

SUMMARY AND OUTLOOK

The primary objective of the present work was to modify the surface of commercial microfiltration membranes with polyelectrolyte multilayer assembly. Due to the formation of uniform thin layer of polyelectrolyte multilayer, the sieving characteristic of the membrane is expected to change. By the proper choice of polyelectrolytes, their deposition parameters such as pH and ionic strength, tailored multilayers are fabricated on microfiltration membranes. The applicability of these surface modified membranes in protein transport and amino acid transport is explored. The transport studies of selected proteins shows that a few bilayers of polyelectrolytes on microfiltration membrane can impart ultrafiltration characteristics to the membrane. Furthermore, the transport study of individual proteins shows that the main factor governing the sieving of proteins through the multilayer membrane is the charge factor rather than the size factor. The transport characteristics of proteins through the polyelectrolyte multilayer depend on pH and the number of deposited layers. The data presented in this study also provides experimental evidence that along with solution pH, ionic strength and protein concentration can strongly influence the transport of proteins through polyelectrolyte multilayers. Amino acid transport studies through the surface modified membranes reveal that even nanofiltration property can be imparted to microfiltration membrane by the deposition of a few bilayer of polyelectrolytes.

The protein adsorption studies points out that it is possible to fine tune the adsorption modalities of proteins on multilayer surface by varying the pH, number of bilayers, time of adsorption, and mode of adsorption. Protein resistant or protein adhesive membranes can be fabricated by changing the pH of protein solution. One striking feature is that the secondary structure of the proteins

remains unaltered on adsorption to CHI/PSS multilayer membranes. This opens up the possibility of fabricating bioactive coatings with the protein adsorbed multilayer membranes. Biofunctional membranes with antibacterial properties can be fabricated upon adsorption of lysozyme into CHI/PSS multilayer membranes. Similarly BSA adsorption studies point out that biofunctional membrane with thromboresistant properties can be made by the adsorption of BSA into CHI/PSS multilayer membrane. Fluorescence quenching studies of lysozyme immobilized membranes can give qualitative information regarding the adsorption pattern of lysozyme adsorbed on multilayer systems.

Even though the polyelectrolyte multilayer research is still in its infancy, a lot of research is going on in this field. The promising results of these studies point to the immense potential of multilayer assembly techniques for surface modification in a viable, economic and simplified way. There are intensive efforts to take this academic research area into industrial and commercial applicability. Two products based on layer-by-layer assembly of polyelectrolytes are being currently manufactured and sold commercially. *CibaVision*, a contact lens marketed by *Novartis* is one of these commercial products. Another recent product made on multilayer technology is *Yassa Sheets* manufactured by *Shiratori Nanotechnology* to protect fruits and vegetables from decomposition.

In the present work, the fabrication of multilayer membrane for the preparation of ovalbumin-free lysozyme is explored. The transport studies of protein mixtures can be performed through the multilayer system. In this context, this will be a rather economical and easy way for protein separation. The immobilization of bioactive molecules like proteins into multilayers have opened up a wide area of research in the field of biosensors, biocatalysts, controlled drug delivery etc.