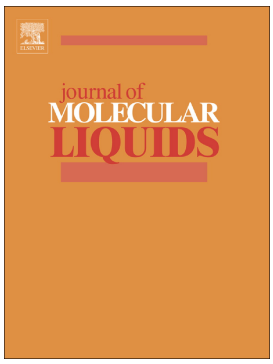

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Low Cost and Easy Synthesis of Aluminium Oxide Nanoparticles for Arsenite Removal from Groundwater: A Complete Batch Study

By

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Abstract: The present study was conducted to evaluate the feasibility of adsorption of aluminium oxide nanoparticles for arsenite, which is toxic and prevalent arsenic species under anoxic condition in groundwater. Therefore, aluminium oxide nanoparticles were synthesised and characterised by Dynamic Light Scattering, Field Emission Scanning Electron Microscopy, Energy Dispersive X-ray spectrometry, Fourier Transform Infrared Spectroscopy, X-ray Diffraction and Transmission Electron Microscopy. Batch adsorption studies were performed as a function of contact time, initial arsenite concentration, adsorbent dose, temperature, pH and influence of other competing anions. The arsenite adsorption was well explained by Freundlich isotherm model. Langmuir adsorption capacity was found to be 500 µg/g at 298 K. The kinetic data followed pseudo-second-order model with film diffusion step controlling the mechanism. The values of thermodynamic parameter, $\Delta H°$ was −26.09 kJ/mol, while the values of $\Delta G°$ were −3.75, −2.99, −2.20 and−1.49 kJ/mol at 298, 308, 318 and 328 K respectively, suggesting exothermic and spontaneous nature of the process. The change in entropy ($\Delta S°$=−0.075 kJ/mol) indicated the decrease in entropy of the system, as adsorbate concentration increased on aluminium oxide nanoparticles surface and reduced the mobility of arsenite. The activation energy (Ea) content of the process was found as 5.64 kJ/mol, which confirmed the nature of adsorption as the physical adsorption. The results indicated the potential utility of Al_2O_3 nanoparticles for arsenite removal from any natural water resources.

Keywords: Adsorption; Al_2O_3 nanoparticles; Arsenite; Removal efficiency; and Isotherm models.