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Preparation of activated carbon from molasses-to-ethanol process waste vinasse and its performance as adsorbent material

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Abstract

Herein, the preparation of activated carbon from waste vinasse by using hydrothermal H_2O_2 oxidation combined with a two-step pyrolysis process has been described for the first time as a new utilization approach for the waste vinasse. The characterization studies were performed by TGA, FT-IR, Raman spectroscopy, SEM-EDX and gas adsorption measurements. The approach generated a microporous activated carbon with high specific surface area (989 m^2/g) from waste vinasse. After simple experiments on various dye solutions, adsorption performance of the activated carbon was specifically studied on the methylene blue solution as functions of solution pH, contact time, adsorbent amount and reusability. The obtained activated carbon had a higher Langmuir adsorption capacity towards methylene blue (909.091±31.900 mg/g) than many other adsorbents and it is reusable for at least six cycles. The adsorption performance of the obtained activated carbon was also evaluated using both simulated and real dye-house effluents.

Keywords: Adsorption; Hydrothermal oxidation; Hydrogen peroxide; Reusability; Surface area; Two-step pyrolysis.

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