technology. The exceptionally controlled porosity, ultra-high surface area and unique physio-chemical performances has its ubiquitous presence in industrial and academic communities. Comprehensively, a number of pollutants has been extracted from water by using MOF membranes and have manifested increasingly admirable performance.

Keywords: Metal organic framework, membrane, nanotechnology, linkers, absorptive

IL 25

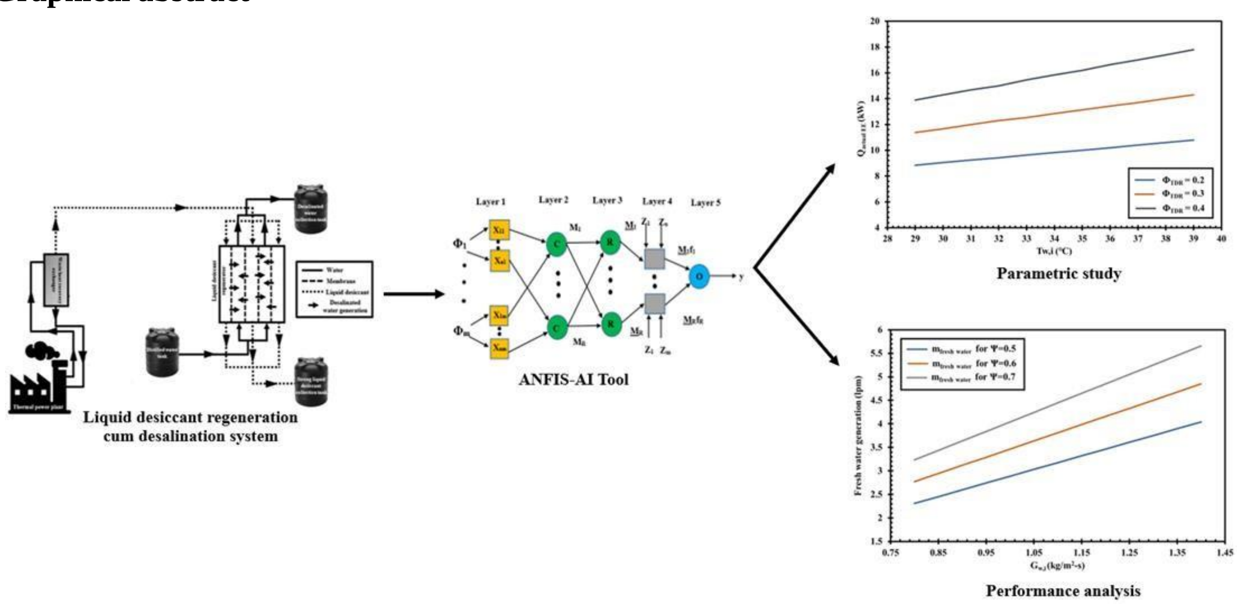
Dr. B. Kiran Naik

Assistant Professor, Thermal Energy Systems Laboratory (STESL), Mechanical Engineering Department, NIT Rourkela, Rourkela

Topic: Parametric Investigation of Membrane Based Liquid Desiccant Regeneration cum Desalination System Employing ANFIS-AI Tool

In this paper, for the first time, an adaptive-network-based fuzzy inference system (ANFIS) type artificial intelligence tool has been implemented for parametric and performance investigations of flat plate membrane based liquid desiccant regenerator cum freshwater extraction (desalination) system employing industrial waste heat as low-grade energy source. Initially, the feasibility of the ANFIS-AI tool for performance analysis of regeneration cum desalination system is carried out. The outlet and performance parameters chosen for this study are vapour pressure and temperature of water and liquid desiccant, freshwater generation rate, energy exchange and seasonal energy efficacy ratio. From the feasibility study, it is found that ANFIS-AI tool is in good agreement with the experimental data with the mean absolute error (MAE), root mean square error (RMSE), mean absolute percentage error (MAPE), coefficient of determination (R^2) and error approximation of 0.049, 0.038, 0.19, 0.99 and ±8.3%, respectively. Using trained ANFIS-AI tool, the influence of inlet parameters such as water and solution inlet temperature as well as flow rate, thermal and moisture effectiveness's on freshwater generation and energy exchange are investigated in detail. From the parametric and performance analyses, maximum freshwater extraction rate and energy exchange observed across the membrane based liquid desiccant regeneration/desalination system are 5.8 liters per minute and 17.8 kW, respectively. Further, influence of water inlet temperature on system efficacy ratio is also assessed and understood that during summer season more fresh water is generated compared to winter and rainy seasons.

Graphical abstract



IL 26	**Dr. Dasari Ayodhya** Department of Chemistry, Osmania University, Hyderabad Topic: Construction of Ag/CuO@gCN heterojunction composite membrane with competent photocatalytic degradation of 4-hydroxybenzoic acid and 3-phenoxybenzoic acid for wastewater treatment Membrane separation and advanced oxidation processes (AOPs) with heterojunction based composites have been respectively demonstrated to be effective for a variety of water and/or wastewater treatments. In this study, a highly efficient visible light-driven photocatalytic membrane composed of Ag/CuO@gCN membrane was successfully designed and fabricated via a via facile calcination route. The uniformly assembled membrane, Ag/CuO on gCN sheets were confirmed by using UV-vis DRS, XRD, TEM, BET surface area, and FTIR analysis. The Ag/CuO@gCN photocatalyst was optimized with amount of 15 mg/L had the highest photocatalytic degradation of 4-hydroxybenzoic acid (4-HBA) and 3-phenoxybenzoic acid (3-PBA), and it follows the pseudo-first-order kinetic constant (k) equation. The visible-light photocatalytic activities for degradation of 4-HBA and 3-PBA over Ag/CuO@gCN composite membrane are distinctly enhanced, which is 3.1 and 2.4 times that of gCN as well as Ag/CuO composite. The significantly improved performance is attributed to the synergistic effect, including lamellar configuration of gCN nanosheets and heterojunction between Ag and CuO. Furthermore, the trapping experiment was conducted to estimate the main reactive species in the degradation of 4-HBA and 3-PBA for stability of the Ag/CuO@gCN composite. The as-proposed Ag/CuO@gCN heterojunction composite membranes may shed light on the design and application of materials in water purification.
IL 27	**Andrey Kislyi** Kuban State University, Krasnodar, Russia Topic: Application of Ti_4O_7 anode from pressed granules for anodic oxidation of organic pollutants in water treatment Electrochemical advanced oxidation processes (EAOPs) are considered as promising water treatment technologies. In this study, a substoichiometric titanium oxide (Ti_4O_7) granulated anode was used for anodic oxidation (AO) of hydroquinone solution. The effect of current density on oxidation rate and current efficiency was studied. **Introduction** EAOPs are demanded technologies due to their simple design, high efficiency and high degree of mineralization. One of the well-known directions of EAOPs is AO. AO is a method in which organic components are oxidized into mineral compounds in aqueous solutions, where the main oxidizing agents are highly reactive electrochemically formed radicals [1,2]. The electrode material has a great influence on the AO efficiency. "Active" electrodes are low oxygen evolution potential (OEP) anodes (IrO_2, RuO_2 or Pt). “Non-active” electrodes are high

OEP anodes (SnO_2, PbO_2 or boron doped diamond) that promote partial and selective oxidation of pollutants (i.e electrochemical conversion). Along with other "non-active" anodes, a Ti_4O_7 has become a promising electrode material for AO due to its high electrical conductivity, chemical stability, high OEP, and relatively low manufacturing cost [3,4,5].

It is known that electrodes based on porous materials are more efficient than plate electrodes for AO. The increase in efficiency is achieved by increasing the electrode surface area and the mass transfer of organic compounds to the anode surface. Granulated electrodes made of porous material can be an alternative to solid porous electrodes.

Material and Methods

In this research, a Ti_4O_7 granulated anode was used to oxidize model aqueous solutions of hydroquinone (COD 600 mg/L). We used a 0.1 M Na_2SO_4 as a supporting electrolyte. The solution was pumped through a specially designed electrochemical cell with a Ti_4O_7 granulated anode and a grid platinized titanium cathode, in batch mode, with a constant electric current. During the experiment, samples of solutions were taken and their chemical oxygen demand (COD) values were determined by the dichromate COD test. Instantaneous current efficiency (ICE) was calculated from a COD data.

Results and Discussion

The COD value of solution of hydroquinone reached 75±24 mg/l (Figure 1a) after 5 hours of the experiment at 37 mA/cm^2. Experiments with different current densities were carried out to optimize the process (Fig. 1). Notably that the hydroquinone oxidation rate decreases with decreasing current density. However, there is a significant increase in ICE. On average for the entire time of the experiment, ICE at current densities of 37, 18 and 9 mA/cm^2 was 9%, 12%, 25%, respectively. In all experiments, the COD value at the initial time is lower than the COD of the prepared solutions. This may be due to the rapid adsorption of organic compounds on the well-developed anode surface. This can explain the extremely high ICE at the beginning of the experiment: the high content of hydroquinone near the anode surface contributes to the fact that most of the hydroxyl radicals are spent precisely on the hydroquinone oxidation reaction.

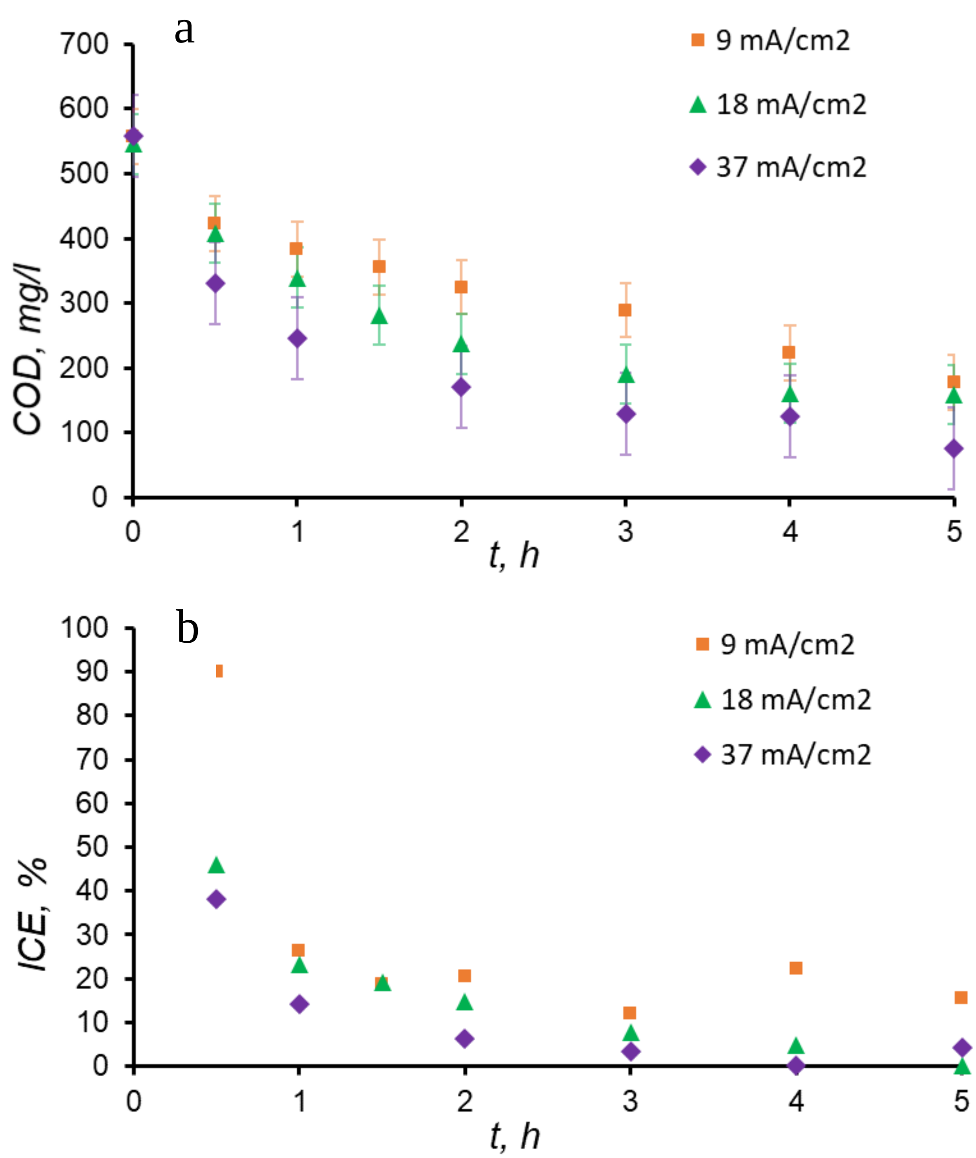


Figure 1. Dependence of the COD (a) and ICE (b) on the AO time of hydroquinone at different current densities (indicated in the graph)

Conclusions

A granulated Ti_4O_7 electrode was used as an anode in the AO process of hydroquinone solutions. It is shown that a decrease in the current density leads to a decrease in the oxidation rate and, simultaneously, to a significant increase in the current efficiency. It is possible that the use of pulsating current regimes will lead to a significant increase in the oxidation efficiency, since during the pause period (the current is equal to zero hydroquinone molecules will be sorbed on the porous anode surface.

