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INVESTIGATION OF FOULING MECHANISM ON GRAPHENE OXIDE POLYETHERSUFONE NANOCOMPOSITE ADSORPTIVE MEMBRANE

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Abstract
Wastewater effluent contaminated with heavy metals originating from numerous human and industrial activities is one of the major threats to the environment. Lead (Pb) is one of the common and most toxic pollutants in natural waters. Pb contamination present in water is associated with mining and semiconductor industries pose serious health issues towards human and ecosystem. Currently, utilization of membrane governing adsorption and filtration process is one of the alternative technologies to remove heavy metals from wastewater. However, membrane fouling is still a great challenge in the filtration process for wastewater treatment which limits its technical and economic performance. The use of nanomaterials to enhance the polymeric membrane properties has attracted researchers to fabricate an enhanced nanocomposite membrane for removing heavy metals from wastewater. Therefore, in this study, a nanocomposite membrane is fabricated by incorporation of graphene oxide into polyethersulfone membrane, namely graphene oxide polyethersulfone nanocomposite (GPN) membrane. The characterization was conducted through Field emission scanning electron microscopy- Energy dispersive X-ray (FESEM-EDX) to reveal the elemental composition of the membrane. The rejection performance of the GPN membrane for Pb removal was conducted under the dead-end filtration system. To prevent and control fouling, the membrane fouling and blocking mechanisms were analysed using single and combined pore blocking models. From pore blocking analysis, cake filtration outperformed all other filtration mechanisms, with the highest R2 at all transmembrane pressures applied for single models meanwhile intermediate-cake layer dominated the combined model analysis with highest R2= 0.99898 and lowest sum square errors (SSE) of 1.9×10-5 for GPN filtration process. The results suggested that the GPN membrane could be used for a longer filtration time and the existence of simultaneous pore blocking on GPN filtration. This research study could significantly contribute to establish the technically feasible membrane technology to treat heavy metals from industrial effluents before disposal into water bodies.

Author Keywords
Fouling mechanism; Nanocomposite membrane; Pore blocking; Wastewater treatment

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