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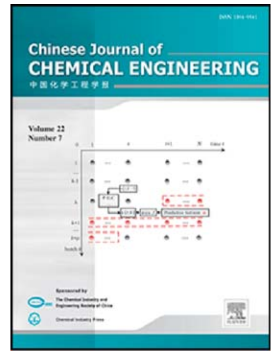

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PREPARATION OF PVC/PVP COMPOSITE POLYMER MEMBRANES VIA PHASE INVERSION PROCESS FOR WATER TREATMENT PURPOSES

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ABSTRACT

In this work, new composite membranes were successfully prepared via phase inversion technique using polyvinyl chloride (PVC) and polyvinylpyrrolidone (PVP) as polymers and tetrahydrofuran (THF) and *N*-methyl-2-pyrrolidone (NMP) as solvents. The prepared membranes have been characterized by scanning electron microscope (SEM), and fourier transforms infrared spectroscopy (FTIR). The scanning electron microscope results prove that the prepared membranes are smooth and their pores are distributed throughout the whole surface and bulk body of the membrane without any visible cracks. The stress-strain mechanical test showed an excellent mechanical behavior enhanced by the presence of PVP in the prepared membranes. The membranes performance results showed that the salt rejection reached 98% with a high flux. This, in turn, makes the prepared membranes can be applied for sea and brackish water treatment through membrane distillation technology.

Keywords: Membrane; Polyvinylchloride; Polyvinylpyrrolidone; Phase inversion

1. INTRODUCTION

Recently, the need for fresh water for various applications is raising with the growth of the world population. It was noted that most of the world water resources are mainly saline water. Furthermore, the fresh water (~2.5%) is either stored underground or in the form of ice/snow covered mountainous areas. This scarcity of fresh water is driving the implementation of water/wastewater treatment and especially water desalination, which is investigation on an increasing large scale [1,2]. Polymeric membranes have gained very important place in water treatment technology due to their excellent behavior. Membranes could have relatively high efficiency and save energy without any chemicals addition; this behavior enhances researchers to focus on membrane technology. This technology is environmentally benign and became the preferred technology over conventional separation processes like filtration, distillation and ion exchange, for producing high-quality products, and providing greater flexibility in the system design [3-5].

Many ways could be used to prepare porous polymeric films, such as stretching, sintering, phase separation processes and track etching. Controlled phase separation of polymer solutions is the most common technique through the above mentioned ways. [6]. Phase-inversion process consists of the induction of phase separation in a previously homogeneous polymer solution. This process could be carried out in wet or dry media. Wet media involves change in temperature via immersing the solution in a coagulation bath, while dry media involves the introduction of the polymeric film to a nonsolvent atmosphere [4,7].

The membrane works as a semi-permeable barrier which allows passing of single or more species or compounds of a gaseous and /or liquid mixture or solution under a certain driving force [8-10].This driving force could be a change in , concentration, pressureor voltage. Membrane processes could be classified as microfiltration (MF), ultrafiltration (UF), nanofiltration (NF), reverse osmosis (RO), dialysis (D), electro dialysis (ED), pervaporation (PV), membrane distillation (MD) or gas separation (GS). This classification depends mainly on the separated species particle size and the applied driving force [11-13].Compared with other membrane separation processes, using MD has many attractive features. These features include mild operating conditions, total rejection of salt could be achieved; intensive to feed concentration, as well as stable performance at high contaminant concentrations [2]. Additionally, MD process experiences less fouling due to the relatively large pore size of the membrane required for it . Furthermore, MD is able to use alternative energy sources, such as solar energy [14].

Membrane distillation is a thermally and pressure driven process in which hot and cold water streams could be separated through a hydrophobic micro porous membrane. Liquid water is prevented from passaging through the membrane due to its hydrophobic nature; however, vapor is allowed to pass vapor pressure gradient is evolved due to the difference in temperature. This consequently leads to the passage of water vapor through the membrane and condensation of it on the colder surface [15]. Therefore, high permeability, high hydrophobicity and low thermal conductivity are important