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Effect of Hydrophilic Silica and Dual Coagulation Bath on Structural and Mechanical Properties of PVDF Membrane for Membrane Distillation

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Abstract

Membrane distillation (MD) is one of the most applicable processes for purifying water by the hydrophobic membrane. Nanocomposite membranes have good potential in membrane process due to their extraordinary properties. In this study, PVDF flat-sheet membranes were produced by dry-wet phase inversion (DIPS) technique via dual coagulation bath. Also, the nanocomposite membranes were modified by hydrophobic SiO2 nanoparticles. The pore size and percentages of macro-voids of fabricated membranes were recognized by secondary electron microscope (SEM) and mechanical properties were elicited via tensile test. As a result, the pore size and percentages of macro-voids increased for 3wt% SiO_2 and then decreased when 6wt% SiO_2 were embedded. The percentages of macro-voids for nanocomposite membranes were higher than the percentages of macro-voids for the neat membrane. The decrease in pore size should be related to agglomeration. Furthermore, the tensile strength increased by adding the SiO2 nanoparticles and as a consequence, the elongation at break descended.

Keywords: PVDF nanocomposite membrane, Hydrophilic SiO2 nanoparticles, Membrane distillation, Membrane structure, Mechanical properties

1. Introduction

Membrane distillation (MD) was known as a suitable process for water desalination. MD uses the vapor pressure differences to desalination the saline water. The proper structures for membranes should result high flux and salt rejection with high wetting resistance and fouling resistance. Increasing in pore size and decreasing in tortuosity factor caused to increase in the flux of water. A wetting resistance improved whenever an average pore size tends to bubble point (BP). Also, the water contact angle (CA) and the bubble point test show the hydrophobicity of the membrane surface.