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ÁREA: Synthesis and characterization of catalysts and adsorbents

Activated carbon obtained from Tucum (*Astrocaryum vulgare Mart.*): an alternative bioadsorbent for dye removal in aqueous media

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Abstract

With the increase in environmental law enforcement regarding industrial effluent contamination, such as synthetic dyes, methods and technologies to treat and control them have been increasingly sought. In this context, adsorption is an effective method for removing contaminants, with the advantage of using alternative materials such as activated biochar. The objective of this study was to investigate the capacity of the adsorption of activated carbon produced from the endocarp of tucum (*Astrocaryum vulgare* Mart.) (ATC) in the removal of rhodamine B dye in aqueous media. The ATC was characterized using the following methods: ash and moisture content, FTIR (Fig.1), pH at the point of zero charge (Fig.2) and Scanning Electron Microscopy (Fig.3). The experimental data were fitted to the Langmuir and Freundlich isothermal models from their linear mathematical equations (Fig.4).

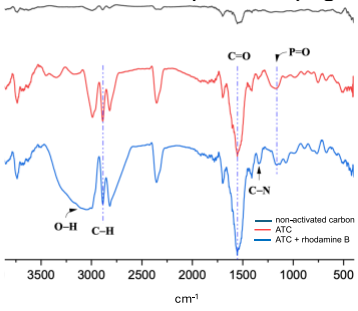

Fig.1

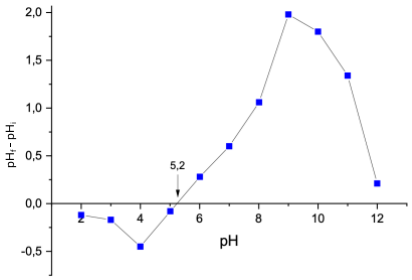

Fig.2

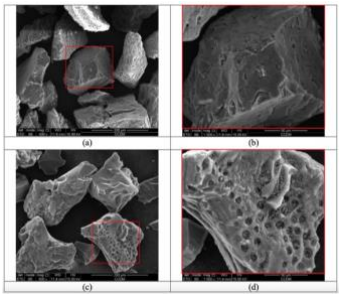

Fig.3

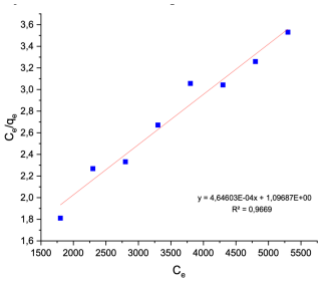

Fig.4

The ash content of ATC was 1.13%, while the moisture content was 1.62%. These values are consistent with the values found in the literature for materials similar to ATC (Haryanti, 2024). Unactivated carbon is poor in functional groups on its surface. The bands between 1475-1600 cm^{-1} (C=O and C=C) are attributed to the increase in aromatic structures due to the activation and pyrolysis process. The bands between 1220-1180 cm^{-1} can be attributed to the stretching of hydrogen bonded to the P=O group and O-C stretching vibrations in P-O-C coupled to aromatic rings, proving the activation of H_3PO_4. A band between 1360-1250 cm^{-1} (C-N) shows the adsorption of the dye on the ATC surface. The pH_{pzc} value equal to 5.2. Micrographs (a) and (b) show the morphology of non-activated carbon, showing a homogeneous and regular surface. Micrographs (c) and (d) show the morphology of ATC, showing more irregular surfaces with the presence of pores of varying sizes. The experimental data of the adsorptive process showed a better fit to the Langmuir model ($R^2 = 0.967$). Wei (2022) investigating the use of activated carbon in the removal of rhodamine B, obtained a good fit of the experimental data with the Langmuir model. The maximum adsorption amount was 1467.01 $mg.g^{-1}$, with 93.21% dye removal. ATC is a promising adsorbent for dye removal in aqueous media.

Palavras-chave: Activated carbon. Rhodamine B. Adsorption. Astrocaryum vulgare Mart

References

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