	Acknowledgements We are grateful to the Russian Science Foundation (grant No. 22-79-10177), for the financial support. **References** 1. Panizza M., Cerisola G. // Chem. Rev. 2009. V. 109. No. 12. P. 6541. 2. Garcia-Segura S., Ocon J.D., Chong M.N. // Process Saf. Environ. Prot. 2018. V. 113. P. 48. 3. Garcia-Rodriguez O., Mousset E., Olvera-Vargas H., Lefebvre O. // Crit. Rev. Environ. Sci. Technol. 2022. V. 52. No. 2. P. 240. 4. Meng C., Zhuo Q., Wang A., Liu J., Yang Z., Niu J. // Electrochim. Acta. 2022. V. 430. P. 141055. 5. Ma J., Trellu C., Oturan N., Raffy S., Oturan M.A. // Chem. Eng. J. 2023. V. 456. P. 141047.
IL 28	**Dr Ashim Kr basumatary** Assam Engineering College, Guwahati Topic: Purification and treatment of industrial wastewater with inexpensive inorganic tubular membrane The treatment of wastewater is alarming situation in around the globe as the industrialization process increased many fold everywhere widely in the world. Conventionally various separation techniques such as distillation, absorption, adsorption, extraction are not upto the mark for fulfilling sustainability of the environment. However, the researchers have focused on application of ceramic membrane to sustain globally from the upsetting pollution. Inorganic membrane has definite special possessions like high mechanical strength, thermal stability and resistance to corrosive environment. Moreover membrane separation process can be carried out at room temperature in adding up to other benefit. It has the merits of low energy requirement and better selectivity. Ceramic membrane is superior quality in compared to polymeric and liquid membranes. The module of the membrane may be flat sheet or disc shape and tubular. The works present here is the fabrication of tubular ceramic membrane with the manufacture of low cost clay materials. Selected clay materials are mixed together and extruded in an extruder machine. It is dried for 24 hrs in ambient condition and sintered in stepwise microprocessor muffle furnace at a temperature of 950 ºC with the heating rate of 0.5 °C/ min. The prepared membrane was characterized with porosity measurement, pure water permeability test, FESEM, TGA and chemical stability to check the feasibility of the separation mechanism. The tubular membrane is utilized for the treatment of dairy wastewater and it is reported to be 52.08% removal at a low pressure of 13.08 kPa. Moreover, fouling mechanism was examined using four conventional pore blocking models.

IL 29	**Ram Naresh Bharagava** Department of Environmental Microbiology, Babasaheb Bhimrao Ambedkar University , Lucknow (U.P.), India Topic: Water pollution and it's minimization approaches Industries are the key contributors in the national economies of developing countries, but unfortunately these are also the major source of pollution in environment.Different kinds of wastewaters are produced based on different industrial activities such as distilleries, tanneries, textile, pulp and paper, pharmaceutical, electroplating, and so on.However, the nature and characteristics of industrial wastewaters vary greatly from industry to industry, mainly depending on the production process adopted, raw materials used, and quality of product produced.Industries discharge high-strength wastewaters, which cause serious environmental and health hazards due to the presence of a variety of organic and inorganic pollutants. Therefore to minimize the environmental and health threats because of water contamination, industries should discharge their wastewater into the environment only after the adequate treatment either at ETP or CETP. Besides it, common public should also adopt some practices like minimum use of fertilizers/pesticides by farmers, unwanted medicines, pesticides, paints, solvents, oil, antifreeze, or other products containing harmful chemicals should not be drained or flushed down the toilet. ***Key words:*** Industries, Chemical Pollutants, Environmental Pollution, Health Hazardous,Minimization Approaches
IL 30	**Dr. M. JEROLD** Assistant Professor, Department of Biotechnology, National Institute of Technology Warangal, Warangal - Telangana State, India Topic: Evaluation of Alginate Biopolymer Stabilized Pickering Emulsion Liquid Membrane for Methylene Blue Extraction from Aqueous solutions In the present study Pickering emulsion liquid membrane (PELM) was used for the extraction of dye from wastewater. PELM is a three-phase dispersion system that includes an immiscible organic phase in addition to two miscible liquid aqueous phases such as internal and exterior (membrane). The emulsion is created by homogenizing the aqueous internal phase and organic oil phase with solid particles as a stabilizing agent to produce water-in-oil (w/o) Pickering emulsion. Green and sustainable technology is aimed to promote the use of bio-friendly solid particles as a stabilizer for the preparation of PELM. Biopolymers act as emulsifiers by integrating them into the interfacial region of emulsion droplets by directly adsorbing them into the interface during the process of droplet development and stabilization or by interacting with other emulsifiers or biopolymer layers already present at the interface. This is primarily because of the biopolymer particles' extraordinary capacity to adsorb onto the interface, improve stability against environmental stresses, and emulsifying properties. These polymers are non-toxic, economical, and stable in nature. In the PELM system, they increase the stability of emulsion by reducing the droplet

	movement by increasing the viscosity of the liquid membrane phase. Also, biopolymers reduce the surface tension by the formation of film coating around the oil droplets which in fact results in the reduction of coalescence and creaming rate. In the present investigation, alginate biopolymer a natural emulsifier was utilized as stabilizing agent to replace the synthetic surfactants. In PELM, the petroleum based diluents such as kerosene, n-heptane and dicholoro-ethane are extensively used which are toxic, non-renewable, non-biodegradable, flammable, highly volatile in nature. Therefore, it is highly mandate to replace the petroleum diluents with green diluents to prevent the secondary pollution. Currently, green diluents are widely used in ELM due to the environmental benign in separation processes. Waste cooking oil (WCO) is abundantly available and it is dumped as bio-waste into the environment causes various environmental issues. Valorization of WCO as green diluents in ELM process can replace the usage of petroleum based diluents, thereby results in the minimizing the toxic product and enhancement of waste to value added product in achieving the goals of sustainable development. In the present investigation, alginate biopolymer stabilized Pickering emulsion liquid membrane (PELM) was employed for the extraction of Methylene blue (MB) from aqueous solution. The novel PELM composed of aliquat 336 as a carrier, potassium hydroxide (KOH) as a stripping agent, and waste cooking oil (WCO) as the green diluent. WCO is a non-toxic organic solvent was used as substitution of petroleum based organic solvent in the preparation of PELM. The optimum conditions for the maximum removal of MB were: Emulsifier concentration – 1 (*w/w %)*, Carrier concentration – 20 (*w/w*%), Treat ratio – 1:5 , internal phase concentration – 1 M, initial external feed phase concentration – 5 ppm, O/A ratio – 1:1 . The mechanism of MB extraction was also presented. At optimized condition, the maximum extraction of 91.58% was recorded. Kinetic analysis shows that the MB extraction by PELM follows zero-order reaction. Furthermore, the thermodynamic analysis reveals that the extraction process was an endothermic, and spontaneous in nature. **Keywords:** Extraction, Alginate, Emulsifier, PELM, Methylene Blue,
IL 31	**Akshay Modi** Department of Chemical Engineering, Indian Institute of Science Education and Research Bhopal, Bhopal Topic: Case Study of Nanoparticle-Loaded Polyacrylonitrile Membrane for Micellar-Enhanced Ultrafiltration of Nitrate from Contaminated Groundwater The contamination of groundwater by nitrates due to excessive use of fertilizers in agriculture is a serious global problem. Nitrate poses a significant health risk causing blue-bay syndrome and mental retardation in children and forming a carcinogenic product in adults. Beyond a specific limit, it is harmful to aquatic lives. Thus, nitrate removal for aquifer rehabilitation had attracted the attention of the scientific community. Micellar-enhanced ultrafiltration is a promising treatment method because of its high removal efficiency, low energy requirement, and simple operation. At the same time, the fabrication of an efficient membrane with long-term performance stability is a challenge. In this study, we demonstrated a novel, facile method to stabilize a layer of nanoparticles on

	polyacrylonitrile ultrafiltration membrane by methacrylate hydrogel. The modified membrane exhibited a hydrophilic surface with lower roughness than the pristine membrane. The efficacy of the membrane towards nitrate removal via micellar-enhanced ultrafiltration process was tested using nitrate-contaminated groundwater samples. The membrane reduced nitrate levels from 40–70 ppm to 6.1–24.1 ppm using 2-stage filtration process. These values are well below the standards for nitrate. Notably, a complete rejection of the surfactant was also achieved. The membrane's performance remained consistent for multiple filtration cycles, with more than 90% flux recovery ratio. The modified membrane, comprising methacrylate hydrogel/nanoparticle layer on polyacrylonitrile membrane, remained intact even after the filtration experiments, indicating their potential for field application of nitrate removal from contaminated groundwater.
IL 32	**Aissat Miloud** University of Tissemsilt, Faculty of Sciences and Technology, Tissemsilt University, Tissemsilt, Algeria Topic: Enhancing Anionic Dye Removal from Aqueous Solutions using Kaolin-based Membranes coated with Sol-Gel Salt Chloride films In this study, porous ceramic multilayer ultrafiltration membranes were prepared and characterized for the treatment of water using local Algerian clay, specifically the KT2 Kaolin of Tamazaret. The membrane supports were first produced by casting in plaster molds and then improved by a functional thin film layer created via the sol-gel method. The method followed for the synthesis of the gel was inspired by Pechini's method. It was very simple method for preparing metal oxide powders where polymeric precursors were replaced by metal salts. These ceramic membranes were tested for the removal of anionic dyes under a filtration pressure of 3 bar for a duration of two hours. The performance of the membranes was evaluated based on pore diameter, water flux, thickness, and removal efficiency. The results revealed that the membrane showed an excellent rejection rate of 100% for the anionic dyes after the deposition of the layer. The material was characterized using several techniques such as ATD-ATG, DRX and SEM imaging. These characterization techniques provided detailed information about the microstructure, chemical composition and mechanical properties of the membrane. Additionally, retention and permeability of the membrane were also studied to evaluate the overall performance of the ceramic membrane. It was found that the ceramic membrane showed excellent mechanical strength and chemical stability, making it suitable for industrial applications. **Key words:** porosity, sol-gel, filtration, anionic dye, DRX.
IL 33	**Yusuf Wibisono** Department of Bioprocess Engineering, Universitas Brawijaya, Jl. Veteran Malang 65145 Indonesia

	Topic: Taguchi Analysis of Natural Phenolic Compound Impregnated Polymeric Membranes for Biofouling Restriction Membrane technology is widely used for water treatment, yet it suffered from fouling, including the adherence of biological foulant. Antibacterial agent can be added to increase membrane resistance toward biofouling. In this study, phenolic substance derived from *Moringa oleifera* seed powder was used as antibacterial agent, and impregnated into cellulose acetate membrane matrix. Variables were compared, including the difference in the employed solvent (DMF, DMAc, and DMSO); seed powder concentration (0.5, 0.75%, and 1%); and, casting film thickness (0.2, 0.3, and 0.4 mm). The membrane performance were measured based on the final thickness, tensile strength, elasticity, pore diameter, surface water contact angle, and permeability. Taguchi analysis were conducted to obtain the optimal condition and dominant factor in the preventing biofouling on the membrane surfaces. L9 Taguchi method with 3 different factors and 3 different levels were employed. **Keywords:** cellulose acetate; microfiltration; membrane; biofouling; *Moringa oleifera*, Taguchi L9

	Short Invited Lecture
SIL 1	**Abhishek Kumar** Research Scholar, IIT Madras Topic: Silicon Nanoporous Memebranes: Extraction of Effective Diffusivity Using Simulation Silicon Nanoporous Membranes (SNMs) have many applications in molecular separations likehemofiltration and dialysis [1-5]. Our group have earlier reported on using SNMs for biomolecular separation [3-5]. Dialysis of urea and creatinine through both single SNMs as well as lateral array of SNMs have also been reported [5]. Present study is to understand the diffusion mechanism and to characterize the diffusivity and its variation with respect to the surface charge and molecular weights. This paper reports a simulation method and its implementation for simulating the transfer of various molecules through 15 nm thick silicon nanoporous membranes (SNMs) with average pore size of 8-10 nm. The simulations are done to determine the effective diffusivity (Deff), bysetting up conditions very close to actual experiments. Molecular diffusion in such mesoporousmedium, in addition to molecule size, also depends on the charge on the pore walls, nano-confinement and the tortuosity of pores. In this work, we have first estimated the effectivediffusivity through the SNMs, by matching the simulation with experimental results. This effective diffusivity value is then used to explain measurements on the separation of moleculeswith varying size and surface charge, which is essential for a better understanding of mass transport through such nanoporous media. We found that Deff has a power law dependence on the molecular weight, as opposed to the bulk diffusivity which varies as the inverse square rootof the molecular weight.

