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Treatment of molybdenum(VI)-containing groundwater using chitosan nanoparticle: adsorption mechanism and performances

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ABSTRACT

A novel nano-adsorbent prepared by hydrothermal carbonization of chitosan was used for removing molybdenum (Mo(VI)) from groundwater. Optimal adsorption parameters were determined via varying pH, time, concentrations, and temperatures. The results indicated that the removal rate of Mo(VI) by chitosan carbonization nanoparticles (CCN) was depended on pH values and the maximum adsorption efficiency could be achieved when the pH is in the range of 1.5–3.3. Kinetic studies showed that Mo(VI) could be removed rapidly, and the experimental results fitted pseudo-second-order kinetic model well. Mo(VI) adsorbed by CCN was described well by Langmuir model and the theoretical maximum adsorption capacity reached 192.308 mg g^{-1} at 303.15 K. Thermodynamic parameters indicated that the adsorption process was endothermic, entropy increasing, and spontaneous. Electrostatic interaction and hydrogen bonding were the major adsorption mechanisms. Regeneration and real groundwater treatment experiments revealed that Mo(VI) could be removed efficiently by CCN, and CCN could be recycled for a long term. Altogether, CCN might be a green, efficient, and recyclable adsorbent for Mo(VI) removal from groundwater.

Keywords: Molybdenum; Adsorption; Chitosan carbonization nanoparticles; Groundwater; Mechanism

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