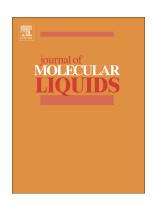
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ACCEPTED MANUSCRIPT

A superior adsorbent of CTAB/H₂O₂ solution-modified organic carbon rich-clay

for hexavalent chromium and methyl orange uptake from solutions

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Abstract

Raw clay (RC) rich in organic matter (OM) was separately treated by hydrogen peroxide

(H₂O₂), cetyltrimethylammonium bromide (CTAB) and a solution of CTAB/H₂O₂. The

new strategy of RC modification using CTAB/H₂O₂-solution presented a swollen

product (CTAB/H₂O₂-clay) with porous structure. Raw and modified clays were

characterized by XRD, SEM, FTIR, zeta potential, S_{BET} surface area and tested as

adsorbents for hexavalent chromium Cr(VI) and methyl orange (MO) from solutions.

Adsorption experiments were conducted under experimental parameters including pH,

shaking time, initial concentrations, adsorbent mass, temperature and ionic strength.

CTAB/H₂O₂-clay gave the highest adsorption capacities for Cr(VI) and MO as

compared to the other products at pH 2.0 and 3.0, respectively. Adsorption equilibrium

of Cr(VI) and MO was evaluated using Langmuir, Freundlich, Temkin and Dubinin-

Radushkevich models. Langmuir model fitted well the uptake results and the maximum

uptake capacities (q_{max}) at room temperature (25 °C) were found to be 67.05 and

194.28 mg/g for Cr(VI) and MO, respectively. The values of mean free energy (E) were

greater than 8.0 kJ/mol revealed the chemical nature of Cr(VI) and MO uptake. The

pseudo-second-order model with $R^2 = 0.9999$ described well the kinetics data.

Thermodynamic parameters (ΔH^0 , ΔG^0 and ΔS^0) indicated that the uptake of Cr(VI) and

MO was spontaneous and endothermic.

Keywords: Raw clay; organic matter, hexavalent chromium, methyl orange; adsorption

characteristics; thermodynamic studies

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