Geometry and simulation environment were setup in COMSOL and its LiveLink for MATLAB.The extracted diffusivity from the experimental data on four protein molecules (α-Amylase, BSA, Catalase and Xanthine Oxidase) of varying sizes reported in [3], is fitted against their molecular weights. A power law variation is seen, of the form $a.x^b$, where a = 1.12e-8 and b =

-4.16. A comparison is also made between diffusivity values through SNMs (at room temperature) and corresponding values in bulk [7-9] for protein molecule diffusion [3]. We found a 7 order magnitude lesser values for SNMs as compared to bulk. This drastic reductioncan be caused by the presence of constrictions like necks and bridges along the pores (as reported in [10]) and could also be because of the presence of electrical double layer around theanalyte molecules. So, this study concludes that transfer mechanism through these nanoporousmembranes are different than the bulk and can be understood better with the help of their effective diffusivity.

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SIL 2	**Abhishek Soti** Research Scholar, Civil Engineering Department, Nagar, Jaipur Topic: Performance assessment community RO plants and reject management Water has much broader influences on health and wellbeing and issues such as the quantity and quality of the water supplied are crucial in determining the health of individuals and whole communities. The health of the population significantly affects both social development and economic progress. It is essential to ensure equitable access to community RO plant services by identifying priority areas and ensuring improvements in the quality of water of the community RO plants. Therefore, a study of fifteen community-based RO plants installed in Bharatpur districts of the state of Rajasthan was taken up to evaluate the performance of community RO system in terms of removal of chemical contaminants. Questionnaire surveys were used to assess the adequacy of maintenance systems and derive information on the acceptability of these systems among the beneficiary population to judge the long-term sustainability. Factors such as issues of reject disposal was identified as the major areas that needed interventions for enhancing the performance of community RO plants and minimizing the adverse environmental impacts over their life span to ensure long-term sustainability. This paper describes the broad findings of the study for both technology as well as social issues and suggests possible interventions to circumvent the same. **Keyword:** Reverse osmosis; Sustainability; Health impact
SIL 3	**JENNY N** Research scholar, Dept. of Chemical Engineering, NIT Calicut Topic: MIL-53 (Al) impregnated PVDF-co-HFP/PDA Janus membrane for seawater desalination via membrane distillation The commercial membranes for membrane distillation are vulnerable to scaling and fouling when employed for water recovery from highly saline water with low surface tension compounds. To address this challenge, we fabricated fluoroalkylsilane (FAS) grafted MIL-53(Al) impregnated PVDF-co-HFP Janus membrane with polydopamine (PDA) surface coating and tested for seawater desalination by direct contact membrane distillation (DCMD). The water contact angle of the top and bottom layer of the fabricated membrane was estimated at 47.7 ± 1.67^0 and $118.52\pm2.04^{0,}$ respectively. The hydration layer formed on the membrane surface owing to the hydrophilic PDA layer prevented the adhesion of oil droplets on the membrane surface, simultaneously enhancing the flux. While the FAS grafted MIL-53(Al) in the membrane matrix helped to maintain the hydrophobicity of the bottom layer and improved the pore-wetting resistance. The Janus membrane with 0.01wt.% MIL-53(Al) displayed a stable permeate vapour flux of 10.5 L/m^2h for 60 hours without undergoing pore wetting when tested with real seawater. This membrane also exhibited excellent resistance to wetting by seawater containing a high concentration (0.6mM) of sodium dodecyl sulphate (SDS). Furthermore, the membrane was able to recover water with uniform quality from seawater containing 500 ppm oil and 50 ppm SDS. This indicates the membrane's resistance to wetting by oil which could be further confirmed with the underwater oil contact angle of 135 ± 1.2^o. **Keywords:** Membrane distillation, MIL- 53(Al), Polydopamine, Janus membrane, Seawater desalination

SIL 4	**Radhika Malhotra** Student, National institute of Technology Calicut, Kerala Topic: Development of High-Flux Thin Film Nanocomposite Membrane for Water Recovery using Forward Osmosis Forward Osmosis (FO), an emerging low-pressure membrane technology offers great potential for water recovery from various wastewaters.It exploits the osmotic pressure gradient between the feed and the draw solution as the driving force. Membrane fouling and reverse solute diffusion remain the bottleneck in the wide application of FO. To overcome these challenges, we fabricated thin film nanocomposite membranes with two different classes of hydrophilic modifiers, MetalFerrite nanoparticles (MFN) and Covalent Organic Frameworks (COF). The nanofillers chosen from these classes were Nickel-Ferrite nanoparticles and Nitrogen-Enriched Nanoporous Polytriazine (NENP-1). The optimum concentrations of these modifiers in the TFN membranes were 0.005 wt.% and 0.003 wt.% respectively. The water contact angle of optimized TFN membranes was observed to be $62.2 \pm 3.1\,^{o}$ and 33 ± 0.9^{o}respectively. The fabricated membranes were tested for water recovery from wastewater containing persistent organic pollutants. The performance of the membranes was evaluated in terms of permeate water flux, specific reverse solute flux, and antifouling properties. Draw solute studies have also been carried out with the optimized membranes.For both optimised membranes, the permeate flux with 1M NaCl draw solution was greater than the flux obtained when fertilizer draw solutes (1M Diammonium Phosphate and 1M Ammonium Sulphate) were used.An artificial neural network approach is also developed to anticipate the permeate water flux and the reverse solute flux of the forward osmosis process. The overall R^2 values for both the networks were found to be more than 90% and the optimized architectures had 3 hidden layers (20, 15, 35) and 2 hidden layers (10, 50)for water flux and reverse solute flux respectively.
SIL 5	**SMITHA V KAMATH** Senior Research Fellow, Centre for Nano and Material Sciences, Karnataka Topic: Fabrication of MIL-88 (Fe)-Integrated Sugarcane Bagasse-derived Superhydrophilic Adsorptive Filters for Wastewater Cleanup Contamination of water due to organics has created commotion amongst humanity, owing to its deadliness towards living beings and environment. This urges the need to develop efficient sustainable approaches for water treatment. The current research has focused on utilizing *Saccaharum officinarum* bagasse (SB), one of the significant wastes, as precursors forfabrication of filters. The pristine filters were integrated with MIL-88 (Fe) with the intension of introducing active sites, thereby increasing the filter efficiency as well as addressing the leaching and material recovery hurdles faced by bare MOFs. The pristine SB filters displayed adsorption performances towards dyes such as methylene blue (MB), crystal violet (CV), malachite green (MG), rhodamine B(RhB) and metal ion such as chromium (Cr^{+6}) with removal effectiveness of 96% for MB. For rest of the dyes, the removal efficiencies were around 40% and about 7% removal efficiency for Cr^{+6} was achieved. Incorporation of SB filters with MIL-88(Fe) was seen to enhance the filter performance for removal of all dyes with about

	>90% removal effectiveness and about 40% removal for Cr^{+6} ions. It could be proposed that the coordinative interactions of X-O-Fe (X: contaminant) between the contaminant and MIL-88 (Fe) were responsible for the outstanding material activity. Moreover, the drain-type module packed with stacked MIL-88(Fe)@SB filters were capable of eliminating the contaminants from the water flow. Thus, the current work attempts to open up a new avenue for utilization of sugarcane bagasse for wastewater treatment and processes thereof. **KEYWORDS:** Sugarcane bagasse-derived filters, MOFs, water purification, oil-water separation. **References:** 1**.** *Journal of Hazardous Materials* 406 (2021): 124728. 2. *Carbohydrate polymers* 223 (2019): 115060.
SIL 6	**ATUL PATEL** Department of Applied Chemistry Delhi Technological University, New Delhi Topic: Separation of Rhodamine B using Nano-Filtration process With increasing industrialisation, dyes have become one of the most promising colourants used worldwide on a large scale. It has been estimated that around 12-15 % of these dyes are discharged as effluents into the water bodies. One of such dyes is Rhodamine B which is used widely in textile and food colouring. These dyes are harmful, toxic and carcinogenic in nature. They cause pollution of the water bodies, death of the aquatic organisms, reduce the light penetration into the water hence lesser under water photosynthesis and many more severe problems. Therefore, it becomes important to filter them before discharging. In the present investigation, nano-filtration of Rhodamine-B dye was done using membrane HF-150. Effect of different parameters on the rejection rate of the dye such as the amount of Rhodamine B, flow rate of the feed solution, pressure of the system was studied. Furthermore, volume and flux of the permeate solution was calculated and its relation with above mentioned parameters was also investigated. Dye removalefficiency of the membrane was measured in terms of rejection percentage. The rejection percentage was found to be above 90%. The findings of the work can be of promising application in dye removal and waste water purification.
SIL 7	**Gajipara Disha Hareshbhai** Department of Chemical Engineering, Sardar, Vallabhbhai National Institute of Technology, Gujarat, India Topic: Membrane fouling and performance study for salt removal using membrane distillation Since a few years ago, membrane technology has advanced quickly due to the high-quality demand for water. Salt and dark water desalination often use the thermally driven membrane distillation process, which is one of

the several membrane separation methods. This paper's primary goal is to evaluate the effectiveness of $MgSO_4$ salt separation from water using Direct contact membrane distillation (DCMD). The phase inversion approach is used in this study to create a membrane with a set composition of PVDF (20 wt%), sodium alginate (SA) (0.5 wt%), carboxylated multiwall coated carbon nanotubes (MWCNT-COOH) (0.06 wt%), solvent N, N dimethyl formaldehyde (DMF). This optimum value of membrane composition is decided by the Taguchi method of design of experiment. On this membrane, the experiment was conducted using an aqueous feed solution of $MgSO_4$ salt for 80 hours. The flow was monitored and the rejection was also calculated at a specific time interval. Flux was measured at the beginning of the experiment and was highest for a fresh membrane; after the 80-hour experiment, it decreased. Atomic force microscopy (AFM) and Fourier transform infrared spectroscopy (FTIR) respectively were used to characterize the membrane surface before the experiment and after fouling. After 80 hours of operation, there was a very slight decrease in permeate flux of this PVDF membrane, which may have been caused by modest scaling on the membrane surface.

Keywords: Direct contact membrane distillation, PVDF, $MgSO_4$, MWCNT-COOH.

SIL 8

Subasini Shanmugam
Research Scholar, Department of Chemistry, The Gandhigram Rural Institute - Deemed to be University, Dindigul, Tamilnadu

Topic: High performance activated carbon impregnated sodium alginate membranefor the removal of organic pollutants

Biopolymericsodium alginatemembraneimpregnated with activated carbon (AC) was prepared to enhance the performance in terms of filtration efficiency as well as permeabilityduring water treatment. The novel biopolymeric membrane was used to remove dual pollutants; antibiotic diclofenac (DCF) and brilliant blue (BB) from aqueous solutions. TheACwere prepared from groundnut shells (GS) and rice husk (RH) and was blended with SA. The surface analysis of the membrane was carried out using SEM and identification of functional groups present were observed using FTIR.Membranes showed almost similar removal efficiency for DCF and BB. The influence of various parameters like contact time, pH and dosage of adsorbents were also investigated. The kinetic data supported the linear forms of Freundlich isotherms and adsorption process followed multilayer physisorption process. Biopolymeric membraneswith adsorbents from different sources retained their adsorption efficiencies up to their 3rdcycle.

