Adsorption behavior of methylene blue on acid-treated rubber (Hevea brasiliensis) leaf

Ali H. Jawad a, *, Shaimaa Hassan Mallah b, Mohd Sufri Mastuli a

a Faculty of Applied Sciences, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, MALAYSIA, Tel. +603-55211721, email: ahjm72@gmail.com, ali288@salam.uitm.edu.my (A.H. Jawad), Tel. +03 5543 6594, email: mohdsufri@salam.uitm.edu.my (M.S. Mastuli)
b Department of Chemistry, College of Science, ALMuthanna University, IRAQ, Tel. +9647804611780, email: Shaimaa.h2m30@yahoo.com (S.H. Mallah)

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ABSTRACT

The rubber (Hevea brasiliensis) leaf is an agricultural waste was chemically treated with H2SO4 to be a potential biochar adsorbent for methylene blue (MB) adsorption from aqueous solution. The acid-treated rubber leaf (ATRL) was characterized by a CHNS-O, Brunauer-Emmett-Teller (BET), X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), 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 (0–1440 min). The equilibrium data were well fitted to Freundlich isotherm compare to Langmuir and Temkin isotherms. The maximum adsorption capacity, qmax of ATRL for MB adsorption was 263.2 mg/g at 303 K. The kinetic uptake profiles were well described by the pseudo-second-order model. The thermodynamic adsorption parameters such as standard enthalpy (ΔH°), standard entropy (ΔS°), and standard free energy (ΔG°) showed that the adsorption of MB onto ATRL surface endothermic in nature and spontaneous under the experimented conditions. All results mentioned above revealed that the ATRL can be feasibly utilized for the removal of MB from aqueous solution.

Keywords: Rubber leaf; Acid-treated; Chemical activation; Sulphuric acid; Adsorption; Methylene blue