CHAPTER 4

SUMMARY AND CONCLUSION

Ultrafiltration membranes were prepared by phase inversion technique from blend solutions of CA/PSf and CA/PU with different polymer compositions i.e., at 100/0, 95/5, 90/10, 85/15, 80/20 and 75/25 ratios using DMF as solvent. Increase in polymer composition beyond 75/25 of CA-PSf or CA-PU resulted in phase separation of the polymers and hence formation of membranes at these compositions were not possible. Compared to other inorganic additives, Polyvinylpyrrolidone (PVP) was found to be the suitable pore former at various concentration of 0, 2.5, 5 and 7.5 wt% in UF membranes and is effective in controlling the morphology of the resultant membranes. Further, it also enhances the compatibility of blends in the casting solution.

The above blend membranes were compacted and characterized in terms of PWF, MWCO pore size and water content. Further the hydraulic resistance of these membranes were studied at different transmembrane pressures.

The morphology of the membranes were investigated using SEM and the top surface and cross sectional features of the membranes were studied in the presence and absence of additive PVP.

The separation of proteins viz. BSA, EA, pepsin and trypsin were carried out to investigate the applicability of these blend membranes for separation of proteins in aqueous solutions. The separation of BSA was
found to be comparatively higher with reduced flux, in view of its higher molecular weight.

Further, the separations of metal ions such as Cu (II), Ni(II), Zn(II) and Cd(II) were carried out using PEI as complexing agent to enhance the ultrafiltration of ionic solutes. The % rejection of Cu ions were found to be higher as compared to other metal ions, with comparatively lower flux due to the formation of stable complex with PEI.

Thus, the hydrophilicity of polysulfone membranes could successfully be increased by blending with CA and was effective in separating the toxic heavy metals and proteins from aqueous streams. Similarly, the hydrophilic nature of CA was enhanced by blending with more hydrophilic polyurethane polymers. These blends are also effective in separation of toxic heavy metal ions and proteins from aqueous streams.

Further, CA/PU system provides higher separation efficiency compared to CA/PSf system due to small pores in the former system.

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. In those membranes, all the parameters, in addition to the already studied characteristics, such as uniform pore size and thickness can be maintained. 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 a better choice.
The removal of toxic metal ions such as Cu(II), Ni(II), Zn(II) and Cd(II) from metal extraction and refractories are also our future plan of action.

As a whole, with respect to toxic heavy metal ion removal, better product recovery from effluent is considered as the goal. Modelling of the above separation can also be attempted. The membrane can also be used for Reverse Osmosis applications after necessary modifications.