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Effect of production conditions on morphology and permeability of asymmetric cellulose acetate membranes

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Abstract

Membranes are widely used in wastewater treatment. In this study, cellulose acetate (CA) (M_w = 52,000) was mixed with polyethylene glycol (PEG) (M_w = 400) as an additive in N-methyl-2-pyrrolidone as a solvent. The phase inversion method was used for preparation of flat sheet membranes. Effects of CA and PEG concentrations and also coagulation bath temperature on the membrane morphology were discussed in terms of membrane thickness and cross section structure. Pure water permeation flux of the membranes was also measured.

Keywords: Cellulose acetate; Membrane morphology; PEG additive; Precipitation process; Phase inversion

1. Introduction

Development of synthetic membranes opened up a new avenue to membrane separation technology in the 1960s [1]; thus during the past 40 years, membrane separation technology has been widely applied in various fields of industries worldwide [2]. Nowadays membrane processes are needed for a wide spectrum of separations including supply of high-quality water for communities and industries (to remove surfactants [3–5], microparticles and macromolecules, organic colloidal, dissolved organic matters (DOM) [6,7] etc.), food and pharmaceutical industries to obtain high-grade products, and removal or recovery of toxic or valuable components from various industrial effluents [8]. The phase inversion process induced by immersion precipitation is a well-known technique to prepare asymmetric membranes [9–14]. By immersion of a substrate into a coagulation bath, solvent in the casting solution film is exchanged with non-solvent in precipitation media and phase separation occurs. This process results in an asymmetric membrane

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