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SYNTHETIC NANO γ-Fe_2O_3 COATED LATERITE SAND FOR ADSORPTIVE REMOVAL OF FLUORIDE FROM NATURAL WATER

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Fluoride is one of the major chemical contaminants which causes a reduction in the quality of drinking water available in many parts of the world including Sri Lanka. The fluoride content in natural waters increases to 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^{-1}. Although fluoride is considered as an essential element for human health, excess intake leads to various diseases, among which dental and skeletal fluorosis are prevalent. From among the several materials and methodologies available for the removal of 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 coating of laterite sand with maghemite (γ-Fe_2O_3) nanoparticles improves the efficiency of laterite in adsorption of fluoride. Maghemite nanoparticles were synthesized via the chemical co-precipitation method. The samples synthesized 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; this favours fluoride adsorption exhibiting the highest capacity.

Keywords: Adsorption, Co-precipitation, Maghemite, Nanoparticles