ABSTRACT

Membrane filtration is an attractive separation process, as it is usually performed under gentle conditions. Membrane processes have been applied in various types of industries such as the separation, concentration and purification in food technology, biotechnology and petrochemical processes, as well as water and wastewater treatment.

Ultrafiltration has dominating role in the industrial process for over three decades. The applicability of these systems can further be widened with development of new membrane materials with specific applications. With this objective in mind, membranes in the ultrafiltration range based on cellulose acetate (CA), poly phenylsulfone (PPSU) and sulfonated poly phenylsulfone (SPPSU) have been prepared and characterized. The applications of these membranes for the separation of proteins and metal ions have also been investigated.

The results and discussions part of the thesis describe about the effect of compaction time on pure water flux of the above membranes, at 414 kPa pressure. Further after compaction, the pure water flux of the above membranes at 345 kPa and the percent water content of the membranes have also been presented. The membrane hydraulic resistance of all the blend membranes was also determined by finding flux at various pressures from 69 to 414 kPa and the results are discussed. The hydraulic resistance of all blend membranes has been reduced significantly. SEM images were taken for pure CA and blend membranes with and without additive and discussed.
Based on the properties and performance study, few of the CA/PPSU and CA/SPPSU blend membranes were used to study the separation of proteins such as Bovine Serum Albumin (BSA), Egg Albumin (EA), Pepsin and Trypsin and the rejection and permeate flux results are discussed. For CA/PPSU (90/10 wt%) system showed the maximum BSA rejection 95% and for CA/PPSU (70/30 wt%) system showed minimum rejection 88% was observed. The rejection percentage of BSA for CA/PPSU (90/10 and 70/30 wt%) at 7.5 wt% additive concentration was found to be 84 and 76% respectively. BSA showed higher rejection compared to other proteins due to its higher molecular weight. For CA/SPPSU system reveals low rejection of all proteins on comparison with CA/PPSU system due to change in the structural and porous properties.

The membranes were also used for the study of rejection of toxic heavy metal ions such as Cu$^{2+}$, Ni$^{2+}$, Zn$^{2+}$ and Cd$^{2+}$ by complexing them with macromolecular chelating ligand, polyethyleneimine and the results are discussed. The atomic absorption spectra results reveal the maximum rejection for copper complex is 98.9% for CA/PPSU (90/10 wt%) system and minimum rejection of about 96.3% for the cadmium complex without PEG 600. For CA/PPSU (70/30 wt%) system the rejection of copper complex 98.3% and cadmium complex 93.6% without PEG 600 was observed. For CA/PPSU (70/30 wt%) with 7.5 wt% PEG 600 additive concentration the maximum rejection of copper complex is 88.2% and minimum rejection of cadmium complex is 73% for was obtained. For CA/SPPSU system reveals low rejection of metal complexes on comparison with CA/PPSU system due to change in the structural and porous properties.

The thesis also contains summary and conclusion of the work carried out along with future plan of action.