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37

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Title : PVA/PEG – Teos Hybrid Membrane for Permeation of Crude Glycerol

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Purification of crude glycerol by employing membrane separation as a mechanism involved in the process had been widely conducted due to its environmentally process and sustainability of energy. Realizing that hybrid membrane has better thermal and mechanical stability as well as better processing flexibility as compared to membrane from pure organic polymer and inorganic material, this research investigated on the use of hybrid membrane as a barrier layer in thin film composite (TFC) for permeation of crude glycerol. In this study, thin film composite membrane consists of polysulfone as base support and hybrid membrane as the barrier layer. In a hybrid membrane formulation, a polymer blend of polyvinyl alcohol with polyethylene glycol was chosen as organic polymer which was cross-linked with tetraethylorthosilicate (TEOS). Glycerol was added as an organic additive to improve the plasticizing effect of hybrid membranes. There were three stages of work involved in the research. The first stage was investigating on base support where suitable concentration of polysulfone had been determined by water flux evaluation and investigation on suitable range of organic polymer, TEOS and glycerol concentrations. The evaluations were carried out through physical and chemical characterization and performance evaluation particularly on thin film composite through separation of crude glycerol solution. Besides good thermal and mechanical stabilities, and high surface hydrophilicity of hybrid membranes as compared to base support and membrane from pure polymer, the incorporation of glycerol had enhanced flexibility of membrane's matrix. These properties had overcome the rigidity of structure and brittleness of ordinary hybrid membranes. Major findings from this stage revealed that the suitable range of total polymer was between 5 to 7 wt.% and TEOS concentrations between 1 to 4 wt.% for formulation of hybrid membranes particularly in permeation process of crude glycerol. The second stage of research involves characterization of crude glycerol and permeation of synthetic crude glycerol which consists of glycerol, water, methanol and NaCl through the fabricated thin film composite. The main purpose was to evaluate the separation pattern of NaCl and glycerol through the TFC. Based on the evaluations, formulation of hybrid membranes with high percentage of polymer and tetraethylorthosilicate had led to high salt rejection but it suffered with low permeation of glycerol. Therefore the best formulations of hybrid membrane particularly in term of polymer and tetraethylorthosilicate concentrations and condition for feed solution that yields high NaCl rejection, high percentage permeation of glycerol and reasonable volume of flux had been determined by using design of experiment. Result showed that the regression equations generated from the experiment were accurate to predict all the responses and the best formulation was achieved at 5 wt.% total polymer with 4 wt.% TEOS, and feed condition with 75 % w/w water addition. The resulted responses were 36% NaCl rejection, 85% permeation of glycerol and 43 L/m^2.day of flux rate. Permeation of crude glycerol through the fabricated thin film composite, which exhibits a nanofiltration behaviour with a pore flow model as a transport mechanism, has been found as a potential pathway for crude glycerol purification which has some advantages over the existing process that employs membrane such as operation at low pressure and at room temperature.