MASS TRANSFER COUPLED WITH VOLUME CHANGES IN ION-EXCHANGE RESIN BEADS

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ABSTRACT

Mass transfer in ion-exchange resins was studied by monitoring the volume changes of individual beads in a flow-through cell as a response to step changes in the composition of the surrounding binary solvent mixture. Strong poly(styrene-co-divinylbenzene) as well as weak acrylic cation-exchange resins were used. It was found that the particle size may pass through a minimum during the shrinking process, whereas there may be a maximum in the particle size during the swelling of the resin. The existence of a minimum and maximum were attributed to differences in the diffusivities, sorption isotherms, and molar volumes of the solvents. Anamalous shrinking behaviour was observed for the weak acrylic exchanger at high ethanol concentrations, but not for the strong exchanger. A mathematical model was derived from describing diffusion coupled with volume changes of the resin. The model was able to reproduce the shrinking behaviour of the resins, except for the anamolies, with good accuracy. The swelling behaviour of the resins was reproduced only qualitatively.