Keywords: Activated Carbon, Sodium Alginate, Rice Husk, Groundnut Shell, Diclofenac, Brilliant Blue

SIL 9

Manish Kumar
Department of Chemistry, Indian Institute of Technology, Ropar, India

Topic: Ionic Liquid Functionalized Reduced Graphene Oxide Membrane for Water Desalination

	In order to address concerns about water shortage, there is growing interest in membranes based on graphene oxide (GO). The oxygen functionalities (such as carboxyl, hydroxyl, and epoxy) attached to graphene sheets and forming a strong hydrogen bond with water give GO its amazinghydrophilicity. Moreover, the two-dimensional nanostructure of GO results in high throughput andexceptional separation performance. Here, we used a brand-new, remarkably stable reduced graphene oxide that was functionalized with a benzimidazolium ionic liquid and made via a vacuum-assisted method for water filtration. In an aqueous environment, the stability, structural, permeance, and rejection characteristics of developed membranes were thoroughly examined. Byforming cationic connections, cationic group and GO nanosheets improve membrane stability in aqueous settings and create nanoscale channels for straightforward water transport, greatly enhancing the efficacy of salt and dye. To remove water salinity, the pore size and number of nanoscale channels were carefully controlled with monitored deposition process and membrane thickness. Additionally, the great potential of ionic liquid-functionalized GO laminate membranesfor water-based applications is demonstrated by a simultaneous enhancement in water permeanceand solute rejection.
SIL 10	**JAMJAGGALI C PRADEEP KUMAR,** Research Scholar, Department of Chemistry, Fergusson College, Pune Topic: Concurrences linked to Nano filtration vitally by membrane matrices Researchers are currently considering membrane separation tactics due to their eco-friendly, reliability and excessive efficiency. In recent times, polymeric and inorganic membranes within the separation enterprise have made enormous development and technical trends for fabrication of nanofiltration by mixed matrix membranes for various processes and applications has been developed effectively. Mixed matrix membranes (MMMs)possess a huge range of physiochemical properties. However, these properties are highly effective due to well mannered and precisely designed mixed matrix membranes. MMMs for nanofiltration have an upscaling approach because it changed into first delivered at some point in late 80s. With houses in between the one of ultrafiltration and reverse osmosis, NF membranes find applications in many interesting packages mainly in water, sewage water treatment and desalination. Other applications include the ones in pharmaceutical, biotechnological food, and non-aqueous types of utility. The evaluation will comprehensively look at the latest advances in NF membranes research. Zeolites are captivating and flexible substances, vital for wide range of industries due to their unique structure and extra mechanical strength. The article focuses on zeolite-MMMs for nanofiltration. New programmes were also explored in lots of industries. In the review, NF process by MMMs assembled and filled with hybrid organic-inorganic compounds are studied through previous research work done. As nanofiltration being an efficient membrane chemical separation technology has a copious emerging trend and the usage of various MMMs has provided a remarkable approach in respective sectors. This review ends with several tips at the destiny prospect of NF membrane studies, improvements on these vibrant trends and lastly conclusions highlighted about the same. **Keywords:** Zeolite, Mixed-matrix membranes, ultrafiltration, Water purification, Nano filtration
SIL 11	**Nishita Sharma** Research Scholar, Department of Chemistry, Chaudhary Bansi Lal University, Bhiwani, Haryana, India

	Topic: Adsorptive potential of Saccharum munja as a low-cost and eco-friendly biosorbent for the removal of Chrysoidine Y dye from aqueous solutions Anthropogenic interference in the environment via introduction of toxic contaminants has raised a serious concern worldwide. Researchers have adopted different technologies to remediate wastewater, among which adsorption has gained much importance. Herein, Saccharum munja was used for the adsorptive removal of Chrysoidine Y dye from aqueous solutions for the first time. The physicochemical properties of adsorbents were analyzed with different characterization techniques. Effect of different parameters on the adsorption efficiency of the as-prepared biomass was studies by carrying out batch adsorption studies. Further, kinetics, equilibrium and thermodynamics of the adsorption process was evaluated with the help of various models. The results depicted excellent reusability of the biomass for repeated adsorption cycles, making the process economically viable. **Keywords-** Chrysoidine Y dye; *Saccharum munja*; wastewater treatment; adsorption; reusability.
SIL 12	**Ashwani Kumar Tiwari,** PhD scholar, Department of Applied Chemistry, Delhi Technological University, Delhi Topic: The concentration of phenolic compounds using nano filtration based membrane process Mother earth is the plentiful source of various compounds that have many health related benefits.Phenolic compounds are one of those classes due to their properties like anti-oxidant, anti-inflammatory and anti-infective nature. Membrane assisted processes represent a reliable method for separation and concentration of such compounds as these processes have certain benefits like no use of high temperature and toxic chemicals, reduced operational costs and easy to scale up through mathematical modeling. The transport models can be used for predicting the mass transfer phenomenon across the membrane module. Experimental and theoretical results can be used to predict the parameters of the models and validation.
SIL 13	**Ananthi P** Research Scholar, Department of Chemistry, The Gandhigram Rural Institute, Dindigul Topic: Cellulose acetate based-membrane supported by Fe –MIL 88A for the removal of diclofenac and ciprofloxacin micropollutants Micropollutants such as pharmaceuticals, personal care products, suspended particles etc. are a great menace to water resources in recent times.It is necessary to develop membranes with enhanced permeability, fouling resistance, stability and efficacious contaminants and salt removal from wastewater.These requirements for the effective filtration of wastewater could be resolved by the incorporation of highly water stable metal-organic frameworks (MOFs) into membranes. In this study, two types of membranes are bare cellulose acetate (CLA)-polysulfone (PS) [CLA-PS] (M1) and MOF-incorporated CLA-PS/MIL-88A membrane (M2)—were synthesized, characterised, and assessed for their filtration and rejection functions.The prepared membranes exhibited high rejection percentages of 90 % and 88 % for diclofenac and ciprofloxacin respectively. Crystalline

	nature, functional groups, surface roughness and morphologyof the modified membrane were examined by XRD, FT-IR and SEM-EDX. Additionally evaluated were membrane's antifouling and water permeability performance. A prepared membrane show excellent ability to remove micropollutants. **Keywords**: cellulose acetate, metal organic frameworks, micropollutants, membranes
SIL 14	**ATHIRA VINCENT** Chemical Engineering student, National Institute of Technology, Calicut Topic: Zinc-Doped Fe3O4 Nanoparticles for Flux Enhancement in Membrane Distillation Processes The growth of the pharmaceutical and personal care industry is one that often goes unnoticed in this era of digital advancement. While the easy and cheap availability of a wide range of cosmetic and pharmaceutical products have immensely improved our quality of life, it also means that we now have an even wider range of chemical contaminants polluting our household and industrial wastewater. Phthalates, microbeads, polythene, silicones and carbomer are examples of common micro and nanoparticles found in widely used self-care products and these are non-biodegradable[12]. Hence, an efficient process in terms of cost, ease of operation and extent of removal of contaminants is required. This paper discusses an inexpensive process which involves doping a bivalent transition metal cation[3] (In this case, Zn^{2+}) into a ferric oxide complex. The particle can be coated with a hydrophobic layer with substances like FluoroalkylSilane and embedded into the membrane matrix for membrane distillation (MD) process, which has an expected cost of 3$/m³ [4] for recovering water, which is relatively inexpensive compared to certain conventional methods of water recovery like Reverse Osmosis. Such membranes embedded with nanoparticles also seem to enhance the flow of vapour through the membrane due to increase in flux produced as a consequence of the increased roughness on the membrane surface. This paper discusses the effects of Zinc doped Ferric oxide embedded onto membranes for MD while treating water with pharmaceutical contaminants, and compares the differences in flux obtained for various configurations of membranes with respect to the hydrophobicity of the nanoparticle. **Keywords**: Membrane distillation, Zinc doped Fe_3O_4, pharmaceutical effluents 1. Singh, R. & Prashant, R. A review on characterization and bioremediation of pharmaceutical industries ' wastewater : an Indian perspective. *Appl. Water Sci.* 1–12 (2017) doi:10.1007/s13201-014-0225-3. 2. Balakrishna, K. &Rath, A. A review of the occurrence of pharmaceuticals and personal care products in Indian water bodies. (2017) doi:10.1016/j.ecoenv.2016.11.014. 3. Sustainability, W., Africa, S. & Group, I. T. A Review of Nanoparticle-Enhanced Membrane Distillation Membranes: Membrane Synthesis and Applications in Water Treatment. doi:10.1002/jctb.5977. 4. Schwantes, R., Chavan, K., Winter, D., Felsmann, C. &Pfafferott, J. Techno-economic comparison of membrane distillation and MVC in a zero liquid discharge application. *Desalination* vol. 428 50–68 (2018).
SIL 15	**Vaishnavi Murlidhar Bhoyar** Student, School of Chemical Engineering, MIT World Peace University, Pune, Maharashtra

Topic: Application of nano fillers embedded membranes for dye separation to recycle and reuse water: A brief review

Presence of dye in water has become a major issue for the environment as well human health. Water contamination harms the ecosystem and spreads harmful diseases acrosspopulations. It can cause abnormalities of chromosomal in mammalian cells and nuclear abnormalities in animal cells. It can also cause cancer of the liver, lungs, and bladder. A Several health effects including haemorrhage, skin ulceration, nausea, etc. are caused by multiple trace metals contained in dyes, such as Cr, Cu, As, and Zn. Toxic dyes are a significant factor in the change of soil's physical and chemical properties.Harmful dyes cause the death of soil microorganisms, which lowers agricultural productivity.Major contributor for dyes in water is textile industry. Annually, approximately 280,000 tonnes of textile dyes are released into industrial water nearby.The extensive manufacture and usage of synthetic dyes impact significantly to environmental pollution, raising substantial public concerns.

Several industrial and scientific research has been focused on the production of polymer nanocomposite membranes employing various nanofillers throughout the last few decades. The purpose is to highlight the significance of nanoparticles in the membrane sector using different effective nanofillers for water treatmentand dye removal applications. For production of clean water, these membrane technologies haveaddressed few challenges like membrane fouling and cost. Through various modification techniques, nanomaterials give polymeric membranes superior permeability, hydrophilicity, thermal stability,selectivity, mechanical strength, and antibacterial characteristics. Various characterisation tools have been used to examine the morphological and chemical properties of polymer nano-composite membranes. The use of nanoparticles and nanofillers pave a new avenue for highly quick and selective water filtration membranes.

This reviewwill discuss membrane improvements with the addition of a variety of nanomaterials-nanoparticles,nanofillers and other nanocomposite structural materials. It has also been discovered that the development of sustainable wastewater treatment method is greatly aided by nanomaterials and nanotechnology.

SIL 16

Dharmveer Yadav
Research Scholar, IIT Bombay, Mumbai

Topic: Anti-fouling Nanomagnetic-polymer Composite Membrane for Environmental Remediation

Water pollution by organic contaminants is a significant problem that affects water quality and can have harmful effects on aquatic life, including reduced reproduction, growth, and survival rates. These contaminants can also adversely affect human health, even at low concentrations. Exposure to some organic contaminants can lead to cancer, reproductive problems, and developmental delays.Removing organic contaminants from water is essential to protect human health and the environment. Several methods can be used to treat water contaminated with organic compounds, including physical, chemical, and biological treatment. Membrane-based technologies have emerged as promising approaches for water purification and environmental remediation due to their ability to separate contaminants from water streams with high selectivity and efficiency. This work fabricated nano-composite membranes using the phase inversion method by loadingpolysulfone matrix with varying amounts of magnetitenanoparticles (MNP). IncorporatingMNPs into the Psf membranes enhanced the performance and permeability with the rejection efficiency as high as ~ 99%. MNP increases the surface roughness, which improves the hydrophilic and oleophobic properties, resulting inenhanced performance of these membranes for separation. Psf-MNPnano-composite membranes exhibited remarkable anti-fouling properties and preventedthe depositionof pollutants on the membrane surface. Our studies suggest that the Psf-MNPnano-composite membrane show increased surface functionality and has promising long-term performance with reusability for environmental remediation of organic pollutants.

Keywords: *Polysulfone, Magnetite, Nanoparticles, Organic pollutants, Emulsion treatment.*

SIL 17

Sandhya Katunga
Student, School of Chemical Engineering, MIT World Peace University, Pune, Maharashtra

Topic: A review on drug separation from wastewater using membranes incorporated with different nanoparticles

In recent times, pharmaceutical industries contribute as a major source of water pollution due to global epidemic outbreak. Pharmaceutical drugs and their waste products in large amount are dumped into the water bodies that become a huge risk for both environment and human health.

Nanomaterial is anpromising material with potential technical impacts in numerous applications including wastewater remediation. Nanomaterials typically have high adsorption capacity,reactivity, high degree of functionalization which makes them suitable for water purification. There are different nanoparticles available like single or multi walled carbon nanotubes, metal oxide, graphene oxide, and several others have been explored for water remediation and also helps in its modification with aappropriate functional group.

Membrane separation process were considered to be good option for water purification, currently manypolymer membrane, carbon-based materials, metal organic frameworks, and other inorganic materials have been discussed. The present review article mainly focuses on removal of pollutants originating from pharmaceutical wastewater using composite membranes made up of different nanoparticles to improve membrane's flux, separation efficiency, and resistance to fouling are discussed in detail with their advantages and limitations.This review analyses the detailed features and benefits of individualform of nanoparticles for potential use in membranes are reviewed.Considering complex chemical nature of pharmaceutical drugs,the difficultyconcerned in the separation process explores the functioning, interactions, dispersion, and alignment of nanomaterial embedded membranes.

