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Adsorption Thermodynamics of Arsenic on Laterite Soil

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Abstract - Adsorption equilibrium of arsenic (in both As(III) and As(V) states) onto laterite soil was studied at the temperatures of 298, 308 and 318 K. Batch experiments were conducted to find out the arsenic removal capacity. The effects of process parameters such as contact time, adsorbent dose, adsorbent size, temperature and pH were investigated. Detailed studies on adsorption isotherms (Langmuir, Freundlich and Dubinin-Radushkevich) were conducted. By using the Dubinin-Radushkevich (DR) isotherm, the energy (E) related with adsorption was calculated and the results showed that the adsorption was mostly physisorption. It was observed by calculating the value of the dimensionless equilibrium parameter (R_L) that the adsorption was favorable. The standard free energy change (ΔG°), enthalpy change (ΔH°) and entropy change (ΔS°) were determined and the calculated values showed that the adsorption process for both As(III) and As(V) was exothermic and spontaneous. Regeneration of the adsorbent was possible using 1M NaOH solution and the regenerated adsorbent could further be used for arsenic removal.

Keywords : Arsenic removal, Laterite soil, Temperature effect, Adsorption isotherm, Dimensionless equilibrium parameter, Thermodynamic parameters and Desorption studies.