CHAPTER 4

SUMMARY AND CONCLUSION

Flat sheet ultfrafiltration blend membranes based on cellulose acetate, cellulose acetate/aminated polyethersulfone, and cellulose acetate/carboxylated polyethersulfone with a thickness of 0.20 ± 0.02 mm were prepared by solution blending and phase inversion technique. The polymer compositions CA/APES and CA/CPES were varied from 100/0, 90/10 , 80/20, and 70/30 wt % ratios using DMF as solvent. When the APES and CPES content was increased above 30 % phase separation was observed, showing the incompatibility between the polymer components.

To improve the performance of the membranes, PEG 600 was found to be a good pore former in terms of compatibility and water flux, compared to the other pore formers. The maximum optimum concentration of additive was found to be 10.0 wt % for both blend systems. The prepared membranes were initially compacted at a pressure of 414 kPa to make the uniformity in membrane structure. The pure water fluxes of the compacted membranes were measured at a transmembrane pressure of 345 kPa. The percent water contents of the membranes were determined from wet and dry weights of the membrane samples. The pure water fluxes of the membranes at different transmembrane pressures were measured and the hydraulic resistances of the membranes were determined from the plot of the pure water fluxes Vs transmembrane pressures.

MWCO of all the membranes were also determined by permeation of proteins (trypsin, pepsin, EA and BSA) of varied molar masses of 20, 35, 45 and 69 kDa. In CA/APES system, the molecular weight cut-off was lowest at 90/10 wt % composition in absence of additive and highest at 70/30 wt % composition with 10 wt % additive, determined from permeability studies of proteins. MWCO of CA/CPES system showed the same but with vast change in permeate flux. Morphology of the membranes was investigated by SEM. The top surfaces and cross section of the CA and CA/APES, CA/CPES blend membranes were studied in the absence and presence of PEG 600 additive of various compositions.

The protein separation (trypsin, pepsin, bovine serum albumin and egg albumin) in terms of permeate flux and percent rejection have been investigated at dilute concentrations, BSA was found to have the highest separation with lowest product rate of all membrabes. While trypsin showed least separation and highest flux. This variation has been accounted in view of the size of the molecules.

Further, heavy metal ions such as Cu^{2+}, Ni^{2+}, Zn^{2+} and Cd^{2+} in the form of their complexes with PEI as metal-chelate were used for rejection and permeate flux study. The Cu-PEI complex had higher separation and lower flux. This also could be explained with the size of molecules.

In all the membranes, the composition of APES, CPES and the pore former additive PEG 600were used to tell about the membrane characteristics, separation and product rate efficiencies. In general, though the rejection of solute is inversely proportional to the product rate, it has been found that the decline in flux is very marginal compared to their original water flux. This may be due to the enhanc of hydrophilicity of blend membrane by APES or CPES polymers.

4.1 FUTURE PLAN OF ACTION

As the blend membranes so prepared are being found to have efficient separation with respect to proteins and heavy metal ions, scaling up from laboratory scale of the above process should be attempted.

For such a large scale system, the existing manual casting method can be replaced by machine casting which will give uniform and required thickness. The membranes to be prepared can be applied to separate proteins and metal ions. For the separation of proteins, plate and frame model can very well be used and for the metal ion separations spiral wound module is better choice.

The method may be applied to toxic heavy metal ion removal, and better product recovery from effluent. Modelling of the above separation can also be attempted. The membrane can also be used for reverse osmosis and nanofiltration applications after necessary modifications.

In addition, as an extension of the present investigation, they could be applied for tertiary level, industrial effluent treatments. Ultrafiltration blend membranes could be applied to space and radioactivity fields for effective removal/separation of toxic material generated in constructive or destructive purposes.