



Carbonization of rubber (*Hevea brasiliensis*) seed shell by one-step liquid phase activation with H_2SO_4 for methylene blue adsorption

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ABSTRACT

The rubber (*Hevea brasiliensis*) seed shell, which is an agricultural waste, was carbonized by one-step liquid phase activation with H_2SO_4 to be a potential bio-char adsorbent for methylene blue (MB) adsorption from aqueous solution. Carbonized rubber seed shell (CRSS) was characterized by a CHNS-O, Brunauer–Emmett–Teller (BET), X-ray diffraction, Fourier transform infrared spectroscopy, scanning electron microscope with an energy dispersive X-ray spectrometer (SEM–EDX), point-of-zero charge (pH_{pzc}), and proximate analyses. Batch mode adsorption studies were conducted by varying operational parameters such as adsorbent dosage (0.02–0.30 g), solution pH (3–11), initial MB concentrations (50–300 mg/L) and contact time (0–1,440 min). The equilibrium data were well correlated by Langmuir isotherm compared with Freundlich and Temkin models. The maximum adsorption capacity, q_{max} , of CRSS for MB adsorption was 208.3 mg/g at optimum pH 8 and temperature 303 K. The kinetic uptake profiles are well described by the pseudo-second-order model. All results mentioned above revealed that the CRSS can be feasibly utilized for the removal of MB from aqueous solution.

Keywords: Rubber seed shell; Carbonization; Chemical activation; Sulphuric acid; Adsorption; Methylene blue
