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Use of chemically treated babassu coconut activated carbon in the adsorption of tartrazine yellow.

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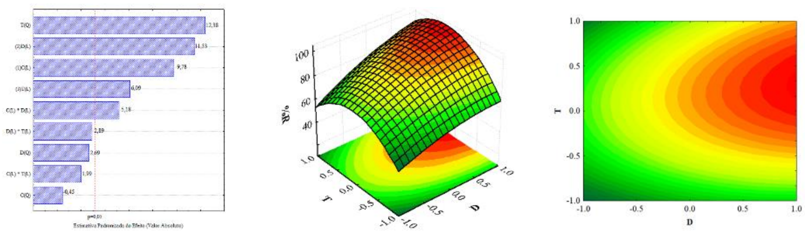
Highlights

- Dosage and treatment were the most relevant variables for the adsorption of tartrazine yellow
- The equilibrium time was less than 1.0 minute. The overall adsorption capacity achieved was about 1.9 mg g^{-1}.
- Maximum tartrazine yellow removal reached 100.0%

Resumo/Abstract

The food industry generates effluents containing various dyes, with Tartrazine Yellow (TAR), a synthetic compound that is toxic when ingested in large quantities, being one of the most common. Remediation of water bodies is necessary, and several studies address mitigation measures. Adsorption, a potentially efficient and low-cost alternative, is a technique that utilizes lignocellulosic residues. Therefore, this study evaluated babassu coconut activated carbon (BACC) in three forms: untreated (BACC-n), treated with H_3PO_4 (BACC-a), and treated with NaOH (BACC-b) for the removal of TAR from aqueous solutions. The material was characterized by pHpcz, XRD, ATR-FTIR, and SEM, and the adsorption tests were analyzed using kinetic (PPO and PSO) and isothermal (Langmuir and Freundlich) models. The pHpcz values (5.15 - 5.99) indicated a positive surface at pH 2, favoring the adsorption of the anionic dye. The chemical treatment increased the porosity without altering the amorphous structure of the material. The kinetics followed the Pseudo-First Order model, with equilibrium in less than 1 minute and qe ≈ 1.9 mg g^{-1}. The Freundlich model fitted the data best, with Kf = 4.61 $mg^{1-1/n}$ $L^{1/n}$ g^{-1} and n = 11.23 for CACB-n, indicating favorable adsorption on heterogeneous surfaces. From the chemometric analysis, the Pareto Diagram (Figure 1A) was plotted, the response surface of the two most significant variables (Figure 1B).



The results showed that untreated CACB had greater adsorptive capacity, even with lower porosity, and chemometric analysis confirmed treatment and dosage as the most influential variables, with up to 100% TAR removal under optimized conditions. It is concluded that CACB is an efficient and sustainable adsorbent, standing out as a low-cost alternative for the treatment of industrial effluents containing synthetic dyes.

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