광촉매 나노복합막 제조 및 특성에 관한 연구

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PREPARATION AND CHARACTERIZATION OF TiO_2 NF COMPOSITE MEMBRANE AND PHOTODEGRADATION UNDER UV IRRADIATION

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1.Introduction

TiO_2 NF composite membrane has some unique characteristics such as high water flux, semiconducting properties, photocatalysis and chemical resistances over other membranes. Most of photocatalyst used as a pure powder form has the problems of withdrawl and light shield by particles. therefore the manufactured NF composite membrane can perform photocatalytic reaction and seperation simultaneously by means of TiO_2 photocatalyst attached to NF composite membrane surface.

In this work, TiO_2 photocatalyst were attached to membrane surface after we made PA active layer by interfacial polymerization for better selectivity. TiO_2-NF composite membranes were modified by different manufacturing conditions and varying the ratio of TiO_2.

We've been studying the performance for photocatalytic decomposition under UV light for the purpose of the rejection of humic acid.

The characterization of membranes were appiled on conductivity, FT IR, XPS, XRD, SEM, AFM and so on.

2. Experiments.

PES supports were fabricated by casting PES solution in DMF on nonwoven polyester fabrics followed by solidification in water. The compositions of the PES/DMF solutions were as follows : 15/85 in weight percent. The resultant polymer solution was cast on a nonwoven fabric and gelled in a coagulation bath at 24℃ The thickness of the support layer was controlled to approximately 150㎛, adjusting the casting knife. The membranes are recovered from the coagulation bath and washed thoroughly with distilled water to remove all residual monomer and solvents. The entire casting unit was kept in an air conditioned room and the temperature was maintained between 25 and 30℃ with a relative humidity of 30~35% during the entire period of PES casting.

Interfacial polymerization of PA active layers on the surface of microporous PES support was selected as the fabrication way. The steps of the formation of PA composite membranes are like this : the substrate which was taken out from water with 2wt% MPD containing 0.05wt% NaOH was immersed into 0.2wt% TMC solution with 0.01 wt% TiO_2 powder in normal hexane for 1min for the interfacial polymerization, after which it was cured in oven at 70℃for 5 miniutes. The TiO_2 - NF- composite membrane so prepared were kept in distilled water until its use.

Membrane performance tests were carried out at 0.6Mpa using a couple of solutions at various operating condition. The salt rejection was measured by the salt concentration in the permeate obtained through ion conductivity meter.

3. Results and Discussion

It was showed that The TiO_2 - NF- composite membrane had a increase tendency in salt rejection as compared to that the neat NF membrane.

The rejection increase can be associated with a rigid cross-linked PA structure caused by a curing at 70℃.

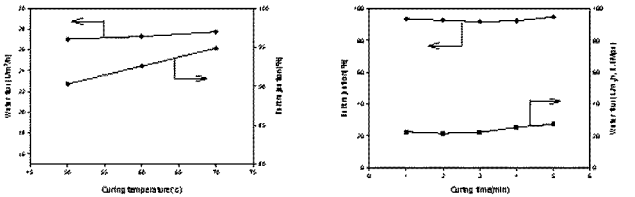
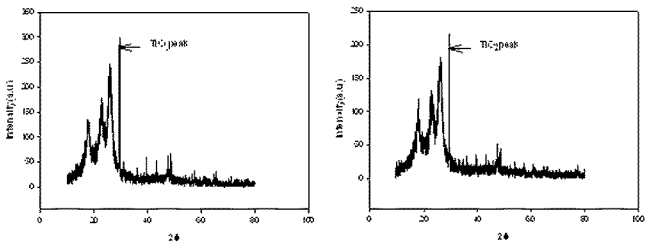


Fig. 1. Performance of TiO_2-NF composite membrane according to curing temperature and time

As TiO_2 NF composite membrane in this study is operated under high pressure, simply adsorbed particles can be detached from membrane surface. As shown in Fig.2, XRD results shows that some TiO_2 particle in hybrid membrane have a sufficient binding strength for the real operation , which can explain adsorption behavior of TiO_2 nanoparticle.



(a) before operation (b) after operation

Fig.2. XRD Pattern of TiO_2 - NF composite membrane.

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