비수계용액분리용 실리콘이 코팅된 고성능 나노막 제조 및 특성평가

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Preparation and Characterization of Silicone-coated nanofiltration membrane with high performance for separation of non-aqueous solution

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1. Introduction

Membrane separation processes in the oils & fats industry have recently been applied. A considerable work has been done in the areas of hexane recovery from oil miscella, vapor recovery, condensate return, degumming, refining and bleaching, hydrogenation catalyst recovery, waste-water treatment, and others [1]. Crude vegetable oil is refined to remove undesirable components, such as free fatty acids (FFA), after extraction from oilseeds. In alkali-refining, the FFA form soaps, which are removed by centrifuging. The deacidification process has a significant economic impact, and several drawbacks with alkali-refining

have been noted: (i) oil losses due to saponification and by occlusion in soapstock; (ii) soapstock has little value even though FFA in their native state find many uses; and (iii) large amounts of water are used to wash the oil after caustic treatment, which leads to contaminated discharges and high disposal costs. With soybean and cottonseed oils, total batch refining losses can be as high as three times the FFA content [2 - 5].

The purpose of this study is to prepare the silicone-coated nanofiltration membranes with interfacially polymerized thin film layer and determine the optimum conditions for a good performance of non-aqueous alcoholic and hexane solution.

2. Experimental

2.1. Materials

Piperazine (PIP) and 1,3-phenylendiamine (MPD) were used as a diamine blend, and trimesoylchloride (TMC) was used as an acid chloride for interfacial polymerization.

Polydimethylsiloxane (PDMS) consisting of two componets (prepolymer RTV 655A and crosslinker RTV 655B) was used for preparation of silicone-coated membrane.

2.2. Membrane preparation

PDMS was dissolved into the TMC organic solution, and afterwords, interfacilly polymerized.

2.3. Membrane characterization

Feed solution comprising a 1000ppm oleic acid or 20ppm Sudan IV solution in hexane or methanol was pumped into cells at 200psi and 25℃. The concentration of feed and permeate was measured with HPLC having refractometer and and UV at 510nm of λ_{max}.

By measuring the contact angle and zeta-potential, the surface nature of silicone-added polyamide composite membrane was studied.

3. Results and Discussion

By incorporating PDMS in the polyamide membrane, organic solvent flux and and rejection rate were considerably increased.

The addition of PDMS in the polyamide membrane changed the surface

property significantly to be hydrophobic, which results in a solvent flux increase. A comparison of our membrane with a foreign one of Membrane D shows a relatively lower flux and a very high rejection. A rejection increase of our membrane results from a combination of silicone and polyamide layer.

4. References

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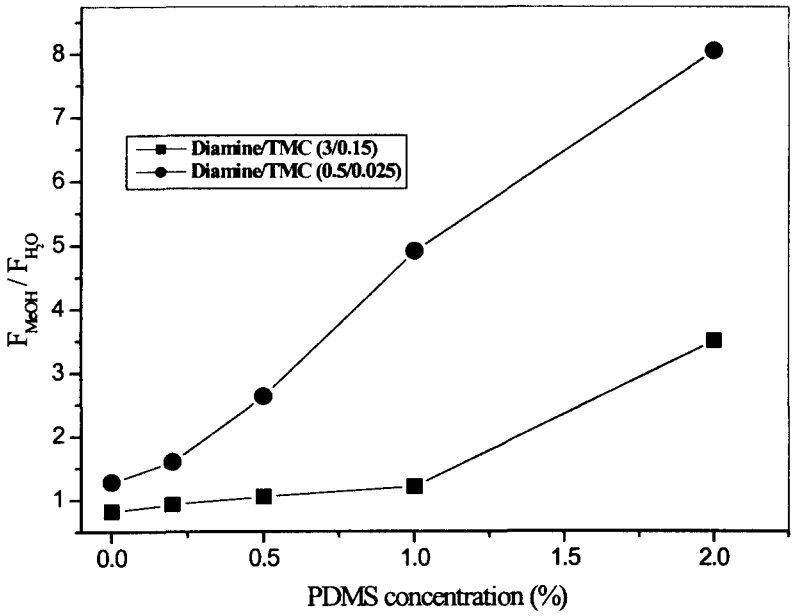

Figure Nanofiltration membrane performance prepared from polyamide and silicone.