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Study on air-bubbling strengthened membrane distillation process

Wu Chunrui, Jia Yue, Chen Huayan, Wang Xuan, Gao Qijun, Lu Xiaolong*

State Key Laboratory of Hollow Fiber Membrane Materials and Processes, Institute of Biological and Chemical Engineering, Tianjin Polytechnic University, Tianjin 300160, P.R. China
Tel./Fax: +86-22-24528201; email: wuchunrui79@yahoo.com.cn

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ABSTRACT

In this work, a novel air-bubbling vacuum membrane distillation (AVMD) process was constructed on the basis of traditional vacuum membrane distillation (VMD) process. Compressed air was pressed into the lumen side of the hollow fiber membranes together with the hot feed solution just at the inlet of membrane module. So gas/liquid two-phase flow was formed in membrane lumen. Hydrophobic polyvinylidene fluoride (PVDF) hollow fiber microporous membranes were employed in this work. The effects of operating conditions, such as the feed air flow rate, the feed temperature and concentration on the performance of AVMD process were studied. The surface morphology of the PVDF membranes used in the VMD and AVMD process was characterized by scanning electronic micrograph (SEM). The results showed that the permeate flux increased as the air flow rate and/or feed temperature enhanced. The permeate flux of VMD process was 22 kg/m^{2}h when tested at 75°C with a feed flow rate of 120 l/h and a vacuum pressure of 0.085 MPa. While, the flux of AVMD process reach 40 kg/m^{2}h with the aid of a gas flow rate of 60 l/h. The flux of the two processes both declined gradually as the feed concentration increased from 3.5 g/l to 300 g/l, but that of AVMD was much slower. The conductivity of the product water was kept lower than 3 μS/cm. SEM paragraphs showed that there's much more salt deposition on the surface of the membrane used in VMD process than that used in AVMD process.

Keywords: Air-bubbling vacuum membrane distillation (AVMD); Polyvinylidene fluoride (PVDF) hydrophobic membrane; Two phase flow; Desalination

1. Introduction

*Corresponding author.

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