SIL 18

Ishika Bhatia
Student, Netaji Subhas University of Technology (NSUT), Dwarka, Delhi

Topic: NANOFILTRATION MEMBRANES FOR WATER PURIFICATION

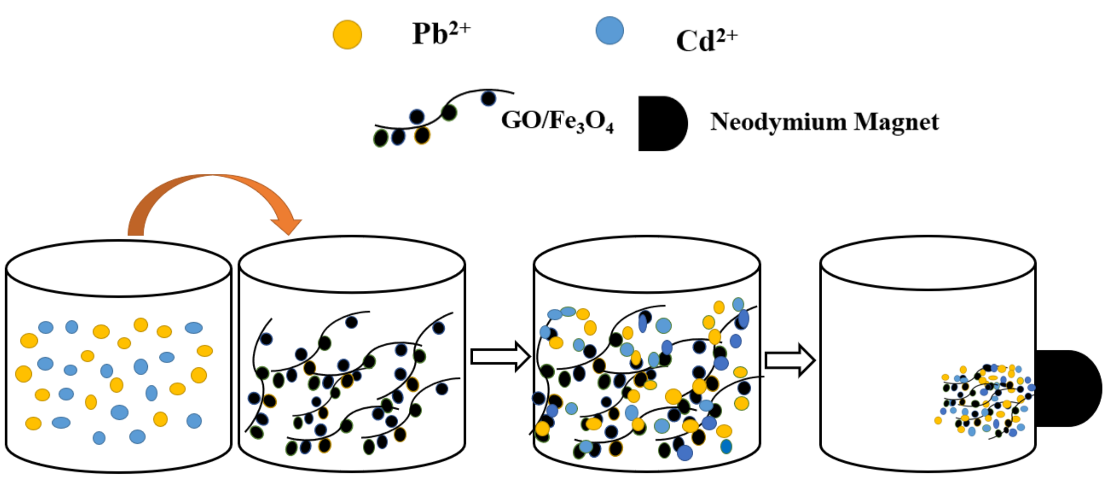
The human wellbeing and the Indian economic progress can be well explained by industrialization. However, since natural products are employed as inputs in many industries for the production purpose, it results in ecological issues like water pollution. Access to clean, safe and sustainable water is one of the concerns of India. Many purification processes are employed to treat contaminated water. The main objective of the purification process is to remove the harmful bacteria, microorganisms, turbidity and salts from raw water. In contrast to chemical-based treatments like ozonation and chlorination which produce significant amounts of harmful byproducts, membrane filtration systems generate microbiologically safe drinking water which is cost effective

	and free from the use of chemicals. The driving force for ionic movement across membrane includes pressure difference, concentration gradient and a potential field which initiates the movement of ions. According to the size and charge properties, reverse osmosis (RO), Nanofiltration (NF), ultrafiltration (UF) and microfiltration (MF) have been introduced as four categories of membrane assisted filtration system. Among them, the market has been dominated by NF membranes since 1980s because of their excellent performance, low operation pressure, high flux and high retention of multivalent ions, comparatively low operation and maintenance costs. NF can separate dissolved components with molecular weight of about 200-1000 amu and a molecular size of 1 nm. While other methods have higher energy cost, can also remove most of the minerals, making the water acidic. Hardness, organic and particle pollutants can all be removed with NF membranes. In this study, we are going to present how nanofiltration works in the water purification process and the factors that affect the nanofiltration.
SIL 19	**NIKITA JOSHI** STUDENT, SARASWATI HOSTEL, NETAJI SUBHAS UNIVERSITY OF TECHNOLOGY, DWARKAA Topic: Quantum Dots Synthesized Membrane as a Potential for Water Purification
SIL 20	**Varuna Watwe** Ph.D. student, Post-graduate and Research Centre, Department of Chemistry, MES AbasahebGarware College, Pune, India Topic: Environment-friendly Optical sensor for Cr (VI) in aqueous systems based on image analysis Chemical analysis of hexavalent chromium in wastewater samples is crucial due to its deleterious impact on the environment. While the colorimetric method for quantifying Cr(VI) usingDiphenyl carbazide (DPC) is simple and reliable it has limitations in filed studies due to use of multiple chemicals and a colorimeter or spectrophotometer.Optical sensors can prove to be beneficial in field studies for qualitative analysis. Quantitative analysis can be effectively done using image analysis software thus replacing the usage of any colorimetric device. In view of this in the present work we have developed a membrane-based cellulose acetate (CA) optical sensor that detects Cr(VI). The membrane consists of CA as the polymer backbone, DPC as a selective chromophore for Cr (VI), Aliquat 336 (AL-336) as an anion exchanger and di-octyl phthalate (DOP) as a plasticizer. When exposed to wastewater samples containing Cr(VI) at near neutral pH levels, the membrane develops magenta color in 10-15 minutes, which remains stable for up to 4 days. The colored membranes were analyzed using image analysis with a Mat lab code and the intensity of the color was found to vary linearly with the concentration of Cr(VI). The calibration curve obtained after plotting the color intensities as a function of the Cr (VI) concentration was found to have a regression value of 0.9830 The sensor's composition was optimized by varying the amount of CA, Al-336, DOP, and DPC. Membrane was also tested for the interference of Cr(III) on the determination of Cr(VI) and found it to be negligible up to five times the concentration of Cr(III). Our membrane optical sensor is highly sensitive, exhibits a fast response, and is stable, making it promising for practical application in the sensing of Cr(VI) in real wastewater samples. The sensor has been validated using UV-Visible spectrophotometry and statistical tests such as t-test, F-test, and ANOVA. The sensor was found to have a detection limit of 40 ppb and a sensitivity of 0.03 ppb. Overall, the membrane optical sensor

	offers a simple and effective solution for detecting Cr(VI) in wastewater samples without requiring extensive laboratory equipment. **Keywords:** Hexavalent chromium; Cellulose acetate; DipheylCarbazide;Image analysis.
SIL 21	**Aruna Yadav** Research Scholar, Department of Chemistry, Chaudhary Bansi Lal University, Bhiwani, Haryana Topic: Self-cleaning membranes for water purification applications: A review Membrane assisted wastewater purification has been identified as one of the most promising technologies due to its almost complete removal of contaminants within very less fraction of time. Different polymers have been explored for the preparation of membranes and modified with materials to enhance its efficiency such as graphene, carbon nanotubes, graphene oxide, biopolymers, nanoparticles and many more. Despite several advancements, membranes are still sensitive to fouling by organic, inorganic, colloids and microbes, which results in the deterioration of membrane performance with time. Recently, fabrication of self-cleaning membranes has gained impulse that prevent deposition of foulants and cleans its surface automatically, extending the membrane's lifespan. This review takes into account the role of self-cleaning membranes for water purification applications. **Keywords-** self-cleaning membrane, foulants, water purification, photocatalysts, nanoparticles.
SIL 22	**ASHUTOSH DUBEY** Research Scholar, Central University of Gujarat Gandhinagar Topic: Microwave assisted synthesized graphene oxide, nanocomposites for remediation of toxic metal ions We have successfully synthesized graphene oxide based magnetic nanocomposite (GO/Fe_3O_4) and nonmagnetic (GO-$Ni(OH)_2$) nanocomposites by microwave-assisted modified Hummers' method for remediation of toxic metal ions (Pb^{2+}, Cd^{2+}). The characterisation techniques namely XRD, Raman, FESEM, HRTEM confirmed the formation of nanocomposites. The obtained XRD patterns of (GO/Fe_3O_4) were consistent with the standard cubic phase of Fe_3O_4 with a face centered cubic (fcc) structure (JCPDS file 19-0629). The XRD pattern of(GO-Ni $(OH)_2$) shows presence of α-$Ni(OH)_2$ and β-$Ni(OH)_2$ phasescorresponding to (101) and (100) plane. The HRTEM images of GO/Fe_3O_4shows spherical shaped Fe_3O_4 nanoparticles were uniformly and orderly distributed on GO sheets while GO-$Ni(OH)_2$ nanocomposite shows leaf, rod and flower like morphology of $Ni(OH)_2$ assembled on graphene oxide sheets.Raman spectra revealed the good quality of synthesized nanocomposites. The Brunauer–Emmett–Teller (BET) analysis showed high (126 m^2/g) surface area magnetic nanocomposite while nonmagnetic nanocompositesexhibit specific surface area of 77 m^2/g. The high surface areaof nanocomposites accounts for large number of active binding sites for the adsorption of heavy metal ions. The detection and removal of metal ion in aqueous solution was conducted using ICP-OES analysis. The result of adsorption studies shows that(GO/Fe_3O_4) nanocomposite shows higher adsorption capacity for Cd^{2+} ions and lower for Pb^{2+} ions due to the formation of cadmium complex ($CdOH^+$) in the solution having higher stability constant value as compared to lead complex $PbOH^+$. However the nonmagnetic (GO-$Ni(OH)_2$) nanocomposites shows higher adsorption of Pb^{2+} ions due to its high electronegativity relative to Cd^{2+} ions. The removal of heavy

metal ions with graphene oxide based magnetic nanocomposite is more facile due to its magnetic nature. It was found that adsorption depends on the concentration of metal ions in the solution. Higher concentration of metal ions requires higher dosage of adsorbent.

Graphical Abstract



SIL 23

L. Rameesha

Research scholar, PG and Research department of chemistry, Alagappa government arts college, Karaikudi

Topic: Microwave assisted synthesized graphene oxide nanocomposites for remediation of toxic metal ions

SIL 24

Annoy Roy

Delhi Technological University, Delhi

Topic: ANN-BASED MODELLING OF MEMBRANE-BASED ALIPHATIC AROMATIC SEPARATION

Separating aliphatic and aromatic compounds is a significant challenge in the petrochemical industry, particularly during the refining process. It becomes particularly difficult to distinguish between aliphatic and aromatic molecules that possess similar physical and chemical properties and have boiling points that are close to each other. In this study, we developed an approach based on Artificial Neural Networks (ANN) to model the separation of aliphatic and aromatic compounds using different membranes. Additionally, we examined the correlation between various parameters such as the membrane type and vapor activity. The separation characteristics were determined by analyzing sorption and pervaporation data. An ANN was created using MATLAB's Deep Learning Toolbox. To optimize the ANN's hidden layer node count, we used a graph obtained in the MATLAB environment. The graph showed that eight nodes produced the lowest mean square error. The model's predictions were adequately confirmed by a correlation coefficient higher than 0.99. The continuous set of data points derived from this model can be used to create a graph of various input parameters and help us determine the optimal membrane for the separation of aliphatic and aromatic compounds.

SIL 25

Hemkumar K
Research Scholar, Department of Chemistry, The Gandhigram Rural Institute, Gandhigram, Dindigul

Topic: Photocatalytic degradation of brilliant blue dye using CMC loaded with Co-MOF composite membrane

Anthropogenic activities lead to depletion of water quality. In this study, we attempted to prepare carboxymethyl cellulose (CMC) based photocatalytic membraneloaded with Co-Metal organic framework (MOF). The prepared membrane was characterized using FT-IR, SEM with EDX, XRD and XPS spectral methods and the results showed the successful incorporation of CMC with Co-MOF. The photocatalytic behaviour of the prepared material was examined by a photodegradation experiment. The prepared membrane showed good photocatalytic efficiency for the removal of brilliant blue (BB) under a stimulated visible light source. The degradation was carried out at various operational parameters such as pH, initial concentration of dye and catalyst dosage. The degradation of BBwas confirmed by UV-Vis spectroscopy and further, the intermediate products formed after degradation were confirmed using LC-MS analysis. The mineralization of BB before and after degradation was also studied using total organic carbon analyzer (TOC).

Keywords: Carboxymethyl cellulose; Metal-organic-framework; Co-MOF; Photodegradation.

SIL 26

E. Pasechnaya
Kuban State University, Membrane Institute, Krasnodar, Russia

Topic: Counteracting membrane fouling by polyphenols during electrodialysis stabilization of red wine

New aliphatic membranes CJMC-3, CJMA-3 and aromatic ion-exchange membranes CSE, ASE were tested to determine their suitability for use in the electrodialysis tartrate stabilization and to evaluate the fouling of these membranes by red wine components at short (6-8 hours) operating time. It is shown that the structure of membranes affects the scenario of fouling with polyphenols. Layer-by-layer modification of the surface of aromatic membranes counteracts this fouling.

Keywords: Electrodialysis, Red wine, Tartrate stabilization, Aliphatic, Aromatic, Ion-exchange membranes, Modification,Fouling

Introduction

Quality grape wine is an integral part of the food preferences of most of the world's population. One of the causes of clouding of wines and precipitation in them is the formation of poorly soluble potassium and calcium tartrates.Electrodialysis (ED) tartrates stabilization does not involve the addition of foreign substances and does not lead to a loss in wine quality compared to the cold treatment or reagent methods. That is why ED has been approved for commercial use as an alternative technology for tartrate wine stabilization. Fouling with wine components (primarily anthocyanins and proanthocyanidins) prevents the widespread adoption of electrodialysis in the wine industry.

Recently, relatively inexpensive aliphatic membranes have appeared on the market, in particular, manufactured by Hefei Chemjoy Polymer Materials Co. Ltd., China.In addition, well-known manufacturers of aromatic membranes, such as Astom (Ya-maguchi, Japan), are upgrading widely used membranes. However, their behavior in ED wine stabilization is still unknown.

The purpose of the study is to compare the behavior of new aliphatic and aromatic ion-exchange membranes during tartrate stabilization of red wine using electrodialysis, as well as to evaluate their fouling with wine components.In addition, it is interesting to evaluate the possibility of reducing the interaction of polyphenols with the membrane material by layer-by-layer modification. Our idea is to use modifier polyelectrolytes whose molecular structure has no affinity for aromatic polyphenols. In addition, the modified surface must acquire the same sign of electric charge as the polyphenols in solution near the membrane surface.

