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# 통합형 Polyetherimide 나노막 제조 및 특성평가

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# Preparation and Characterization of Integrally Skinned Uncharged Polyetherimide Asymmetric Nanofiltration Membrane

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## 1. Introduction

Most commercially available nanofiltration (NF) membranes are the composite polyamide membranes prepared by the interfacial polymerization [1,2]. However, the main drawback of polyamide membranes is their susceptibility against free chlorine and alkaline which causes degradation of the amide group. And Jegal and Lee have reported that NF membrane could be prepared from poly(vinyl alcohol) (PVA) or PVA-ionic polymer (sodium alginate or chitosan) in order to overcome drawbacks of composite polyamide membranes [3]. And, in such membranes, the toplayer and sublayer are composed of different polymeric materials so that each layer should be optimized separately.

And it is very difficult to make a hollow fiber composite membrane. Therefore, in order to overcome these drawbacks of the composite membrane, there is a need to prepare the integrally skinned asymmetric membrane suitable for NF membrane application.

Integrally skinned asymmetric membranes can be obtained through the phase inversion methods, where a casting solution with multi-components is immersed in a coagulant bath [4,5]. Especially, an asymmetric membrane having a dense or porous skin with a porous sublayer has been widely interested [6-8]. Effective procedures enough to produce the desired membrane structures are needed, including changing compositions in the casting solution [6-8] or in the coagulation bath [5,7].

The purpose of this study is to prepare the integrally skinned asymmetric membranes and determine the optimum conditions for a good performance NF membrane. In addition, asymmetric membranes were prepared by the dry/wet phase inversion. The effects of different nonsolvent additives on the membrane properties and morphologies were studied.

## 2. Experimental

### *2.1. Materials*

Polyetherimide (PEI, Ultem 1000) made by General Electric was used as membrane material. The polymer was dried for at least 5h at 100C before being used in preparing the polymer solution. N-methyl-2-pyrrolidone (NMP) and diethylene glycol dimethyl ether (DGDE) were purchased from Aldrich and used as solvents. Acetic acid from Aldrich was used as a nonsolvent and deionized (DI) water used as coagulation media. All the chemicals were used without further purification.

### *2.2. Membrane preparation*

PEI was dissolved at 60C in multi-component solvents to form a 20wt% polymer solution. The casting solution was kept at room temperature for 24h and then cast on a polyester non-woven fabric

with a doctor knife having 200m thickness. The nascent membrane was evaporated at 251C, 655% relative humidity for 30sec and then immersed in a 251C DI water coagulation bath. After the immersion, the membranes were washed for 12h to remove all solvents.

## 3. Results and Discussion

In order to prepare the integrally skinned nanofiltration (NF) membrane having high flux and solute rejection rate, the formulation of the casting solution containing appropriate nonsolvent additives was very important. With increasing the content of diethylene glycol dimethyl ether (DGDE), a weak nonsolvent forming a sharp interface between the polymer solution and the coagulant, the sponge-type structure could be prepared. Adding acetic acid (AA) which is a strong nonsolvent in the casting solution renders the casting solution close to the binodal composition. Increasing the content of AA makes the membrane cross section closely connected cellular sponge-type structure. By combination the ratio of DGDE to AA, the integrally skinned NF membranes exhibiting both appropriate NF performance characteristics and ideal membrane morphology (dramatically developed skin layer and sublayer) could be prepared.

## 4. References

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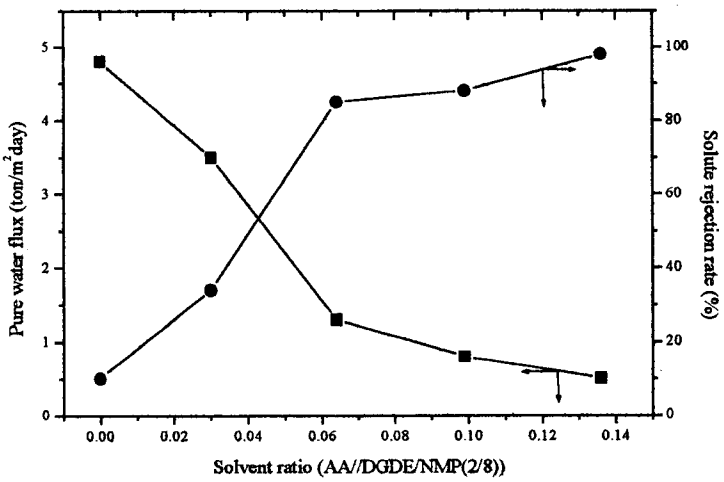


Figure The acetic acid effect on performance of the 20wt% PEI membrane (NMP/DGDE(64/16) cast at 25° C and 65% relative humidity for 30seconds and coagulated at 25° C DI water.