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Characterization of bio-char from pyrolysis of wheat straw and its evaluation on methylene blue adsorption

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ABSTRACT

Bio-char, a by-product from the slow pyrolysis of wheat straw, was characterized and investigated as an adsorbent for the removal of cationic dye, methylene blue (MB) from solution. Elemental analysis, Fourier transform infrared spectrum, X-ray diffraction, and pH of point of zero charge (pH_{pzc}) were presented. Adsorption studies were performed at different pH, salt concentration, contact time and dye concentration in the batch mode. The results showed that there were—OH and other functional groups on the surface of bio-char and the pH_{pzc} of the bio-char was 7.8. The value of solution pH 8–9 was best for the MB adsorption quantity. Salt that coexisted in solution was not favored in MB adsorption. The equilibrium data were modeled with Langmuir, Freundlich, and Sips equations. Overall, the data were best fitted with the Sips model. The maximal adsorption capacity from the Sips model was 12.03 ± 0.41 mg/g at 293 K. Thermodynamic parameters were calculated and the results show that the process was spontaneous and endothermic in nature. Bio-char, a low-cost and eco-friendly adsorbent, can be used to adsorb the cationic dye from the solution.

Keywords: Adsorption; Bio-char; Methylene blue; Isotherm

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