Material and Methods

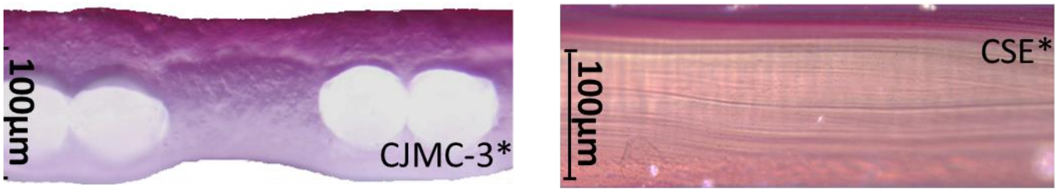
Hefei Chemjoy Polymer Materials Co. Ltd., Hefei, China, manufactures aliphatic CJMA-3 and CJMC-3 homogeneous membranes.Astom, Yamaguchi, Japan, manufactures aromatic homogeneous membranes ASE and CSE. Dry red wine "Tristoriya" (manufacturer TristoriyaAppellation, Novorossiysk, Krasnodar Territory, Russia) was the base of a model solution. This wine was made in 2021 from Cabernet Sauvignon (50%) and Syrah (50%) grapes. The wine contains ions C^{l-} (193 ± 5 mg/L), SO_4^{2-} (969 ± 5 mg/L), K^+ (1281 ± 5 mg/L), as well as molecules and anions of tartaric acid (1281 ± 5 mg/L) and other organic acids. Saccharides and ethyl alcohol are 10 ± 1%wt and 11 ± 1%vol, respectively. The concentrations of anthocyanins (Ant) and proanthocyanidin polymers (PACs) in the wine are equal to 77 ± 3 mg/L (in terms of Cyanidin-3-glucoside) and 235 ± 3 mg/L, respectively. This wine has already been subjected to tartrate stabilization. That is why, 2000 mg/L of tartaric acid and 400 mg/L of potassium chloride were added to imitate the compo-sition of the wine material before tartrate stabilization.
As modified films were used LF-4SK (manufactured by NPO Plastpolimer, Russia) and Poly(allylamine-hydrochloride) (manufactured by Aldrich Chemistry, USA).

Results and Discussion

In the identical conditions of the ED processing of the model solution of a red wine (the current density of 1.22 mA/cm^2 and the average flow velocity of 0.42 cm/s) membrane pairs CJMC-3, CJMA-3 and CSE, ASE provide recovery of 18±1% and 20±1% of tartrates at energy consumptions of $31\cdot10^{-3}$ and $28\cdot10^{-3}$Wh, respectively, while reducing the conductivity of wine by 20±1%.

After a short-term (6–8 h) ED treatment of the model solution, fouling with highly hydrated wine components leads to significant hydrophilization of the surface of all the studied membranes. The high-molecular aromatic components of red wine are localized in the surface facing the desalination compartment, as well as in the near-surface layer of CSE and ASE membranes (Figure 1). Anthocyanins and other colored wine components occupy the entire volume of aliphatic membranes after electrodialysis due to a less cross-linking of the CJMC-3 and CJMA-3 membranes compared to the studied aromatic membranes.

Desalination compartment



Concentration compartment

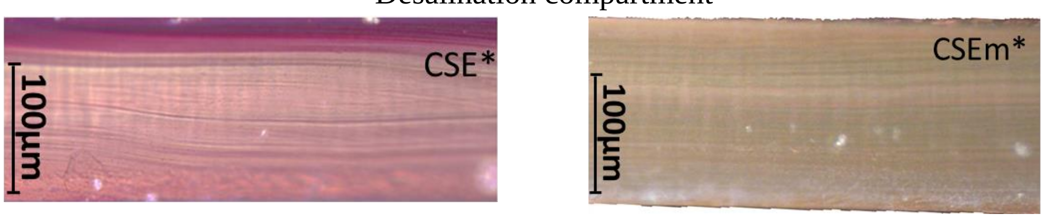
(a) (b)

Figure 1. Optical images of cross-sections of the studied cation-exchange membranes after electrodialysis

In the case of cation-exchange membranes, water splitting increases at the surface of the aromatic CSE membrane, but decreases at the surface of the aliphatic CJMC-3 membrane. In contrast, in the case of anion-exchange membranes, water splitting increases at the surface of the aliphatic CJMA-3membrane, but decreases at the surface of the aromatic ASE membrane.

The use of modified CSEm and ASEm membranes with an aromatic matrix in ED tartrate stabilization of red wine gives encouraging results. Both pristine and modified membranes provide recovery of 17±1% tartrates at energy consumption of 42·10-3 Wh under the same electrodialysis conditions.At the same time,contact angle values of modified membranes and optical images of cross-sections demonstrate a significant reduction in membrane fouling by colored polyphenols. Indeed, the entire volume of the modified cation-exchange membrane CSEm does not contain colored substances (Figure 2b), while the cross section of the pristine membrane CSE is colored with red and violet polyphenols (Figure 2a).A similar but less pronounced difference is observed in the case of the pristine membrane ASE and the modified ASEm (Figure 3).

Desalination compartment

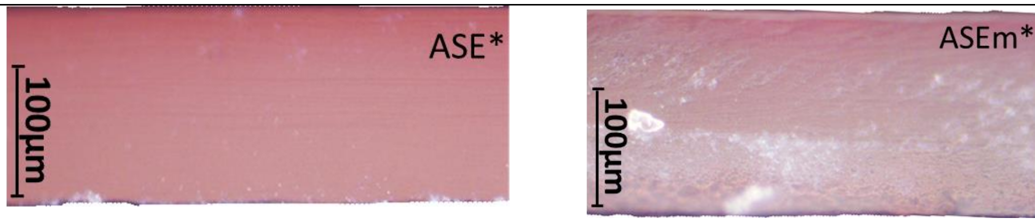


Concentration compartment

(a) (b)

Figure 2. Optical images of cross-sections of the aromaticpristine(a) and modified (b) cation-exchange membranes after electrodialysis

Desalination compartment



Concentration compartment

(a) (b)

Figure 3. Optical images of cross-sections of the aromatic pristine (a) and modified (b) anion-exchange membranes after electrodialysis

Conclusions

All studied membranes are promising for use in ED tartrate stabilization of the red wine.The chemical structure, exchange capacity and electric charge of the fixed groups govern the specificity of fouling of these membranes with wine components.Layer-by-layer modification of aromatic membranes with aliphatic polyelectrolytes protects the volume of membranes from the penetration of colored polyphenols, which reduce ED performance during long-term processing of wine materials. Note that the modification did not lead to a significant increase in energy consumption.

Acknowledgements
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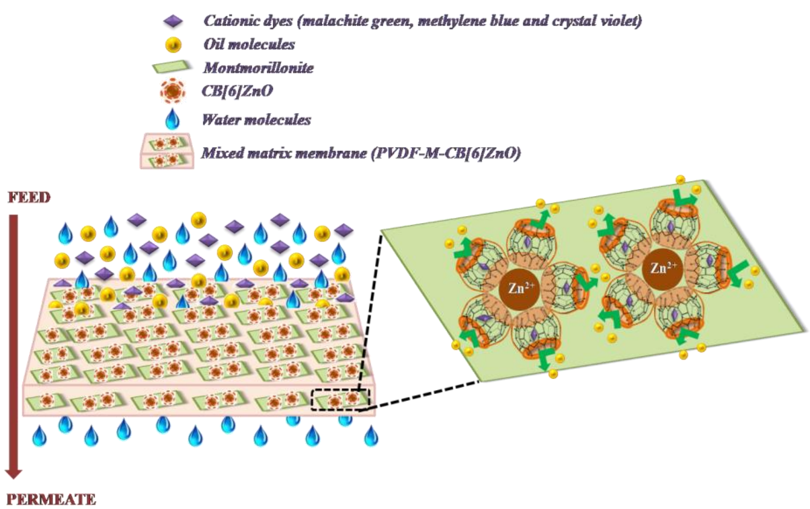
SIL 27

Triparna Chakraborty
Department of Chemistry, School of Technology, Pandit Deendayal Energy University, Gujarat, India

Topic: Fabrication of PVDF-Montmorillonite-Cucurbit[6]uril/Zinc oxide mixed matrix multifunctional ultrafiltration membrane for industrial wastewater purification

Membranes have satisfactorily dealt with the problem of dye-polluted wastewaters and oil-water emulsions. Membranes can be tailored to different pore sizes and are more efficient than traditional processes. However, surface fouling reduces its separation performance. The research focuses on multifunctional polyvinylidene fluoride-montmorillonite-cucurbit[6]uril/zinc oxide (PV-M-CB[6]/ZnO) mixed matrix membranes for dye elimination and oil-water separation. M's high dye adsorption capacity, combined with CB[6] host-guest encapsulation and zinc metal chelation, ensures superior dye elimination. Furthermore, the CB[6]-Zn^{2+} chelate repels oil molecules, promoting greater oil-water separation. The structural changes in the membranes were studied using FT-IR, XRD, and UV-Vis. The cross-sectional morphology of the membranes in SEM images revealed homogeneous dispersion of CB[6]/ZnO due to M in the membrane matrix. AFM describes the reduced surface smoothness of the developed membrane. The 1.6 wt% CB[6]/ZnO loading provides the best uniformity and membrane effectiveness. CB[6]/ZnO along M has increased the pure water permeability of PV-M-CB[6]/ZnO membranes (4114 L/m^2.h.bar) over pristine PVDF membranes by up to 1.3 times. The multifunctional membranes display high dye separation efficiency, with 95.5% of malachite green, 93.2% of methylene blue and 98.2% of crystal violet i.e. ~4 times, ~3.7 times and ~3.5 times respectively over pristine PVDF membrane. Membranes exhibit 97.6% oil-water rejection, ~1.3 times increase and flux recovery ratio of >48% after ten cycles of filtration. Thus, PV-M-CB[6]/ZnO membranes highlight improved hydrophilicity, antifouling performance, and long-span rejection in oil and dye separation.



Keywords: Ultrafiltration membrane, PVDF, montmorillonite clay, cucurbit[6]uril-zinc oxide, dye elimination, oil-water separation

SIL 28

Rini Thresia

Topic: A study on the synthesis and characterisation of cellulose nanofibrils from lognocellulosic barks of Tilifolia plant

The plethora of applications put forward by nanocellulose makes it an increasing demand for its synthesis from various biomass sources. In this work, we put forward the synthesis of cellulose nanofibrils from the barks of G.Tiliifolia. A mild oxalic acid hydrolysis coupled with high pressure homogenization has been employed to obtain highly crystalline, thermally stable nanocellulose fibrils. Structural characterization studies indicate that major portion of hemicellulose and lignin has been removed increasing the crystalline nature. The isolated nanocellulose fibrils can be utilized for various applications like pollution remediation, air purification.

SIL 29

Deeksha Katiyar
Research Scholar, Department of Chemical Engineering, Indian Institute of Technology Jodhpur, Jodhpur

Topic: Ultrafiltration membrane-based water treatment

	Water is one of the important naturally occurring resources and it is very important for the existence of life on earth. Not only living beings but plants also need it. Only 0.4% of the earth's water is usable and drinkable. Not only the quantity but the qualityof drinking water is also decreasing with time due to human activities. So we need some better techniques to filter water with less consumption of energy and the least wastage of water to obtain a large quantity of water with good quality. This study deals with the method of filtering water through the ultrafiltration method which can provide a better quality of filtered water in comparison to conventional methods (multi–grade filter), with minimal energy requirement and minimal water wastage and it can tackle bacteria and virus present in water without the addition of external chemicals. Hence it can be a preferable solution of treatment for open water source which has a high chance of the presence of suspended solids, turbidity, microbial contaminants, faecal coliform etc. It is easy to scale up due to the modular arrangement of filtration candles in the ultrafiltration unit, energy, and cost-efficient. IIT Jodhpur gets a major part of water supply from Rajiv Gandhi Lift Canal. At times, presence of suspended solids, turbidity, microbial contaminants are the major issues. In this paper, the work carried out for the water treatment using Ultra-Filtration unit will be presented.
SIL 30	**Bavana Biddala** Student, Department of Chemical Engineering, IIT Jodhpur, Rajasthan Topic: Molecular Modelling for Dye Removal Mechanism Using Colloidal Gas Aphrons Generated from Tween-20 Surfactant Colloidal Gas Aphrons (CGAs) was first developed in 1970 by Sebba [1], using dilute surfactant solution to entrain micro gas bubbles, which have appreciable life time. CGA is a unique system with gas entrapped at its core and surrounded by monolayer or multilayer of thin aqueous surfactant film; with hydrophilic head of the surfactant oriented towards the aqueous phase and the hydrophobic surfactant tails towards the non-aqueous phase [1]–[3]. CGA system having high interfacial area, high stability, water-like flow property and ability to retain surface charges have been widely and efficiently used for decades in either of the following areas: removal of pollutants; particle separation by flotation; carrier of gases, nutrients and microorganisms; and in protein separations [3]. Recent researches have shown the effective use of CGAs in protein recovery [4]; enhance oxygen mass transfer in bio-reactors [2]; bioremediation [2]; removal of metal ions, e.g. Cu^{2+} and Pb^{2+} to a removal efficiency greater than 90% [5]; separation of micro and nano-scale carbon and iron particles from a batch and column reactors [6] and in removal of cationic, anionic and neutral organic dyes from industry effluents and their extraction from natural sources using flotation techniques [7]–[9]. CGA has also been efficiently deployed in petroleum industries as a drilling fluid in low pressure reservoirs [10] and even to facilitate enhanced oil recovery from depleted oil fields [11]. Hasim et al. [3] has provided a consolidated application list of CGA in various pollution remediation processes. The CGA developed from ionic and neutral charges has been shown to have widely being used to remove organic dyes from industrial effluents effectively, which is due to any of the four mechanisms [3]: (i) ionic coupling of oppositely charged surfactants with the organic dyes; (ii) hydrophilic and hydrophobic interactions between the

CGAs and the organic dyes; (iii) reaction between the CGA surfactant and the organic dye; (iv) ion-dye complex formation due to adsorption of the dye on the CGA surface. Although the studies on the dye removal by using ionic or neutral CGAs [7]–[9] have shown either of the above four effects to be the sole cause for effective dye removal; however, the fundamental understanding on the attachment mechanism of dye molecule to a CGA has not been studied till date, to best of our knowledge. In the present study, we therefore undertook the molecular modelling approach to understand such attachment mechanisms of four organic dyes (viz. orange azo dye, methyl orange, acid orange 7 and diamine scarlet B) chiefly

present in the textile effluents of Rajasthan, India, with the neutral CGA system generated from Tween-20 surfactant. We then compared our result with the existing literature to demonstrate the possibility of the use of Tween-20 for the removal of these dyes from the aqueous solution of textile effluent stream.

