ABSTRACT

The focus of the present work is development of suitable theoretical models for various mass transport phenomena encountered in separation processes across porous interfaces. The theoretical prediction of continuous cross flow membrane separation for various flow conditions and geometries have been undertaken considering gel layer resistance dominating the mass transfer. The separation process coupled with adsorption in the filtration process using mixed matrix membrane is developed for continuous cross flow system as well as during the effluent treatment process. Analytical solution of the coupled equations has been solved using the integral method. The mass transport across porous interface in the sub-micron dimension has been investigated under the influence of electrokinetic effects. The physics of the problem involves complexities related to the fluid rheology, geometry of the channel, charge of the macrosolute and the situation of streaming potential. The results for different situations are obtained analytically, particularly in the limit of the Debye-Huckel approximation, while in case of high surface potential, direct numerical simulation is used. The phenomenon of electrophoresis is accounted during charge solute-wall interaction. A molecular level understanding of binding of metal ions with the sodium dodecyl micelle is studied for their possible solubilization location, degree of binding and stability of the systems. Solubilization of the different inorganic ions and aromatic solutes within the micellar aggregates are analyzed. Inference is drawn regarding the affinity of toxic molecules to bind with the charged micelles for possible separation with micellar enhanced ultrafiltration.

Keywords: Transport phenomena; Mathematical modeling; Mass transfer; Microchannel; Micelle