CHAPTER 4

SUMMARY AND CONCLUSION

Flat sheet ultfrafiltration blend membranes based on polyethersulfone, polyethersulfone /polyetherimide with a thickness of 0.20 ± 0.02mm were prepared by solution blending and phase inversion technique. The polymer compositions were varied from 100/0, 90/10, 80/20 and 70/30 wt% PES/PEI system and the total polymer composition was optimized and maintained at 17.5 wt%. Beyond 70/30 wt% of PES/PEI, phase separation was observed, indicating the incompatibility between the polymer components. To improve the anti fouling property of the membrane, the prepared membranes were grafted with monomers such as Acrylic acid and N-Vinyl Pyrrolidone individually by photochemical reaction with a use of UV lamp at different time intervals. Since, photochemical grafting of membranes was found to show low fouling properties. Modified membranes are expressed as AA-g-PES/PEI, NVP-g-PES/PEI. The monomers concentration were optimized to 5 wt % in order to avoid chain cleavage during UV-grafting.

Degree of grafting was calculated for the AA-g-PES/PEI, NVP-g-PES/PEI membranes. The grafted and ungrafted membranes were 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 contact angle of the membranes was determined. 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 PES/PEI system, the molecular weight cut-off of all membranes was greater that 69 KDa. For AA-g-PES/PEI,the least molecular weight was found for 6 min irradiated samples and all NVP-g-PES/PEI was found to have very low MWCO of 20 KDa irrespective of irradiation time. Morphology of all the membranes was investigated by SEM. The top surfaces and cross section of the PES, PES/PEI, AA-g-PES/PEI and NVP-g-PES/PEI blend membranes were studied. The presence of monomers was confirmed by FT-IR and TGA analysis.

The protein separation (trypsin, pepsin, egg albumin and bovine 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 membranes respectively. While trypsin showed least separation and highest flux. This variation has been accounted in view of the size of the molecules.

Further, fouling behavior of all membranes was studied using BSA as a model. NVP-g-PES/PEI membranes found to have high resistance towards fouling. Flux recovery of NVP-g-PES/PEI membrane was high on the other hand the irreversible fouling values were found to be very low, indicating the better performance in view to fouling. Next to NVP-g-PES/PEI, AA-g-PES/PEI shows a acceptable values on fouling. The enchanced performance of AA-g-PES/PEI, NVP-g-PES/PEI are due to the attachment of hydrophilic monomers on the surface.

FT- IR and TGA studies were not limited to the confirmation of functional groups, but the application is extended to know the mechanism of blending as well as mechanism of photografting.

Filtration protocols and fouling parameters reveals the antifouling property of all the membranes. It was found from all the characterizations that, PES/PEI membrane have good flux values whereas the rejection and fouling behaviors are not upto the level of high performance. But AA-g-PES/PEI, NVP-g-PES/PEI membranes have better rejection values in addition to their high anti fouling properties with a marginal flux decline .

4.1 SUGGESTIONS FOR FUTURE WORK

As the pH plays a vital role in separation and fouling phenomenon, a study at different pH levels should be attempted to know the in depth knowledge.

As the grafted membranes are being found to have efficient separation and high anti fouling properties with respect to proteins, the prepared membranes can be scaled up for dairy industries, where fouling is the major problem they encountered.

Since the above membranes shows a high degree of rejection of proteins, the membranes can be used in pharma and food industry for separation and concentration of proteins. These membranes can be used for desemulsifying of emulsions due to the low Irreversible Fouling values(IRF).