Pervaporation of phenol wastewater with PVDF–PU blend membrane

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ABSTRACT

The compatibility of poly (vinylidene fluoride) (PVDF) and polyurethane (PU) was studied based on the theoretical analysis of solubility parameter and mixing enthalpy. The results showed that PVDF and PU are partially compatible. Then, the blend membranes of PVDF–PU with 5, 10, and 80 wt.% PVDF content were prepared with the application of solution blending in solvent N, N-dimethylacetamide (DMA). The membranes were characterized by Fourier transformed infrared spectroscopy (FT-IR) to assess the intermolecular interactions. And the morphology of the membranes was studied by scanning electron microscope (SEM). 80 wt.% PVDF–PU membrane was porous. However, 5% and 10% PVDF–PU membrane were suitable for pervaporation. The study showed that the degree of swelling (DS) of PVDF–PU membrane increased with the phenol concentration, which suggested that these membranes have stronger sorption capacity to phenol. Then, the pervaporation performance of the membranes was examined. The results showed that the pervaporation performances of the blend membranes have been improved comparing with the plain PU membrane.

Keywords: PVDF; PU; Blend; Pervaporation; Phenol

1. Introduction

Phenol and phenolic derivatives are widely used in chemical industry. In 2010, about nine million ton phenol was produced worldwide, with a significantly increasing trend. Phenol is a kind of common organic pollutants. It is highly toxic and cannot be easily degraded biologically at high concentration. Phenol can be rapidly absorbed through the skin. Phenol can affect the liver, kidneys, lungs, and vascular system. Comas, convulsions, and death may result from overexposing to the environment with high phenol concentration. A large volume of aqueous effluents containing phenol is produced in various fields, such as coal processing, petrochemical, pharmaceutical, pulp and paper industries etc., which will pollute our environment severely [1]. Phenol-containing wastewater may not be conducted into open water without treatment because of its toxicity. In China, the phenol limits for wastewater emissions are 0.3 mg/l (0.3 ppm), while the limit for phenols in potable and waters is 0.002 mg/l [2].

In order to make full use of the industrial value of phenol and protect human health and environment, the separation or recovery of phenol from wastewater has*Corresponding author.

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