UNIVERSITI TEKNOLOGI MARA

FABRICATION OF MAGNETIC HAP-GO-PES MEMBRANE FOR COBALT REMOVAL

MOHAMAD SUFIAN BIN ZAWAWI

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ABSTRACT

Polymeric membrane, polyethersulfone (PES) was fabricated to increase their separation process performance and characteristics. It was fabricated by using magnetic hydroxyapatite (MHAP) Fe_2O_3 nanoparticles together with graphene oxide (GO). They act as additive and adsorbent were prepared by using modified Hummer's method. The fabricated polymeric membrane, MHAPGO-PES was prepared by phase inversion process. GO, MHAP and MHAPGO-PES characteristics were determined by using Fourier Transform IR spectroscopy (FT-IR), X-ray diffraction (XRD) and Water Contact Angle measurement. Fabricated membrane performance test was carried out by two tests which were Pure Water Flux (PWF) test and heavy metal removal by using cobalt ion. From that, the advantages of adding the MHAPGO into PES were identified. GO showed beneficial effects when incorporated into PES by increasing hydrophilicty of the membrane because of the nature hydrophilic behavior of GO. It was approved by Water Contact Angle measurement that the fabricated membrane increased their hydrophilicity as the concentration of the MHAPGO increased. After fabrication, the water flux ratio increases as the concentration of the additives added increases from 18.82 to 324.95 L/m^2.hr for pressure at 1 bar. Same as for the pressure at 2 bar, the water flux increase from 17.66 to 396.10 L/m^2.hr. The rejection rate for cobalt removal was range in 94% to 98%. From the result obtained, it concluded that MHAPGO acted as an effective additive for membrane fabrication.

Keywords— Graphene Oxide, Heavy metal, Hydroxyapatite, Magnetic nanoparticles, Phase inversion, Polyethersulfone.

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CHAPTER ONE
INTRODUCTION

1.1   Research Background

In this recent year, together with increasing industrial development, there is rise in the heavy metal pollution which also recognized as critical environmental harms nowadays. The rise in amount of heavy metal produced make management development still left behind other reasons which is not perfect and introduce various heavy metal ions into the water or environment, creating contamination.

Treating heavy metal from waste water is very challenging matter, as the heavy metal ions production come from wide source of sector such as industrial effluents, oil refining and transportation, petrochemical industries in the production process and dissolving of metal ions into lakes and rivers which is come from soil by acid rain. Heavy metal exposure might give effects to the human either acute or chronic exposure. Those effects are such as Pneumonitis (lung inflammation), lung cancer, diarrhea, nausea, pulmonary fibrosis (lung scarring) and more.

Hence, many technologies and technique have been developed in order to solve this industry problem. In order to overcome this issue is by reusing the water that needs to be treated which requires the advanced technologies implementation, for an example, membrane technologies. According to (Padaki, Murali et al. 2015), for past few years, the using of membrane technology is showing a fast growth because of research and development in industry sector. Based on the survey, it shows that various research on how to develop new adsorbent and membrane filtration had been done. It is suitable to treat the wastewater containing heavy metal.

Membrane separation technology is defined as the physical removal or separation of the trapped particle of contaminants by using a specific manufactured porous material in a certain way (Yu, Han et al. 2017). Membrane generally divided into organic (polymer) membrane and inorganic (ceramic and metal) membrane.

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