In the present work, initially the structures of Tween-20 and all the dye molecules are energetically optimised using the Linear Combination of Atomic Orbital (LCAO) techniques.The LACO calculator in Quantum ATK® software provides an electronic structure description of the atoms using the density functional theory and norm-conserving pseudo- potentials. The detailed mathematical formalism and the calculation of the total energy using the DFT-LACO calculator have been reported by Soler et al. [12]. All the three active sites of the Tween-20 molecule, which attributes towards the interactions with the dye molecules.The bond parameters for the optimised structures of Tween-20 and all the dye molecules are also reported in Table 1. The optimum energies of Tween-20, Orange Azo Dye, Methyl Orange, Acid Orange 7 and Diamine Scarlet B structures; as obtained from geometry optimization, using the Quantum ATK® software are -
109.582 eV, -35.4132 eV, -54.9868 eV, -65.1015 eV and -128.251 eV; respectively. Researchers have shown that the removal of organic dyes using Tween-20, which forms a non-ionic CGA, has been due to the hydrophilic and hydrophobic interactions between the organic dyes and the CGA [3], [7], [8] that forms a CGA-dye complex. The interaction properties along with the binding energies for all the CGA-dye complexes are reported in Table 2. We note that with an increase in the number of dye molecule attachment to the CGA the binding energy becomes more negative and thus an increase in the stability of the CGA-dye complex has been observed. Also, an increase in the molecular weight of the dye increases the stability of the complex formed between CGA and the dye. Similar observations on the stability of the adsorbate-adsorbent complex has been already reported in literature [13], [14]. Thus, it can be concluded that stable complexes are formed between Tween-20 CGA system along with dye molecules, which can then effectively remove dyes from effluent streams. The sequential binding mechanism of dyes with the Tween-20 molecule at the active sites has been also estimated in the present work based on the geometry optimisation through energy minimisation route. The sequential attachment mechanism of a particular dye to the active sites of Tween-20 molecule has been found to be greatly influenced by the orientation of the functional group of Tween-20 with respect to the orientation of the cyclic structures present in the given dye, which controls the accessibility of the active sites of CGA by the dye molecule to form the CGA-dye complex. We have also noted form the computational estimates that stable complexes (higher negative binding energy) of all the dyes considered and CGA molecule in the aqueous solution are formed (refer to Table 2). The recent work, therefore, suggests the efficient use of neutral CGA to remove organic dyes from the aqueous solution. However, the quantification of the amount of each dye removed from the aqueous solution using the CGA, which is generated using neutral Tween-20, is presently being undertaken and would be reported in the next documentation.

SIL 31	**Vineet Panwar** Student, Department of Chemistry, University Institute of Science, Chandigarh University, Punjab, India Topic: Antibacterial application of green synthesized CuO Nanoparticles New antibacterial agents are being developed as a result of recent developments in nanobiotechnologies. Particularly, attention has been focused on metal oxide nanoparticles, which are safe, chemically stable, and biocompatible. CuO nanoparticles have garnered the most interest among the various metal oxide nanoparticles because they exhibit a variety of beneficial physical characteristics, including electron correlation effects, high-temperature superconductivity, and spin dynamics. CuO nanoparticles were shown to have strong antibacterial properties. This antibacterial activity has been determined to be caused by the production of reactive oxygen species by nanoparticles while connected to the bacterial cells, which in turn increases intracellular oxidative stress. This review provides an overview of the antibacterial activities of CuO nanoparticles with special emphasis on their antibacterial mechanism and potential application. This review also aims to identify factors such as size, shape, and oxidation states of Cu, which influence the antibacterial properties of CuO nanoparticles.
SIL 32	**Sugandh Luthra** Student, Department of Applied Chemistry, Delhi Technological University, Delhi, India Topic: Artificial Neural Network based modeling of the supported liquid membrane for simultaneous extraction and recovery of cadmium and lead from wastewater With the exponential popularization of modern industries, more products are being produced, leading to water wastage and chemical disposal. These toxic chemicals are submerged in clean water resources, resulting in increased drinkable water toxicity. Separation of poisonous substances from wastewater is a pressing requirement to adopt the proof of concept of clean industrialization. Supported liquid membrane (SLM) is a popular and widely adopted non-dispersive membrane for the recovery and extraction of solutes from aqueous solution. The efficiency of cadmium and lead separation increases with the use of SLM. In this paper, we have adopted an ANN-based approach to predict the results related to the recovery and extraction of cadmium and lead using the MATLAB deep learning toolbox. The experimental results are predicted by modeling the experimental data and analyzing the effect of the operating parameter. The accuracy of the predicted model is validated with experimental results, and the variation in the features helped in optimizing the study.
SIL 33	**Shrikrushna Sopanrao Katpure** Student, Department of Chemistry, Dr. D. Y. Patil ACS College, Akurdi, Pune Topic: Modifications in water purification techniques for more selectivity & higher efficiency We humans have managed to cause a threat of mortality to the immortal source of fresh water. In the natural form itself 97% of the earth's water supply is in the form of ocean water which is unfit for domestic use. Of the remaining 3% which is fresh water, 2.3% is locked in the polar ice caps. Out of the balance 0.7% fresh water, 0.66% is groundwater, which leaves us with only 0.03% of fresh water available for direct use in rivers, streams

and lakes. Human actions such as the overexploitation of underground water and destruction of vegetation have caused severe impacts such as lowering of the underground water table, drought and reduction of rainfall respectively. Irrigation alone uses about 90% of the fresh water resources and the rapid increase over the past few decades have lead to mild to severe water crisis in all parts of the world. Even Cherrapunji in India, the place with the highest amount of rainfall in the world has also recently fought with water scarcity. Lastly, all the fresh water resources are slowly getting polluted due to the various causes of water pollution, majorly due to human actions. Keeping the afore mentioned in mind, efficient purification of water has become an absolute need of the hour. Old techniques such as Desalination process are not efficient due to the fragility of the filtration (semi-permeable) membrane which cannot withstand the high pressure of seawater.

The aim of this article is to compile the data for the evaluation of new membrane options, with more efficacious, more selective, more strong and more durable materials, such as Mixed-Matrix membrane (MMM) containing Metal Organic Formwork (MOF); Zeolites Nanofiltration Membranes, inorganic filler-based membranes, with low molecular weight materials; covalently cross-linked Ti_3C_2TX (MXene)/cellulose acetate; polymer mixed-matrix membranes. Not just the strength of the material use but also various other factors such as the porous and the non-porous nature of the material have a great impact on the quality of water filtration that the membrane delivers. In this review article we have compared the various membranes with all of their advantages and disadvantages along with their applications so that the choice of the best material for water-filtration membranes can be made.

Keywords: Mixed-matrix membranes (MMM), Metal-organic framework (MOF), Water purification, Desalination, Filler, Zeolites, Nonporous, Nanofiltration

SIL 34

Rhea Idrin Fernandez,
Post Graduate Student, Department of Chemistry, Dr. D. Y. Patil ACS College, Pune

Topic: Recent progress in MOF based membranes for water filtration

Nanofiltration separation methods are currently being considered by researchers for their effectiveness, simplicity and eco-friendly propertiesessential for elimination of water contaminants, and copious separation processes. Well efficient separation techniques can be favoured by combining nano particle fillers withMixed-Matrix Membranes (MMMs). Among the numerous types of MMMs, combining the merits of polymer matrix and organic-inorganic fillers has been notably investigated for desired results. MMMs has gained attention due to their vibrant mechanical, physico-chemical and transport qualities, featuring permeability, selectivity, hydrophilic, fouling resistance and greater thermodynamic robustness across a wide range of temperature and pH. The evaluation offers an outline of capabilities of Metal organic frameworks (MOF)based MMMs as compared to the polymeric and inorganic membranes and it documents that MOF based MMMs show promising performance, also features the capacity to triumph over the traditional permeability and selectivity alternate-off boundaries. First a complete evaluate is furnished on the selections of vibrant porous & non porous materials adopted in MMMs, consisting of MOFs, porous organic frameworks and porous molecular compounds. Secondly, the selection of different ceramic materials and crystalline components adopted in MMMs. With the recent trends in material science, research has shifted towards development and applications of advanced porous and ceramic materials as satisfying fillers to improve the separation performances of MMMs. A comprehensive

	overview of various advanced porous & ceramic materials recently introduced in MMMs is provided including organometallic frameworks, porous organic frameworks and porous molecular compounds. In the hope of urgent need for clean energy,high performance membranes and environmental sustainability, brief conclusions, current challenges regarding industrial implementation and future development strategies for MMMs are presented in outlined. **Keywords:** Mixed-matrix membranes, Organometallic framework, Water purification, Nano filtration
SIL 35	**Ananya Singh** Student, Delhi Technological University, New Delhi Topic: Artificial Neural Network Based Modeling of Membrane Based Process in the Sugar Separation Membrane-based processes for the separation of mixtures of structurally similar sugars of xylose and glucose are found to be very useful. Separating these sugars is exceptionally difficult owing to the similarity in size, charge and structure. On an industrial scale separating different monosaccharides from each other is highly challenging. An enzymatic process that converts glucose to gluconic acid is preferred to enhance the separation factor of xylose, after which xylose is separated from gluconic acid by nanofiltration (NF). However, the membrane process is selected based on suitable operating conditions. In this study, the data extracted from published literature is used as input for an approach based on an Artificial Neural Network (ANN), which trains the model based on the membrane-based process and further analyses the impacts of the operating parameters. A Neural Network was synthesized artificially using the Deep Learning Toolbox of MATLAB. Post-training, the ANN was used to investigate the influence of operating conditions on the optimisation of process and concentration established on appropriate multi-parameter models. The regression model obtained, and the corresponding set of simulations strongly support the required results. ***Keywords:*** *Sugar separation process, Nanofiltration, Artificial Neural Network, Simulation, Operating parameters*
SIL 36	**NIDHI SHUKLA** Chemical Engg. Department, H.B.T.U. Kanpur Topic: Water absorption behavior of banana fiber reinforced composites Banana fiber comes into category of natural fiber. The composite is prepared with combination of fiber & matrix. Fiber act as reinforced & matrix may be thermoplastics or thermosets. Fibers are hydrophilic in nature so absorption of water is increase with increment of fiber loading. Water absorption is different for different fibers. In case of composites, water absorption behaviour decreases with addition of polymer matrix & treated fiber. **Keywords:** banana fiber, water absorption, composites
SIL	**Rutuja Bhoje**

37	Research scholar, Department of Chemical Engineering, Institute of Chemical Technology, Mumbai Topic: Graphene Oxide as a functional material embedded in Polyamide-polysulfone Thin-film Nanocomposite Reverse Osmosis membranes for Desalination Productivity in terms of high-water flux and high salt rejection are two critical parameters for desired reverse osmosis (RO) membranes in addition to excellent chlorine & fouling resistance. At present, M/s. LG Chem makes thin-film nanocomposite (TFN) based RO membranes (LG SW 400 ES & LG SW 400 SR G2)commercially successful with the highest water flux and salt rejection among all RO membranes available in the market. Nanoparticles used in these membranes are proprietary as well as membranes are prone to fouling and vulnerable to chlorine attack. Recent studies revealed that graphene oxide (GO) has been widely used to make RO membranes and shows high water permeability, high durability, and chlorine-resistant properties. This study attempts to develop thin-film nanocomposite (TFN) based RO membranes by incorporating GO into the top polyamide layer to increase permeate flux and fouling resistance. TFC polyamide membranes were synthesized over polysulfone support membranes by in-situ interfacial polymerization using 1, 3-phenylene diamine in an aqueous solution along with GO and 1,3,5-benzene tricarboxylic acid chloride (TMC) in the Isopar-G solvent. Both blank thin film composite (TFC), and TFN membranes were characterized byproduct permeability with separation of NaCl solute under seawater reverse osmosis (SWRO) testing condition, water contact angle, and average surface roughness. Incorporation of the GO in the top polyamide layer enhances the water permeability with a slight decrease in salt rejection properties, and it is more prominent at higher loading of the GO in the top layer. At GO concentration of 0.0025%, the flux increase is quite substantial (~32%) with a marginal decrease in salt rejection. These membranes show better chlorine-resistant and antibacterial properties compared to blank TFC membranes.

