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ÁREA: Síntese e caracterização de catalisadores e adsorventes

Bioadsorbents using Malt Bagasse from Brewery Waste

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Abstract

The textile industry produces large volumes of effluents containing polluting chemical substances, such as dyes. Treating these contaminants is essential to minimize their socio-environmental impacts. [1]. A promising alternative is the use of agro-industrial waste, such as malt bagasse, which is abundant and inexpensive, as a bioadsorbent to remove dyes and heavy metals. [2] Thus, the goal of this work is to explore the potential of malt bagasse on methylene blue adsorption. The pristine, acid-modified (HCl, HNO_3, H_2SO_4, and H_3PO_4) and activated carbon pyrolyzed at different temperature (500, 600, 700, and 800 °C) from malt bagasse were studied. These bioadsorbents were characterized by X-ray diffraction, indicating the presence of diffraction peaks at 16.4, 21.7° characteristics of lignocellulosic biomass (cellulose I), Fig. 1A (i). [3]. After the acid treatment, Fig. 1 (ii-v), there was no long-distance change in biomass structure. For activated carbons, Fig. 1A (ii-v), the cellulose I peak disappeared, suggesting a destruction of the lignocellulosic chains from malt bagasse; the presence of a diffraction peak at ~24° is consistent of a carbon amorphous arrangement. [1]. Just in CM@800, Fig. 1B (v), there was the appearance of peaks at 22 and 30° characteristics of inorganic minerals. The performance of bioadsorbents were evaluated by methylene blue adsorption at different concentrations (10–200 $mg{\cdot}L^{-1}$), Fig. 1C. A highlight for MC@800, which removed 100% of methylene blue in all concentration studied. Meanwhile, the MB@HNO_3 removed 100% of methylene blue in 50 and 100 $mg{\cdot}L^{-1}$ concentrations. These bioadsorbents were submitted to the adsorption kinetics (180 min). Again, both adsorbents removed 100% of the methylene blue after 15 min, 200 $mg{\cdot}L^{-1}$ for CM@800 and 100 $mg{\cdot}L^{-1}$ MB@HNO_3, respectively. According to the adsorption isotherms (not shown here), the CM@800 presented a characteristic kinetic profile of physisorption and the MB@HNO_3, it displayed a chemisorption profile, respectively. This difference may be attributed to the oxidation of the malt surface (hydroxyl groups) in MB@HNO_3, resulting in a stronger interaction with the methylene blue when compared to MC@800 bioadsorbent.

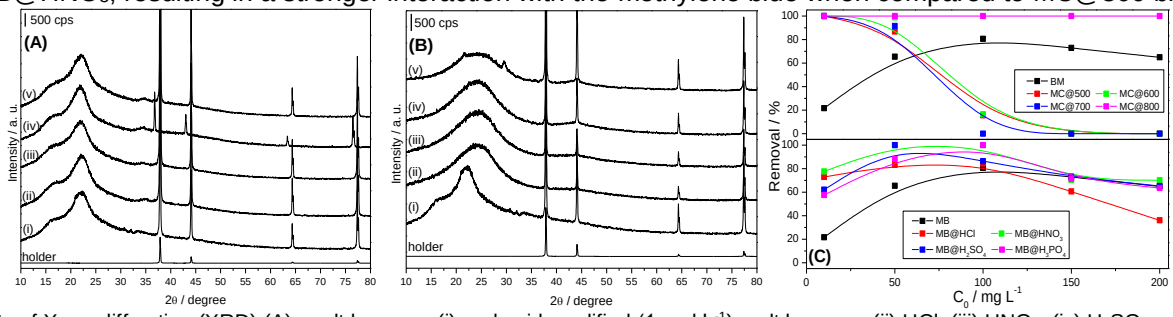

Figure 1. Results of X ray diffraction (XRD) (A): malt bagasse (i) and acid-modified (1 $mol{\cdot}L^{-1}$) malt bagasse (ii) HCl, (iii) HNO_3, (iv) H_2SO_4 and (v) H_3PO_4; (B) activated carbon pyrolyzed at different temperatures: (i) MB; (ii) 500 °C; (iii) 600 °C; (iv) 700 °C and (v) 800 °C; (C) Removal of methylene blue at different concentrations. **Conditions**: $m_{adsorbent}$: 50 mg; Dye solution: 50 mL (10, 50, 100, 150 and 200 $mg{\cdot}L^{-1}$); Temperature: 25 °C; Stirring: 200 rpm; Time: 24 h.

Keywords: remediation, residual biomass, equilibrium.

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