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Removal of Cr (VI) from aqueous solution using MCM-41

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ABSTRACT

Mesoporous molecular sieves (MCM-41) was successfully synthesized using hydrothermal synthesis and characterized by X-ray diffraction and nitrogen adsorption–desorption. Characterization results show that synthesized MCM-41 is a good adsorption material of good crystallinity, large surface area (1,040 m^2/g) and uniform diameter (centered at 2.8 nm). Removal of Cr (VI) from aqueous solution using MCM-41 was carried out by UV-Vis spectrophotometry. The different parameters affecting the adsorption efficiency were investigated and obtained their optimal values (pH 4, temperature 35°C, initial Cr (VI) concentration < 10 mg/L, adsorption time 2 h, adsorbent concentration of 10 mg/L). It is very useful and important to deal with Cr (VI) from aqueous solution. The adsorption isotherm was also investigated. It is found that the adsorption isotherm follows the Langmuir model better. What's more, b of 76.71 mg^{-1} and q of 904 mg/g were calculated from Langmuir linear fitting. The adsorption reaction is spontaneous and endothermic as $\Delta G^0 < 0$ and $\Delta H^0 > 0$. Finally, we studied the adsorption kinetics and find that the adsorption of Cr (VI) ions onto MCM-41 is more suitable for pseudo-second-order kinetics. q_e and k_2 were calculated. The detailed kinetic mechanism is that film diffusion is its mainly controlling step, but intra-particle diffusion is a considerable contribution to adsorption mechanism, which must be meaningful to accelerate adsorption rate.

Keywords: MCM-41; Chromium (VI); Adsorption isotherm; Adsorption thermodynamics; Adsorption kinetics

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