Masters Thesis Information Showcase
Spring Semester-2026
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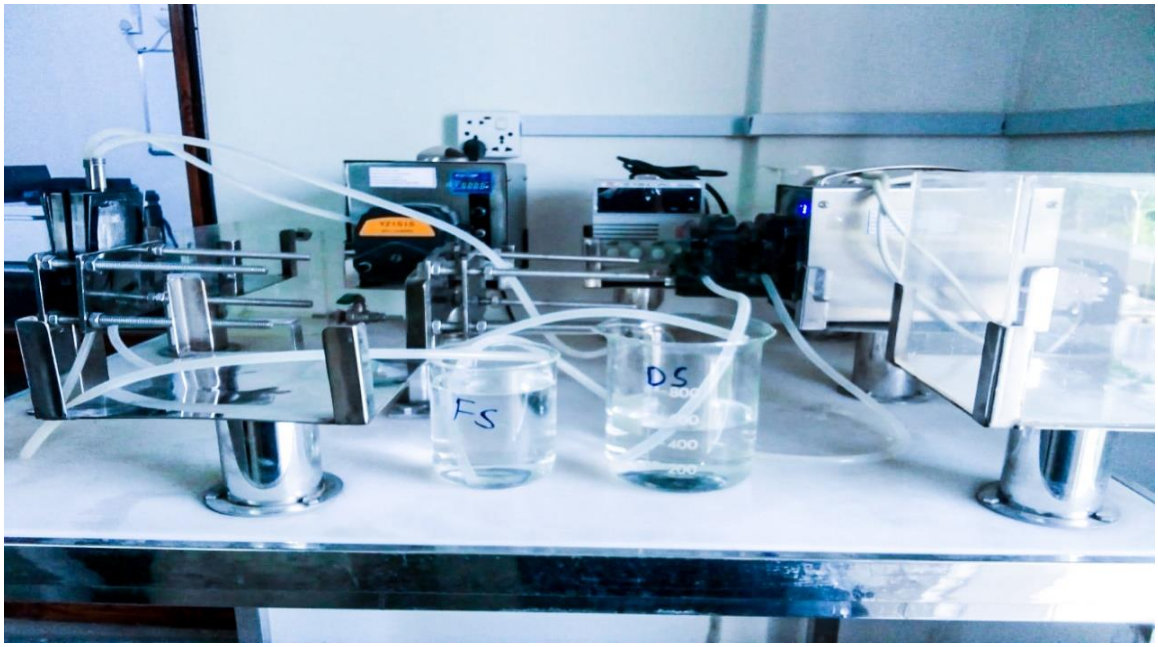
Department: Chemistry
Programme: Masters of Science
Specialization: Industrial Chemistry

1	**Title of the Thesis** **ELECTRICALLY CONDUCTING ANTI-FOULING MEMBRANES FOR SUSTAINABLE DESALINATION PROCESS**
2	**Abstract** (min 300 to 500 words) This study is based on the synthesis and performance testing of electrically conductive anti-fouling membranes for effective desalination and anti-fouling processes. In this study nylon substrate (polyamide; PA) has been modified by using poly-dopamine (PDA) and graphene oxide (GO) nanoparticles to enhance the water permeability and fouling resistance of modified nylon substrate (PA). Structural and surface characterization of modified membranes was done through FTIR, SEM and AFM analyses. FTIR results of hydrolyzed nylon substrate (NS) reveal the presence of N-H around 3300cm-1, C=O at 1710cm^{-1}, Amide C=O Stretch (Amide I) around 1630-1640cm^{-1}, aliphatic C-H stretch around 2930cm^{-1}. Porosity and pore size of modified membranes were calculated from SEM images and found as 0.17066-0.20583 and 1.6837nm, respectively. Surface wettability of the membranes was analyzed by using Drop analysis-LB-ADSA method utilizing image j software. Contact angle of membranes was found as 51.85°, which shows the hydrophilic nature of membrane. Performance of modified membrane was tested for desalination process by using dead-end cell filtration process and membrane was effectively found to remove 80ppm more salt from simulated salt solution (2000 ppm Nacl solution) as compared to pristine nylon substrate. Anti-fouling performance testing of our synthesized membrane was done by using organic, inorganic, proteins, and mixed foulants via dead-end cell filtration process. Water flux Jw before and after running of foulant solutions through membranes was measured, subsequently flux recovery ratio FRR(%) was found up to 99.6%. These results show the remarkable anti-fouling tendency of our synthesized membranes.
3	**Impact on Sustainability of Urban Regions or SDG-11 "Sustainable Cities and Communities"** (min 500 words) Electrically conducting anti-fouling membranes contribute significantly to the sustainability of urban regions by improving desalination efficiency, reducing energy and chemical consumption, enhancing water security, and strengthening the resilience of urban water infrastructure. These benefits directly support the objectives of **SDG 11: Sustainable Cities and Communities**, while simultaneously advancing progress toward SDG 6 (Clean Water and Sanitation)**,** SDG 9 (Industry, Innovation and Infrastructure**)**, and SDG 12 (Responsible Consumption and Production)**.** Their adoption can play a pivotal role in ensuring sustainable and resilient water management strategies for future cities. Water scarcity is increasingly recognized as a major challenge for urban sustainability, particularly in coastal megacities and densely populated regions. By improving desalination efficiency and reducing operational costs, electrically conducting anti-fouling membranes facilitate the production of affordable freshwater, thereby strengthening urban resilience against droughts, climate variability, and water shortages. Furthermore, these advanced membranes support

	sustainable resource utilization by reducing chemical consumption associated with membrane cleaning procedures. Conventional desalination plants frequently rely on chemical cleaning agents that generate secondary environmental impacts and increase operational expenses. The anti-fouling characteristics of electrically conducting membranes minimize chemical usage, lowering the environmental footprint of water treatment facilities and promoting cleaner production practices within urban infrastructure systems. Another important contribution to sustainable cities is the reduction in energy consumption. Fouling increases hydraulic resistance and consequently elevates the energy demand of membrane processes. By maintaining higher permeate flux and reducing fouling-induced resistance, electrically conducting membranes improve energy efficiency and decrease greenhouse gas emissions associated with water production. This aligns with the broader objectives of sustainable urban development and climate change mitigation. In addition, these membranes can enhance the operational reliability of decentralized and smart water treatment systems, which are increasingly being adopted in modern cities to improve water management and distribution. Their integration into advanced desalination and water reuse facilities supports the development of innovative, resilient, and sustainable urban infrastructure capable of meeting future water demands.
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6	**Graphical Abstract**