가용성 폴리이미드 한외여과막에 의한 대두유 정제

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Soybean Oil Refinement by Soluble Polyimide Ultrafiltration Membrane

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1. Introduction

The capabilities of polyimide membranes include high-temperature durability, sufficient mechanical strength, chemical inertness, biological attack resistance and organic solvent resistance. Such a feature is highly attractive for the food and pharmaceutical industries. [1-3] The separation of soybean oil / hexane extract is by membrane process is economically more attractive than that of conventional distillation and centrifuging process. Soybean oil is typically extracted from soybean flakes by hexane in the edible oil process. Many polymeric membranes are damaged by hexane. However, the polyimide membrane is highly attractive in its resistance to swelling and dissolution in hexane. In purification process of soybean oil extracts phospholipids are the main targeting material. Many phospholipids are a valuable by-product in themselves for the production of lecithin. The phospholipids must be removed if glyceride oil losses are to be avoided when the fat is neutralized. The phospholipid removal can prevent the glyceride oil from undue dardening when the oil is deodorized at higher temperature. [4, 5]

The purpose of this study is to prepare the polyimide ultrafiltration membranes by phase inversion method. Moreover, soybean oil extract was ultrafiltered in order to remove impurities such as phospholipids.

2. Experimental

2.1. Materials

Copolyimide synthesized from bis[4-(3-aminophenoxy)phenyl]sulfone (BAPS-m) and 3,3'-diaminodiphenyl sulfone (3,3'-DDS) as diamines and pyromellitic dianhydride (PMDA), 3,3',4,4'-diphenylsulfone tetracarboxylic dianhydride (DSDA), and 4,4'-oxyphthalic anhydride (ODPA) as dianhydrides was used as a membrane material. Ultrafiltration membrane was prepared through a phase inversion method by casting a polymer solution on polypropylene nonwoven fabric. Deionized (DI) water was used as a coagulation media.

2.3. Membrane characterization

At first, various solvent fluxes were measured in order to investigate the solvent stability and surface properties. MWCO of the membrane was tested with PEGs having different molecular weight. Membrane performance in the micelle comprising of phospholipid and hexane could be investigated by measuring the hexane fluxes and rejection of phopholipid with turbidometer.

3. Results and Discussion

The MWCO of the copolyimide was about PEG 20000. The size of the phopholipid micelle was similar with PEG 20000. The micelle could be concentrated to volume concentration ratio (VCR) 10. The phospholipids impurities could be removed by the special UF membrane.

The resistance value of the gel layer was the highest compared to those of membrane itself and concentration polarization layer. In this system, R_f values were about 4 - 8 times greater than R_m and it was 50 - 70% of total resistance values. Therefore, fouling of membranes during an UF of soybean oil micelle should include multi-layer adsorption in the membrane pores and surface fouling. Greater the flux, heavier the fouling due to the faster diffusion rate of solutes toward the membrane surface.

4. References

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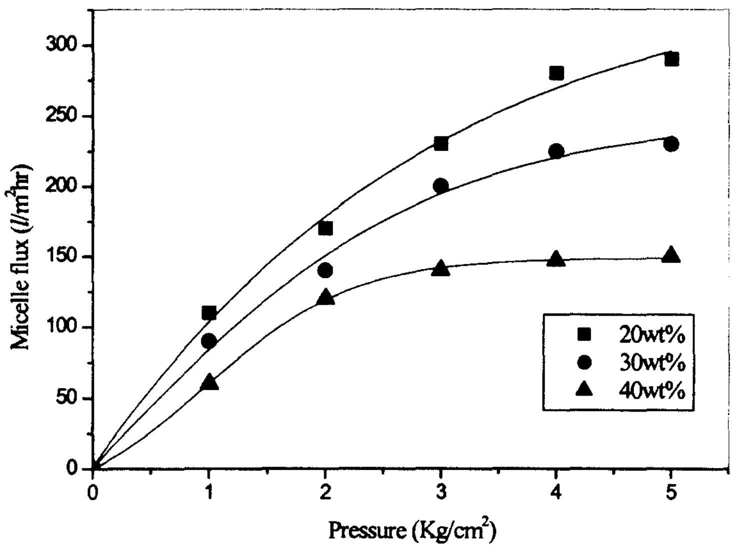

Figure Effect of the operating pressure on the micelle flux at 25℃ and 150rpm stirring speed during dead-end filtration of micelle solution having different concentration.