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HEAVY METAL REMOVAL BY MEMBRANE FILTRATION

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ABSTRACT

In this study, a thin film composite (TFC) membrane was fabricated by using polysulfone (PSF) membrane as supporting layer and hybrid membrane as barrier layer. The inversion method was used in the production of the PSF membrane while the hybrid membrane was formulated by blending organic polymers chitosan (CS), polyethylene glycol (PEG), polyvinyl alcohol (PVA) and crosslinked with tetraethylorthosilicate (TEOS). The aim of this experiment to study the effect of varying the concentration of PVAon the characterization and performance of the TFC membrane. Two different PVA concentration were selected: 2 wt% and 3 wt%. The thin film composite was characterized by using Fourier Transform Infrared Specstrocopy (FTIR) and thermogravimetric analysis (TGA). In performance testing, pure water permeability (PWP) to measure water flux and antifouling properties by using humic acid and deionised water as feed solution was carried out. The performance testing also including mercury removal by using mercury solution in order to analysed the percentage of removal of the mercury. Results shows that TFC membrane with 3% PVA concentration have a better characterization and performance compared to TFC with 2% PVA concentration. Besides, this membrane is good in flux ratio and antifouling properties compared to the TFC with 2% PVA concentration. Overall, this formulation of TFC membrane have a great potential as antifouling membrane in membrane filtration applications.

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INTRODUCTION

1.1 Heavy Metal Generalities

The heavy metals are not the good things that exist in the water and may affect the ecosystem for the long-term effect. The example of heavy metals are lead (Pb), iron (Fe), copper (Cu) and nickel (Ni). Among these heavy metals, one of the most dangerous is mercury. Effluents from manufacturing of chlorine, switch gear/batteries, fertilizers, pharmaceuticals, combustion of fossil fuels, textile industries, pulp and paper industries and agricultural chemicals are among the sources that contribute to the leakage of mercury to the water sources. The effects of the mercury to the organisms is that it can attack the central nervous system that can cause mental and motor dysfunction. This motor dysfunction can lead to paralysis, blindness and chromosome breakage (H.Bessbousse, T.Rhlalou, J-F. Verchere, L. Lebrun, 2010). Therefore, it is important to remove these heavy metals to prevent the negative effects the living organisms and also the environment.

There are various method to remove the heavy metal ions. They are conventional methods and membrane separation methods. The example of conventional methods are liquid-liquid extraction, precipitation and ion exchange (S. Kounshkbangi, 2017). Among the methods, adsorption process is the best process for removal the metal ions as it is an efficient and economical method. However, there is a setback where it is difficult to regenerate the adsorbents from water and agglomeration of adsorbents in aqueous solution within an adsorption process. The other method is membrane separation technology. This technique has been compared with conventional method and the result shows membrane separation technology is better as it has lower power consumption, smaller footprint, lower pressure drop and high efficiency (Vahid Vatanpour, 2017).