



Modified cellulose fibers as adsorbent for dye removal from aqueous environment

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ABSTRACT

The paper proposes a new study of two cellulose-based materials tested as adsorbents for two models of dyes (i.e., anionic Brilliant Red HE-3B (BRed) and cationic Methylene Blue (MB) dye and characterized using advanced analysis techniques (Fourier-transform infrared /attenuated total internal reflection spectra, environmental scanning microscopy, X-ray diffraction analysis, viscosity measurements, average degrees of polymerization, and potentiometric titration) for providing the dye adsorption in the material structure. As main operational parameters in the dye adsorption: environment pH, adsorbent dose and initial dye concentration were investigated. The cationic MB dye, having a lower molecule size, is better retained on both tested adsorptive material types, that is, viscose fibers and oxidized cellulose (S114). Meanwhile, the oxidized cellulose sample was proved to be much efficient in the dye adsorption process than the viscose fibers, due to additional oxidative treatment supported which was introduced some high amounts of carboxyl groups, which was modified the behavior of both dyes in the adsorption systems. The description of BRed and MB dye adsorption onto S114 sample was performed by three adsorption models (Freundlich, Langmuir and Dubinin–Radushkevich) well being fitted the Langmuir (MB) and Freundlich (BRed) models, but also the maximum adsorption capacities (q_0) 25.25 and 454.54 mg/g, onto S114 adsorbent, for BRed and MB dye, respectively. The adsorption energy values (3.706–7.45 kJ/mol for BRed and 3.83–4.352 kJ/mol for MB dye) suggest that adsorption is probably a physical process that engages electrostatic interactions between the charged surface of the adsorbent and the corresponding ionic groups of the dyes.

Keywords: Adsorption; Brilliant Red HE-3B dye; Methylene Blue dye; Oxidized cellulose; Viscose fibers

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