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Low-cost agroindustrial biomasses and ferromagnetic bionanocomposites to cleanup textile effluents

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ABSTRACT

The presence of textile dyes in the environment is a concern since they can be composed of organic and inorganic recalcitrant and/or toxic compounds. Ferromagnetic nanocomposites prepared from agroindustry residues, cork powder (CP), and yeast biomass (YB) were synthetized, characterized, and applied for dyes adsorption. The CP, YB, ferromagnetic nanoparticles (MNP), the ferromagnetic nanocomposites powdered cork (CP-MNP), and yeast biomass from ethanol industry (YB-MNP) were evaluated as sorbents for methylene blue. All sorbents were also applied to cleanup dyed cotton fabric effluent, containing a reactive dye trichomy (Yellow CL-2R, Red CL-5B, and Blue HF-RL, all Drimaren). The experimental sorption capacities (SC_{exp}) of the sorbents for methylene blue with the respective confidence intervals ($1 - \alpha = 0.95$) were 36.4 ± 0.5 mg/g (CP), 33.6 ± 0.9 mg/g (CP-MNP), 27.7 ± 0.2 mg/g (YB), 30.4 ± 1.2 mg/g (YB-MNP), and 2.9 ± 0.5 mg/g (MNP). A proposed decision algorithm was employed to define the isotherms model best fit to each process, and we found CP-MNP (Langmuir), CP (Langmuir), YB-MNP (SIPS), YB (SIPS), and MNP (Freundlich). High sorption efficiency reached up recoveries of 50.0% ± 1.2% (CP), 66.5% ± 0.1% (CP-MNP), 85.9% ± 0.1% (YB), and 82.6% ± 0.1% (YB-MNP) of dye effluents, suggesting that the materials present potential for treatment effluents.

Keywords: Yeast biomass; Cork; Reactive dyes; Modeling; Standard errors; Choose an isotherm model

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