CHAPTER 1

Introduction

Most industries include petrochemical, food, biotechnology, fine chemical, pharmaceutical, paints, coatings, electronics and others use a lot of solvent in manufacturing processes. This generates solvent waste every year. Therefore, the waste management, solvent recovery and treatment of water stream become necessary in order to save the environment.

In the solvent recovery, conventional method such as incineration, distillation, stram stripping, biological treatment and activated carbon adsorption have been successful for minimization of the solvent waste. This method has been also applied for the oil refinery. However, the quality of product is not good, and also the energy consumption is very high when compared to the membrane-based separation method.

The membrane-based separation is simply the higher potential used instead of the conventional method. For example, Lin, Rhee and Koseoglu (1997) had optimized a bench scale membrane degumming process for hexane-oil micella using commercially available, modified, hexane-resistant, ultrafiltration membranes with 99.6% rejection of phospholipid from triacylglycerols that both had the similar molecular weight (about 900 Daltons) and a substantial reduction in color-pigment with good potential for energy saving. However, the selectivity of the membranes should be improved.

In the solvent recovery with the membrane separation, Thomson, Shaw and Gudelis (1983) mentioned about the solvent recovery from foot oil by using modified regenerated cellulose membrane as hydrophilic membranes. In process, Cold slack wax was warmed up and mixed with solvent to dissolve the foot oil, and the solvent was recovered from foot oil solution by contacting with one side of semi-permeable membrane made of regenerated cellulose under pressure. This method was better than passing the solvent-containing oil through a distillation tower in order to boil off the solvent from oil because this tower required considerable amounts of thermal energy, pump, tankage, etc.

As above reasons, the membrane separation technology has been successful over the conventional processes. The membrane separation processes are classified as reverse-osmosis, nanofiltration, ultrafiltration and microfiltration. The membrane material should be thermally, mechanically and chemically stable to withstand the separation process environment including the high pressure, temperature and contact with chemical agents. On the market, the commercial nanofiltration membranes have not been widespread in processing nonaqueous streams because of the lack of stability against the organic solvents. In addition, the few solvent and thermally resistant membrane types made from ceramic and specialized polymers such as polyimides are either too expensive or too high molecular weight cut off.

To improve the membrane performance of nanofiltration membrane, Musale and Kumar (2000b) studied the resistance of novel surface crosslinked chitosan/poly (acrylonitrile) composite nanofiltration membrane to organic solvents depending on the effects of crosslinking parameters: crosslinker concentration and crosslinking time. The surface crosslinked chitosan layer of membrane reduced the swelling in polar solvent, but increased the affinity or solvent flux for non polar solvents. However, this composite nanofiltration membrane maintained the higher solvent flux only 2 hours. This result might be assumed that the chitosan layer was damaged because the degree of crosslinking was too high that the chitosan layer became weak. Thus, the effect of degree of crosslinking on the mechanical strength of crosslinked chitosan layer of this membrane should be studied.

The primary objective of this study was to evaluate the effect of various glutaraldehyde concentration and crosslinking time on subsequent the tensile strength and the solvent resistance of chitosan films.