Facile synthesis of chitosan derivatives and Arthrobacter sp. biomass for the removal of europium(III) ions from aqueous solution through biosorption

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ABSTRACT
Taiwan is one of the leading manufacturers of fluorescent lamps worldwide, which has subsequently contributed to the Europium containing waste generation. This study investigated the use of natural, eco-friendly and biodegradable materials, such as Arthrobacter sp., chitosan powder and chitosan beads to remove the rare-earth europium ion from aqueous solutions. Initial studies were conducted in batch mode where the function of time, pH and metal ion concentration on Europium(III) ion adsorption were investigated. The kinetic data was fitted to Lagergren pseudo-first order, pseudo-second order, Weber eMorris and the particle-controlled diffusion models. It was deduced that adsorption kinetics followed the pseudo-second order model. The experimental data was also fitted to isotherms of Langmuir, Freundlich and Temkin in order to investigate the sorption mechanism. The maximum monolayer adsorption capacities of the Arthrobacter sp., chitosan powder and chitosan beads were determined to be 9.53, 48.3 and 18.4 mg g\(^{-1}\) respectively. Thus, this method could be used for the removal of Europium(III) ion from industrial effluent to prevent soil contamination in agricultural soils, as Arthrobacter sp. exist in soils. Characterization and ligand complexation behavior were investigated by Fourier transform infrared spectroscopy (FTIR), thermal gravimetric analysis (TGA), X-ray diffraction (XRD) and scanning electron microscopy analysis (SEM).

Keywords: Europium, Chitosan, Arthrobacter sp., Langmuir, Kinetics

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