

THE ADSORPTION OF Cr(III) ONTO A KAOLIN: ALGINATE COMPOSITE ADSORBENT

D.M.R.E.A. Dissanayake^{1,2*}, S.S. Iqbal³, Namal Priyantha², M.C.M. Iqbal¹

¹National Institute of Fundamental Studies, Hantana Road, Kandy

²Postgraduate Institute of Science, University of Peradeniya, Peradeniya

³Department of Chemistry, Open University of Sri Lanka, Nugegoda

Chromium (Cr) is a toxic heavy metal used in the leather, alloy and electroplating industries. The direct discharge of chromium retentive effluents from these industries can contaminate the environment and cause chronic diseases, as well as mutations. In this study, a polymer layer silicate composite was developed, using a layered silicate (kaolin) and a biopolymer from seaweeds (alginate), to remove Cr(III) from the aqueous environment. Sodium alginate (A) was dissolved in 100 mL of distilled water at 80 °C for 3 h. Thereafter, cleaned kaolin (K) was added to the solution (A:K=1:20) and stirred for 5 h. The mixture was then added, drop-wise, to 1% CaCl₂ solution. The beads that formed were washed with distilled water and dried at 70 °C for 2 days. The dried composite was ground and sieved (250-350 µm). All the experiments were conducted using 0.20 g of the composite and 100 mL of 5.0 mg L⁻¹ Cr(III), except for the isotherm study where the concentration varied from 0.5-30 mg L⁻¹. Suspensions were shaken on an orbital shaker at a constant speed of 100 rpm. The dried composite material adsorbed 97% (2.02 mg g⁻¹) of Cr(III) from the aqueous solution within 120 minutes. The pH of the metal solution influenced the adsorption process, where the maximum adsorption of 97% was observed within the pH range 4-6. Adsorption followed a pseudo second-order kinetic model with a rate constant of 0.033 g mg⁻¹ min⁻¹. The isotherm data fit the Langmuir isotherm model with a monolayer capacity of 6.14 mg g⁻¹. The adsorption is a homogeneous adsorption process in which a monolayer of Cr(III) is formed on the adsorbent surface. This study indicates that the kaolin: alginate composite could be used as an environmentally friendly green adsorbent to remove Cr(III) from contaminated aqueous environments.

Keywords: Adsorption, Alginate, Cr(III), kaolin

*Corresponding author: email- rasikaeranda.shrea@gmail.com