일반강연 A-6

막오염 저감용 나노 및 역삼투막 제조 및 특성평가

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Preparation and Characterization of low fouling nanofiltration and reverse osmosis membrane

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1. Introduction

Successful utilization of membrane has been greatly limited by membrane fouling. Fouling increases operation and maintenance costs by deteriorating membrane performance and ultimately shortening membrane life. Numerous studies in recent years have investigated the causes and control of membrane fouling, and substantial progress has been made. However, in many applications colloidal, microbial, mineral sats and humic substances fouling of membranes continues to be a serious problem. Many studies have shown that membrane surface morphology and structure influence performance characteristics of membranes [1-4]. In general, an approximately linear relationship between membrane surface roughness and permeate flux for

crosslinked aromatic polyamide reverse osmosis (RO) membranes due to the enlargement of the effective membrane area was shown. However, the rough surface resulted in severe fouling problem due to the easier accumulation of foulants.

In this study, we prepared poly(vinyl alcohol) coated nanofiltration and RO. The membrane surface was characterized for morphological properties (AFM) and zeta potential. Membrane fouling was correlated the measured membrane surface properties.

2. Experimental

2.1. Materials

0.05wt% of poly(vinyl alcohol) of MW 35,000 was coated onto the NF and RO membrane by reacting with glutaraldehyde. The RO membrane was CSM TL (SaeHan, Korea). The NF membranes were CSM NE (SaeHan, Korea), NTR 7250 (Nitto Denko, Japan) and Dow-FilmTec NF-70 (USA). Another NF membrane was synthesized with piperazine and trimesoylchloride. After coating, membrane performance (flux and rejection of NaCl and PEG) was compared.

2.2. Membrane characterization

Membrane surface zeta potential was determined by a electrophoretic method (Otsca). Three runs on three separate different samples were performed at an ionic strength of 0.01M NaCl in the solution of polystyrene colloid coated with hydroxypropyl cellulose ranging from 3 to 11.

Membrane surface roughness was determined by AFM imaging and analysis (Park Scientific instruments).

Foulants of silica colloids, proteins, calcium sulfate and humic acid were used.

3. Results and Discussion

By coating of PVA, slight flux reduction and 10 - 20% salt and organics rejection increase were occurred. Rough surface morphology was changed to smooth surface. The surface charge of the membranes was significantly decreased. From the fouling experiments, it was obvious that membrane roughness was the most influential physical membrane surface property. By coating, membrane fouling was comparatively decreased.

4. References

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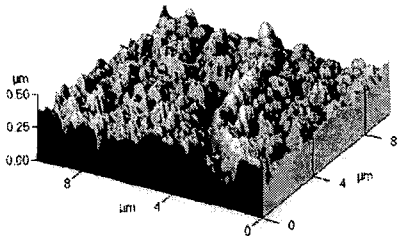
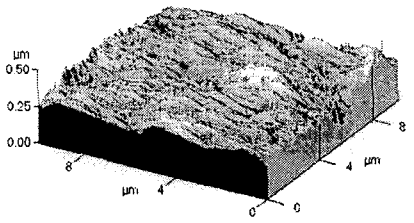
[2] S.Y. Kwak, M.K. Lee, and S.C. Kim, Surface structure and phase separation mechanism of polysulfone membranes by atomic force microscopy, *J. Membrane Sci.*, **163** (1999) 159-166.

[3] S.Y. Kwak, M.O. Yeom, I.J. Roh, D.Y. Kim, J.J. Kim, Correlations of chemical structure, atomic force microscopy (AFM) morphology, and reverse osmosis (RO) characteristics in aromatic polyester high-flux RO membranes, *J. Membrane Sci.* **132** (1997) 183-191.

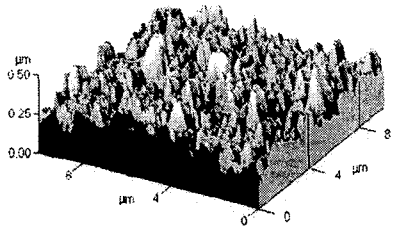
[4] H. Hirose, H. Ito, Y. Kamiyama, Effect of skin layer surface structures on the flux behavior of RO membranes, *J. Membrane Sci.*, **121** (1996) 209-215.



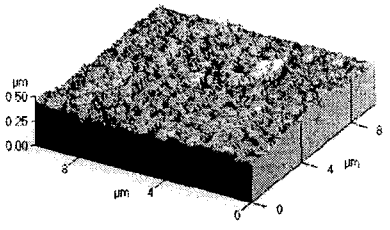
NF-70



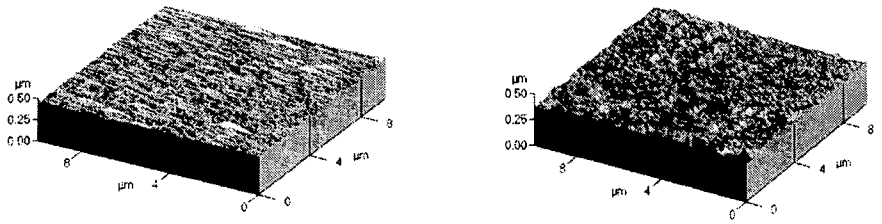
NF-70 / PVA



CSM (TL)

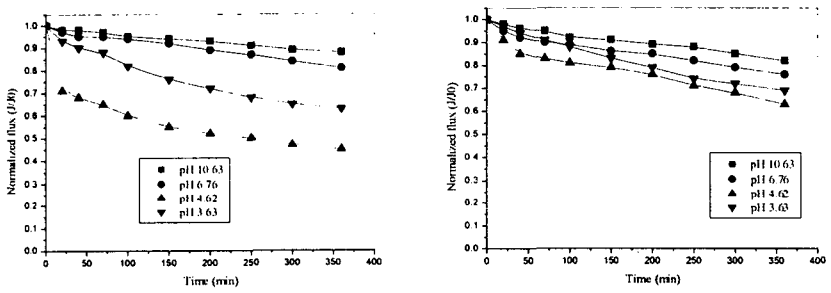


CSM / PVA



CSM (NE) **Our NF membrane**

Figure AFM images of commercial NF, RO and PVA coated membranes



(a) (b)

Figure Fouling of (a) NF-70 and (b) NF-70/PVA membrane by BSA