Membrane	Conc. of GO (%)	SWRO membrane performance		Water contact angle(degree)	Average roughness(nm)
		Product permeability (LMD)	NaCl Rejection (%)		
TFC	Nil	518 ± 16	96.9 ± 0.3	65.0 ± 0.9	65.68 ± 2.15
TFN 1	0.0025	687 ± 19	96.0 ± 0.3	64.0 ± 0.4	100.22 ± 2.23
TFN 2	0.0033	710 ± 17	94.6 ±0.2	61.6 ± 0.9	135.66 ± 4.60
TFN 3	0.050	758 ± 20	94.3 ± 0.2	60.0 ± 0.5	157.98 ± 5.82

Keywords: membrane, thin film nanocomposite, reverse osmosis, graphene oxide,desalination

SIL 38	**SHERIN PETER** Centre RAPSODEE-CNRS UMR 5302- IMT Mines Albi Campus Jarlard,81013 ALBI CT CEDEX 9, France Topic: Bio-based sustainable nanocomposites for wastewater treatment

	Nanocomposites have been used in different ways for the removal of pollutants. However, most of the current practices often require toxic organic solvents or high-cost materials for their synthesis [1], [2]. The hybrid approach of combining adsorption and size exclusion mechanisms widens and accelerates the pollutant removal spectrum. In our study, a nanocomposite was synthesised using a simple, cost-effective, chemical-free method using an inorganic additive (IA), an excellent sorbent with biowaste-derived nanocellulose (NC) and chitosan (CH) that exhibits excellent mechanical properties, film-forming capabilities and processibility. The nanocomposite when filtered with synthetic wastewater having 10 ppm of Ni ion and congo red (CR) dye, the pollution removal percentage was up to 98.7% and 100% for Ni ion and CR dye respectively. The nanocomposite demonstrated outstanding pollutants removal capacity towards pollutants such as Ag, Al, Cd, Fe, Hg, Li, Mo, and Se in 100% and Ba, Beand P more than 80% from industrial wastewater. Overall, this work demonstrated that a nanocomposite membrane can be synthesised without the use of any harmful chemicals or complex modifications yet it can perform outstanding pollutants removal capabilities and scale up at pilot and full scale. **References** J. Ramkumar, J. Majeed, and S. Chandramouleeswaran, "Insight to sorption mechanism employing nanocomposite: Case study of toxic species removal," *Microporous and Mesoporous Materials*, vol. 314, p. 110858, Feb. 2021, doi: 10.1016/J.MICROMESO.2020.110858. H. D. Beyene and T. G. Ambaye, "Application of Sustainable Nanocomposites for Water Purification Process," in *Sustainable Polymer Composites and Nanocomposites*, Inamuddin, S. Thomas, R. Kumar Mishra, and A. M. Asiri, Eds. Cham: Springer International Publishing, 2019, pp. 387–412. doi: 10.1007/978-3-030-05399-4_14.
SIL 39	**Dr. Rehana P Ummer** Assistant Professor (Ad. hoc), School of Nano Science and Nano Technology, Mahatma Gandhi University, Kottayam Topic: Magnetic nanoparticle assisted systems for water purification: A comparative study of Dye degradation efficiency of different photocatalysts
SIL 40	**Dr. Shanthi Prabha V** Science Research Scientist, Advanced Centre for Environmental Studies and sustainable Development (ACESSD), Mahatma Gandhi University, Kottayam, India Topic: Biochar based nanocomposites for waste water treatment from an environmentally sustainable perspective
	Poster session
P 1	**Mukesh Kumar** Ph.D. Scholar, CNMS, Jain University, Bangalore, Karnataka Topic: Growth of mono-to-few layer MoS2 membranes for water desalination

	Despite the fact that 75% of the land of earth is covered in water, a severe worldwide concern known as the shortage of drinkable water is expected to deteriorate due to constant rising of the demand as a result of population expansion, growing industrialization, and growing energy needs.As there is such a large amount of water in seawater, desalination has emerged as a significant andviable strategy to address the rising need for fresh water [1]. Nowadays, polymeric membranes aregenerally used to desalinate water but the polymers have limited water permeability and are proneto degradation, which both raise energy costs and the desalination of water's cost [2]. Two- dimensional (2D) materials have made significant progresses in recent years in this area, resultingin superior water permeability and chemical resistance, making them very attractive as substitute materials for water desalination [3]. Graphene and graphene oxide (GO) are excellent membrane candidates due to their mechanical/thermal/chemical stability, controllable porosity, and controlledchemical functionality. However, creating the pores in graphene and swelling of graphene oxide membrane in water cast limitations on the use of these membranes [4]. Molybdenum disulfide (MoS_2) have some distinct features such as zero swelling in water and 70% higher water flux thana porous graphene membrane [5, 6]. In the present work, we report the synthesis of mono-to-few layers of MoS_2 membranes of lateral size around few of tens of microns by chemical vapor deposition method. Electrochemical reaction technique can be used to precisely fabricate nanopores with a sub-nanometer size on these grown MoS_2 membranes for water desalination. This work would provide an opportunity to explore other 2D membranes beyond graphene as a next generation cost-effective and high-performance membrane for water desalination. **Keywords**: Desalination, 2D Membranes, MoS_2, Electrochemical reaction, Nanopores. *Corresponding author: pramoda.nayak@jainuniversity.ac.in (Pramoda K. Nayak) **References** 1. Curto *et. al.*, A review of the water desalination technologies, *Appl. Sci.* 2021, **11**, 670. 2. Werber *et. al.,* the critical need for increased selectivity, not increased water permeability, fordesalination membranes, *Environ. Sci. Technol. Lett.* 2016, **3**, 112. 3. Li *et. al.*, Experimental realization of few layers two-dimensional MoS_2 membranes of nearatomic thickness for high efficiency water desalination. *Nano Lett.* 2019, **19**, 5194. 4. Elimelech *et. al.* The future of seawater desalination: energy, technology and the environment. *Science* 2011, **333**, 712. 5. Wang, Z. *et al.* Understanding the aqueous stability and filtration capability of MoS_2 membranes. *Nano Lett.* 2017, **17**, 7289. 6. Heiranian *et. al*. Water desalination with a single-layer MoS_2 nanopore. *Nat. Commun*. 2015, **6**,8616.
P 2	**Akshay Khandagale** PG Student, Post-graduate and Research Centre, Department of Chemistry, MES AbasahebGarware College, Pune, India Topic: Synthesis of TiO2 nanoparticles via ultrasonication: Immobilization in Biodegradable polymer membranes for photocatalytic degradation of dyes

	Synthetic dyes are widely used in various industries such as, paper, leather, textile and printing. Discharge of dyes into the environment can cause serious ecological imbalances and health hazards to living organisms due to their persistent and non-biodegradable nature. Therefore, synthetic dye degradation is necessary. Photocatalytic degradation using TiO_2 nanoparticles is a promising method for the degradation of dyes due to its effectiveness, low cost and environmental friendliness. However the use of nanoparticles in the bare form is impractical due to losses during recovery post degradation. There are various approaches reported in the literature for synthesis of TiO_2 nanoparticles. In the present work the ultra -sonication method was used due to its ease of operation. The time required for the ultra-sonication step was found to be a key factor for tuning the properties of the nanoparticles. In the present work the ultra-sonication time was varied from 2h to 10 h. The synthesized nanoparticles were characterized by FTIR and XRD, the results showed that the particles obtained after 4 hours of ultra-sonication had optimum particle size. These nanoparticles were then immobilized in chitosan to fabricate membranes for the photocatalytic degradation of methylene blue (MB). The percentage of TiO_2 immobilized in chitosan was varied between 1-10%. Batch sorption studies were conducted to determine the optimal conditions for maximum photocatalytic degradation. The MB concentration in the solution was varied between 5-20 mg/ L, and the pH of the solution was varied from 2-10. The degradation of MB obtained using 5% TiO_2 immobilized chitosan (1×2 cm)membrane was found to be 78 % at solution pH =10 in 4 h.Degradation data wasmodelled using Langmuir-Hinshelwood equation for kinetic studies. Keywords: Ultra-sonication; TiO_2 nanoparticles; Photocatalytic degradation
P 3	**SHAIKH ARFA- AKMAL** BEGUM AZIZUN NISA HALL,MEDICAL COLONY ,ALIGARH Topic: Metal-organic frameworks (MOFs) as a promising avenue for water purification Water purification is of utmost importance for providing clean and safe drinking waterto the population. In this regard, metal-organic frameworks (MOFs) have emerged aspromising materials for water purification due to their high porosity and tunable properties. This work synthesizes and characterizes three MOFs (Cu-MOF2COOH, Ni-MOF-COOH, and Cd-MOF). The MOFs were characterized using various spectroscopic techniques and single-crystal X-ray studies, which disclose that Cu- MOF-2COOH and Ni-MOF-COOH contain two and three uncoordinated carboxylic acid groups, respectively. In contrast, in Cd-MOF, all three carboxylic acid groups areutilized in bonding. The uncoordinated carboxylate groups in MOFs were found to actas post-synthetic modification sites for metal capture, providing a new approach to developing effective methods for metal capture from water. After post-synthetically modified materials (Fe@Cu-MOF-2COOH and Fe@Ni-MOF-COOH) were tested for organic dye adsorption properties, both doped MOFs showed better adsorptionproperties towards the MB and MO dyes. Three kinetic models were employed to understand the reaction mechanism of adsorption, and the pseudo-second-order kinetic model fits the best in both cases. Overall, this study highlights the dual functionality of MOFs for both metal capture and dye adsorption, emphasizing their potential as a versatile material for water purification applications. Developing effective methods for dye adsorption is critical for ensuring the safety of drinking water and protecting public health because organic dyes can be found in various industrial effluents and pose a severe threat to human health and the environment. **Keywords:** MOFs, Water purification, Metal capture, Dye adsorption.

P 4	**Abhijit Phalke** Post-Graduate and Research Centre, Department of Chemistry, MES Abasaheb Garware College, Pune, India. Topic: Cadmium adsorption on novel Kaolinite-Alginate composite beads Industries, mining, agriculture, and home all use water on a large scale. The waste from these places heavily pollutes water due to their excessive usage. One group of these pollutants is heavy metals. Heavy metals are non-essential, non-biodegradable substances that might harm the ecosystem. Itai-itai illnesses, which are severe, irreversible lesions affecting the human kidneys, liver, and bones, are known to be brought on by cadmium. Precipitation, ion exchange, solvent extraction, floatation, coagulation, and membrane filtration are some of the methods for removing heavy metals from aqueous solutions described in the literature. Amongst them the adsorption approach is the most effective in removing cadmium. The advantages of the adsorption process are the material's reusability, low cost, ease of operation, and high removal efficiency. In the present work, calcium cross-linked Alginate and kaolinite composite beads were synthesized and employed for the adsorption of cadmium. The beads were characterized using FTIR before and after cadmium adsorption. The batch sorption studies were performed to optimize conditions of maximum cadmium adsorption on composite beads. The data obtained from batch adsorption studies were modelled using Langmuir and Freundlich adsorption isotherm models. Also, kinetic studies were performed using pseudo-first and pseudo-second-order models. The isotherm studies indicated adsorption of cadmium on composite beads follows the Langmuir isotherm model and has a maximum adsorption capacity of 31.05 mg g^{-1}. The studies indicated that composite beads could be effectively employed for cadmium adsorption from wastewater streams. **Keywords:** Cadmium; Kaolin; Alginate; Adsorption.
P 5	**Arun P** Research Fellow, Inter University Instrumentation Center, Mahatma Gandhi University, Kottayam Topic: A Systematic Investigation into the Degradation of Diethyl Phthalate in Aqueous Medium Using a High-Frequency Ultrasound System
P 6	**Mikhail Porozhnyy** Kuban State University, Krasnodar, Russia Topic: Using fluorescent-tagged antiscalants to reduce scaling in electrodialysis system with homogeneous ion-exchange membranes
P 7	**Dmitrii Butylskii** Kuban State University, Krasnodar, Russia Topic: Highly selective separation of singly charged ions by hybrid electro-baromembrane method
P 8	**Chithra K R**

	Department of Chemistry, Indian Institute of Space Science and Technology, Trivandrum, Kerala, India Topic: Removal of Ciprofloxacin from Water by Cu-Ru-BMOF Incorporated Mixed Matrix Membrane-Based Filtration