Valorization of an agricultural waste, *Stipa tenassicima* fibers, by biosorption of an anionic azo dye, Congo red

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**ABSTRACT**

The removal of Congo red dye (CR) from aqueous solutions using a novel low-cost biological adsorbent, *Stipa tenassicima* fibers, has been investigated in this paper. Batch experiments were conducted to examine the effect of the main parameters, such as the initial CR concentration, the pH, and the temperature on the sorption of the dye. Maximum adsorption removal was observed at pH 4 and biosorption capacity of *S. tenassicima* was enhanced by increasing the temperature. Rate constants of pseudo-first order, pseudo-second order, and intraparticle diffusion coefficient were calculated to analyze the dynamic of the sorption process; they showed that sorption kinetics followed an intraparticle diffusion model, while the two straight lines describing experimental data indicated that intraparticle diffusion was the limiting step for biosorption. Among the tested isotherm models, the Sips isotherm was found to be the most relevant to describe CR sorption onto *S. tenassicima* fibers. Thermodynamic parameters, such as changes in standard free energy, enthalpy, and entropy, were also evaluated and the results suggested that the sorption reaction was spontaneous and endothermic in nature. The potential of *S. tenassicima* fibers, an easily available and low-cost material, to be used as an alternative biosorbent material for the removal of a dye, CR, from aqueous solutions was therefore confirmed.

**Keywords:** Sorption; *Stipa tenassicima*; Isotherm models; Kinetics; Thermodynamic parameters

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