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INTEGRAL MEMBRANE FROM PSF/PVA/ QUATERNIZED CHITOSAN CROSS-LINKED WITH RHA SILICA POWDER FOR LI/MG SEPARATION

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ABSTRACT

Membrane separation technology is one of the most effective methods to recover Li^+ from salt-lake brine. Due to its high competition with Mg^{2+}, a new technique known as quaternization process is applied in membrane technology to develop a positively charged membrane which scientifically proven can separate high valent cation and low valent cation. The technique of quaternization required grafting quarternary ammonium groups, which serves as the positive charge carriers, onto the polymer chain. In this study, chitosan was quaternized with chlorohydroxypropyl trimethylammonium chloride (CHTAC) to formulate positively charge membrane. The quaternized chitosan (QCS) was then blended with polysulfone/polyvinyl alcohol and rice husk ash silica (RHAS) powder where the RHAS powder acted as a cross-linking agent. The formulation of the membrane consisted of two different loading concentrations of QCS at 2.5wt% and 5wt.%, and the loading of RHAS powder were varied at Owt.%, 0.5wt.% and lwt.%. The membranes were the characterised through Fourier Transform Infrared Spectroscopy (FTIR), Field - Emission Scanning Electron Microscopy (FESEM), Thermogravimetry Analysis (TGA), Zeta Potential Analysis (ZP), X-Ray Diffractometer (XRD) and contact angle. The RHAS powder was also characterised through X-Ray Diffractometer (XRD), Energy Dispersive X-Ray Fluorescence (EDXRF), Scanning Emissions Microscopy (SEM), and Fourier Transform Infrared Spectroscopy (FTIR). The performance of the membrane was analysed through pure water flux analysis, antifouling analysis, and separation process between Li^+ and Mg^{2+}. According to data collected by EDXRF and XRD analysis, the modified extraction process had successfully extracted 98.24% of Si02 and the RHAS powder had an amorphous structure respectively. From the membrane characterisation, the membrane incorporated with lower QCS, at 0.5wt.% RHAS powder exhibited smaller pore size, had better thermal stability and improved membrane hydrophilicity. However, from zeta potential analysis, higher loading of QCS exhibited more positive charges compare to lower loading of QCS. Overall, the membrane containing RHAS powder had better and stable pure water flux and good antifouling behaviour especially at lower loading of QCS, and membrane incorporated with QCS showed a rejection towards Mg^{2+}then able to recover high amount of Li^+ through the separation process. Whereas some membrane suffers with inhomogeneous structure which had influenced its characteristic and performance. Amongst all membrane, it can be concluded that membrane Bl with lower QCS loading with 0.5wt.% of RHAS powder demonstrated the best characteristic and performance compared to other membranes. Hence, the formulation of membrane Bl has potential to be used for lithium recovery with additional advantage of utilising biomass in the membrane formulations.

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