PROTEIN TRANSMISSION ANALYSIS IN ULTRAFILTRATION OF TERNARY MIXTURES

by

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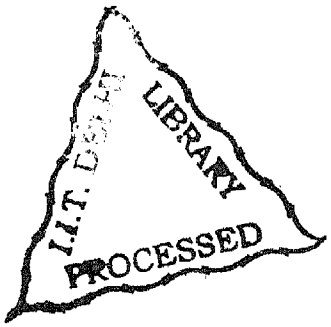

Protein - purification

Bioseparation,

CERTIFICATE

This is to certify that the thesis entitled **"Protein transmission analysis in ultrafiltration of ternary mixtures"** being submitted by **Mr. K. Narsaiah,** to the Indian Institute of Technology Delhi, for the award of the degree of **Doctor of Philosophy,** is a record of bonafide research work carried out by him under my guidance in conformity with rules and regulations of Indian Institute of Technology Delhi. The results contained in this dissertation have not been submitted in part or full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

The factors affecting the volumetric flux and transmission of each protein in a ternary mixture were evaluated with a stirred cell of 50ml capacity at pressures generally less than 1.0 bar. The transmission results of the three cases, i.e. more hydrophilic YM30 30,000 MWCO regenerated cellulose membrane (negligible fouling), relatively less hydrophilic Biomax 50,000 MWCO polyether sulfone membrane (considerable fouling) and YM100 100,000 MWCO regenerated cellulose membrane with high hydraulic permeability (gel polarization) conditions indicate that solution environment (pH and salt concentration) and operating conditions (stirrer speed and TMP) are important factors affecting both transmission and volumetric flux. YM30 and Biomax membranes were used in ultrafiltration of ternary mixture solution of lysozyme, myoglobin and ovalbumin with different pH values and salt concentrations. Volumetric flux of protein solutions was linear and less than buffer flux for both the membranes (namely, YM30 and Biomax up to the pressure of about 80.0kPa). To simulate the condition of gel layer formation, ternary protein solution of BSA, γ globulin, β lactoglobulin was ultrafiltered using YM100 membrane. For YM100, the flux was linear at very low pressure and reached a stationary value at pressures above 13.3kPa. Though considered to be undesirable, fouling in case of Biomax and gel polarization in case of YM100 enhanced the selectivity and could be used favourably in fractionation of proteins. Combined concentration polarization and irreversible thermodynamics model for multicomponent system was used for modelling the transmission of each protein. Despite the many simplifying assumptions and limitations in derivation, the reflection coefficient was surprisingly adequate in describing the transmission even for ternary mixtures of proteins when diffusive transport was negligible and when electrostatic interactions were weak.

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