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Synthesis and characterization of a novel hybrid chelating ion exchanger and its application as an amphoteric exchanger

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Abstract

A new and novel, hybrid chelating ion exchanger zirconium tri ethylene tetra amine (ZrT) has been synthesized by a simple sol-gel route using inexpensive and easily available chemicals. ZrT has been characterized for elemental analysis, TGA, FTIR, X-ray diffraction, SEM, and EDX. Physical and ion exchange characteristics as well as chemical stability of the material in various acids, bases, and organic solvent media have also been studied. Anion exchange capacity (AEC) for Cl^-, Br^-, $Cr_2O_7^{2-}$, F^-, and AsO_4^{3-} has been determined and distribution coefficient K_d for Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+} (transition metal ions) and Hg^{2+},Cd^{2+}, Pb^{2+} (heavy metal ions) has been evaluated by batch equilibration techniques in aqueous and various electrolyte media/concentrations. Based on α, the separation factor, a few binary separations have been performed on a chromatographic column packed with ZrT. The amphoteric behavior of ZrT has been demonstrated using $CuCl_2$ and $HgCl_2$ and amount of cation and anion simultaneously exchanged determined. The practical applicability of ZrT as an amphoteric exchanger has been further highlighted by performing a case study. A study on the regeneration and reuse of ZrT indicates that it is effective up to six cycles without much decline in performance.

Keywords: Amphoteric Exchangers**;** Chelating Exchangers**;** Hybrid Exchangers**;** Inorgano-organic Hybrid Exchangers

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