



Evaluate the Adsorptive Efficacy of Thermally Stable Tin zirconium phosphate Ion Exchange Material for the Removal of Cationic Dye from Aqueous Solution

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Accepted on 6th February 2014

ABSTRACT

Tetravalent metal acid salts based cation exchanger; tin zirconium phosphate was synthesized by co-precipitation method. The ion exchange capacity, chemical stability, effect of temperature on ion exchange capacity and pH titration studies carried out to understand the ion exchange capability. The physico-chemical characterization was studied by elemental analysis, XRD, FT-IR and TGA. The thermal analysis depicted the enhanced thermal stability of this material. The X-ray diffraction study showed that the material formed is semicrystalline in nature. The distribution studies of different metal ions on this material were performed in different solvent systems and it was found to be selective for Pb^{II} and Cu^{II} ions. On the basis of distribution coefficient values, some analytically important binary separations of metal ions viz. like Co^{II} - Pb^{II} , Ni^{II} - Pb^{II} , Hg^{II} - Pb^{II} , Mg^{II} - Pb^{II} , Bi^{III} - Cu^{II} , Th^{IV} - Cu^{II} , Mg^{II} - Cu^{II} , and Hg^{II} - Cu^{II} were achieved on tin zirconium phosphate columns. The UV-Visible spectrophotometric studies revealed the enhanced adsorption ability of this material towards organic pollutants like dyes. The effect of some important parameters such as pH, initial concentration of dye, adsorbent dosage, and contact time on the uptake of methylene blue solution was also investigated. Freundlich and Langmuir isotherm models were applied to the equilibrium data. The adsorption of dye was best described by pseudo first order mechanism. It was found that the material can be used for the wastewater treatment which containing heavy toxic metal ions as well as organic pollutant like dyes.

Keywords: Ion exchanger, methylene blue, adsorption, distribution coefficient, isotherm.
