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SYNTHESIS OF $\gamma - Fe_2O_3$ COATED LATERITE SAND FOR ADSORPTIVE REMOVAL OF FLUORIDE IONS FROM NATURAL WATER

L.M. Thilakarathne[1], W.M.A.T. Bandara[1*], I.P. L. Jayarathna[2,]

[1] Department of Chemistry, University of Peradeniya, Peradeniya, Sri Lanka
[2] National Institute of Fundamental Studies, Kandy, Sri Lanka
**wmatb@pdn.ac.lk*

Fluoride is one of the major chemical contaminants which course for the reduction of availability of drinking water in many parts of the world including Sri Lanka, which can be increased to the extreme levels by both natural and anthropogenic activities. It has been estimated that more than 200 million people worldwide rely on drinking water with fluoride concentration that exceeds the WHO guideline of 1.5 mg/L. Although fluoride is considered as an essential element for human health, excess intake leads to various diseases; dental and skeletal fluorosis is prevalent. From the several materials and methodologies for the removal of the fluoride from water; adsorption is identified as an efficient and cost-effective methodology that can be used by direct addition of natural materials such as laterite sand which is rich in iron and aluminum oxides. Surface modification of the laterite sand using maghemite(γ–Fe_2O_3) nanoparticles improves the efficiency of adsorption of fluoride. Maghemite nanoparticles were synthesized via the chemical co-precipitation method. The synthesized samples were characterized using Fourier transform infrared spectroscopy, X-ray diffraction, particle size analyzer, and scanning electron microscopy. Additionally, the fluoride removal efficiency was estimated using the concentration of fluoride determined by fluoride ion-selective electrode for different adsorbent dosage, pH, contact time, and initial fluoride concentration. The optimum removal percentage up to 85% was obtained at pH=2.0. When pH < pH_{zpc} (point of zero charges at pH=6.83), the surface sites of maghemite are positively charged, which favours fluoride adsorption exhibiting the highest capacity.

Keywords: Adsorption, Maghemite, Co-precipitation, Nanoparticles