Kinetic studies on novel cation exchangers, antimony zirconium phosphate (SbZP) and antimony zirconium triethylammonium phosphate (SbZTP)

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ABSTRACT

Some of the important features of ion exchangers based on antimony(III) are that they have high capacities and the capacities are retained even at high temperatures. Ion-exchange kinetic studies of metal ions on newly synthesised antimony zirconium phosphate and antimony zirconium triethylammonium phosphate were carried out under particle diffusion controlled conditions. Exchange kinetics of Zn\(^{2+}\), Mg\(^{2+}\) and Ca\(^{2+}\) has been studied, and a mechanism of exchange proposed. Various kinetic parameters such as pre-exponential constant \((D_0)\), energy of activation \((E_a)\) and entropy of activation \((\Delta S^*)\) were evaluated which showed the feasibility of metal ion exchange with H\(^+\) ions on these materials. \(D_0\) gives an idea about the mobility of migrating ions. It depends on size and charge of ions, electrostatic interaction of metal ions with exchange sites, site acidity, pore size of exchanger particles, etc. The negative values of \(\Delta S^*\) indicate that the exchange process by metal ions is feasible on the H\(^+\) form of the material. Thus, we can predict the feasibility of an ion-exchange process to be used as a catalyst or inhibitor. The two exchangers under study showed similar trend in kinetic parameters. Their ion-exchange capacities could explain the different values of kinetic parameters obtained.

Keywords: Ion exchange; Composite; Diffusion; Exchange capacity; Kinetic parameters

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