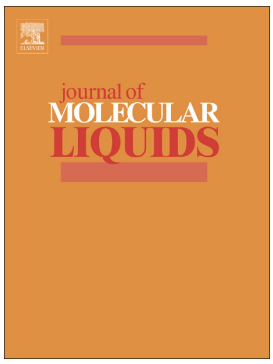

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Synthesis of zeolite nanostructures from waste aluminum cans for efficient removal of malachite green dye from aqueous media

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Abstract

Different zeolite nanostructures were synthesized from waste aluminum cans via a low-cost hydrothermal method using different silicon sources. The produced nanostructures were identified using XRD, FT-IR, SEM, and TEM analyses. XRD proved that the samples which synthesized using fumed silica and sodium metasilicate consist of a composite of (analcime, hydroxysodalite, and zeolite P1) and (sodium aluminum silicate hydroxide hydrate and nepheline hydrate), respectively. Moreover, the samples which synthesized using silica gel and tetraethyl orthosilicate composed of LTA zeolite and a composite of (sodium aluminum silicate hydroxide hydrate and zeolite 4A), respectively. The as-prepared zeolite nanostructures were tested in the removal of malachite green dye from aqueous media using a batch method. The results revealed that the adsorption processes fitted well with the pseudo-second-order kinetic model and Langmuir adsorption isotherm. In addition, the mechanism of adsorption processes was controlled by three successive stages, namely inner diffusion, outer diffusion, and pore diffusion processes where the pore diffusion is the rate-determining step. Additionally, thermodynamic parameters showed that the adsorption processes were spontaneous, physisorption, and exothermic.