INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: Batch and Column Studies for Metal Removal/Uptake under Uncontrolled/Controlled pH Conditions by Granular Activated Alumina from Mono-, Binary- and Ternary-Metal Ion Systems of Cu(II), Pb(II) and Cr(III) at Fixed Total Initial Concentrations

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Thesis Submitted to the Department/ Center : Civil Engineering

Date of completion of Thesis Viva-Voce Exam : 23 August 2016

Key words for description of Thesis Work : Adsorption, Heavy metals, Copper, Lead, Chromium, Mono- and multi-metal systems, Granular activated alumina, Uncontrolled pH, Controlled pH, Batch studies, Column studies

SHORT ABSTRACT

The present work is aimed at carrying out kinetics, equilibrium and column studies for metal removal/uptake under uncontrolled/controlled pH conditions by granular activated alumina (GAA) from mono-, binary- and ternary-metal ion systems of Cu(II), Pb(II) and Cr(III) at fixed total initial metal ion concentration in the solution. The total metal uptakes under controlled pH conditions and total metal removals under uncontrolled pH conditions were observed to be similar and fairly independent of proportion of initial metal ion concentrations present in selected combinations of binary- and ternary-metal ion systems as long as total initial metal ions concentration in the combinations was approximately 0.60 meq/L. During two sets of batch tests, displacement of already adsorbed target mono-metal ions back into solution was observed along with non-target metal removal under uncontrolled pH conditions and non-target metal uptake under controlled pH conditions. When GAA loaded with a mono-metal system or combination of binary metal ion system during the first three loading cycles was exposed to another mono-metal ion system or another combination of binary-metal ion system in the fourth loading cycle, additional metal removal under uncontrolled pH conditions and additional metal uptake under controlled pH conditions of the other metal ions was observed. Further, the variations in metal removals and metal uptakes at equilibrium from mono-metal ion systems generally appeared to overlap at 95% confidence intervals with variations in total metal removals and total metal uptakes at equilibrium from the combinations of binary-metal ion systems and varied within a small band with the ternary-metal ion system having total initial metal ion concentration of 0.60 meq/L. It indicated that the metal removals at equilibrium and metal uptakes at equilibrium depend on the total initial metal ion concentration present in the solution rather than on ionic radius, valence and atomic weights of individual metal ions. In case of column studies, the column beds had shown additional metal removal capability when virgin beds loaded with a mono-metal ion system or a combination of binary-metal ion system followed by reloading of washed beds with another mono-metal ion system or another combination of binary-metal ion system under uncontrolled and controlled pH conditions. When the virgin beds loaded with mono-metal ion system were washed and then reloaded with another mono-metal ion system under uncontrolled and controlled pH conditions, migration of the first metal ion back into the effluent

solution took place. Further, the order of loading and reloading of virgin and washed beds with mono- and binary-metal ion systems appeared to have bearing on higher metals removals by the column beds.

Abstract-TH-1689_09610412