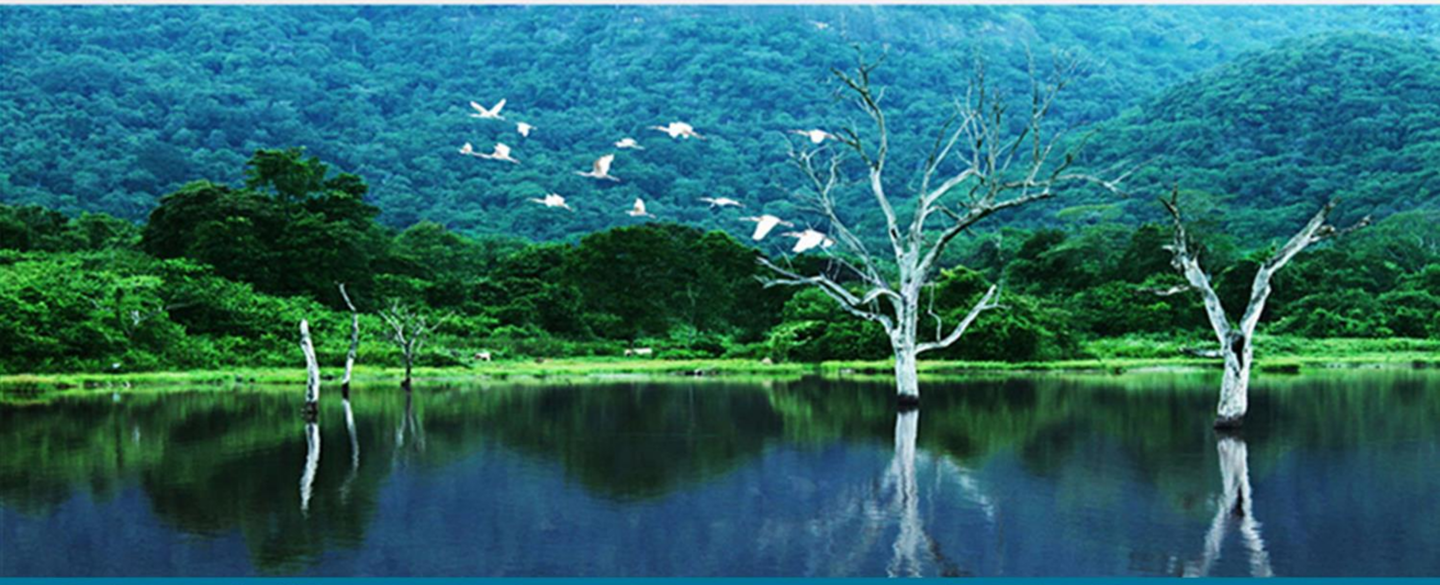
PROCEEDINGS

INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH 2024

CHALLENGES AHEAD



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PERFORMANCE OPTIMIZATION OF THIN FILM NANOCOMPOSITE MEMBRANE FOR WATER PURIFICATION USING A SPIN-ASSISTED METHOD

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Water purification has become a global challenge due to environmental pollution associated with urbanization and industrial activities. Advanced technologies along with sustainable practices should be developed to address this challenge to ensure the access of clean water to all human beings. Nanofiltration (NF) is a promising membrane technology used in the water purification industry. Its energy requirement leads to less high fluxes and salt rejections compared to reverse osmosis. Yet, the majority of commercial NF membranes face numerous challenges, such as high energy consumption, poor antifouling, and limitations of permeability and selectivity. By optimizing the thickness, the required energy and the pressure needed to drive the membrane would be reduced simultaneously. In this study, a spin-assisted interfacial polymerization technique was used to vary the thickness, and the aim was to find out the effect of spin acceleration on the membrane thickness. For this purpose, a thin film nanocomposite membrane (TFN) was developed by fabricating a graphene oxide (GO) incorporated polyamide (PA) layer on top of a porous substrate of polyether sulfone (PES). The spin coating method would ensure the even distribution of GO within the PA layer and its uniformity. Monomers for the PA are piperazine (PIP) and trimesoyl chloride (TMC). The membranes were fabricated using different angular accelerations and a fixed angular velocity of 3600 rpm for 30 s. A homemade crossflow filtration cell was used to check the membrane performance. The pure water permeability (PWP) was evaluated at ambient temperature and pressure of 4 bar. Scanning electron microscopy was used to measure the thickness of the PA layer. The different angular velocities used to fabricate the membranes are 20, 40, 60, 80 and 100 rpm s^{-1}. Membrane fabricated at 80 rpm s^{-1} angular acceleration exhibited the highest permeability of 31.0 L m^{-2} h^{-1} bar^{-1} and 90% of Ca^{2+} and Mg^{2+} salt rejection along with an optimum lower thickness value of 114.0 nm of the PA layer. According to the results, when increasing the angular acceleration, the thickness of the fabricated PA has reduced, and lower thickness values have shown higher permeability values. The lower thickness values of the PA layer have provided less transportation barrier for water molecules and increased the flow of the water through the membrane, thereby reducing the energy requirement for filtration and achieving cost efficiency. This work concludes a novel spin-assisted method to fabricate TFN-NF membranes with high performance.

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Keywords: Nanofiltration, Permeability, Salt rejection, Spin, Thickness

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