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Preparation, characterization and evaluation of fluoride adsorption efficiency from water of iron-aluminum oxide-graphene oxide composite material

Sarat Karkar[a], Sushanta Debnath[b], Pradip De[a], Kamya Parashar[c], Kriveshini Pillay[c], Palani Sashikumar[a], Uday Chand Ghosh[a]*,

[a]Department of Chemistry, Presidency University, 86/1 College Street, Kolkata, India

[b]Crystallography and Molecular Biology Division, Saha Institute of Nuclear Physics, Kolkata-700064, India

[c]Department of Applied Chemistry, University of Johannesburg, Johannesburg, South Africa

*Corresponding author e-mail: ucghosh@yahoo.co.in

ABSTRACT

Graphene oxide (GO)-incorporated iron-aluminium mixed oxide (HIAGO) composite, a nobel material was prepared and characterized by FTIR, XRD, TGA/DTA, SEM, TEM, and Raman spectroscopy, which had been employed for adsorption of the fluoride from aqueous solutions. When this material was examined for fluoride scavenging ability from water, it had been established that the as-prepared HIAGO obtained by incorporating 3.0 g GO per 0.2 fraction of one gram formula amount of the mixed oxide matrix showed highest fluoride adsorption capacity (q_e, mg. g^{-1}) at pH ~ 7.0 and ambient temperature. The material showed an increase of q_e with pH up to ~ 5.5, and then reduced. Kinetically, fluoride adsorption took place obeying the pseudo-second order model. The Langmuir adsorption isotherm described the equilibrium data best with monolayer adsorption capacities 22.13, 22.90 and 27.75 mg. g^{-1} at 288, 308 and 318 K, respectively, indicating endothermic nature of adsorption process, which was also confirmed from the thermodynamic analysis of equilibrium data. Fluoride adsorption efficiency of HIAGO had been predicted by modelling a single stage batch adsorber design parameters.

Keywords: adsorption, composite, co-precipitation, fluoride, graphene oxide, iron-aluminium oxide.