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Surface-modified scarlet firethorn: an eco-friendly and effective dye remover with excellent regeneration potential

Sibel Tunali Akar[a,*], Dilek Yilmazer[b], Tamer Akar[a]

[a]*Faculty of Arts and Science, Department of Chemistry, Eskişehir Osmangazi University, 26480 Eskişehir, Turkey, Tel. +90 2393750/2862; Fax: +90 222 2393578; email: stunali@ogu.edu.tr (S.T. Akar), Tel. +90 2393750/2871; email: takar@ogu.edu.tr (T. Akar)*

[b]*Department of Chemistry, Graduate School of Natural and Applied Sciences, Eskişehir Osmangazi University, 26480 Eskişehir, Turkey, Tel. +90 2393750/2834; email: dyilmazer-87@hotmail.com*

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ABSTRACT

The surface of the scarlet firethorn biomass was modified with dimethylglyoxime. Modified biosorbent (DMGPC) was evaluated for its potential to remove methylene blue (MB) dye from contaminated solutions. Batch- and continuous-mode biosorption conditions were examined by varying initial pH (2.0–10.0), biomass dosage (0.4–4.0 g L^{-1}), time (5–60 min), initial dye concentration (10–1,000 mg L^{-1}), temperature (15–45 °C), and flow rate (0.5–6.0 mL min^{-1}). Langmuir isotherm and the pseudo-second-order kinetic models were used to describe the biosorption process in addition to mechanism characterization. Good biosorption yields were recorded with small amounts of DMGPC. The maximum monolayer biosorption capacity of DMGPC was 266.92 mg g^{-1}. DMGPC exhibited almost 100% regeneration potential up to 20 cycles, and it was successfully used in the synthetic wastewater conditions. DMGPC also showed very good biosorption yield (100%) up to 2000 min in dynamic flow mode. Mechanism of the decolorization process was investigated by zeta potential measurements, IR, and SEM analysis. Results revealed that DMGPC could be a low-cost, effective, and reusable candidate for the removal of MB from aqueous solutions.

Keywords: Biosorption; Desorption; Dimethylglyoxime; Dye; Modification

*Corresponding author.