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Supplementary materials

Rice Straw Biochar and Magnetic Rice Straw Biochar for Safranin O Adsorption from Aqueous Solution

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Supplementary Methods for Physicochemical analysis

Scanning electron microscopy with energy dispersive X-ray spectrometry (SEM/EDX) analysis

The morphology and surface composition of the samples were examined by SEM/EDX analysis, using a scanning electron microscopy SEM (Hitachi S-4800, Japan) coupled with an energy dispersive X-Ray (EDX) spectroscopy (Hitachi, Japan). To obtain good resolution and broad compositional sensitivity, the machine conditions used for were 15 kV acceleration voltage, 12.5 mm specimen stubs, and 8 mm working distance for all measurements. Whilst, backscattered electron images at different magnifications were used to observe the morphologic characteristics and to record the elemental profiles for selected areas of the samples. Major elements at the quantification higher than 1 g/kg (i.e., Si, Na, Mg, Al, P, K, Ca, K, Fe, Cu and Zn) were analyzed with EDX. Each sample was analyzed 3 times and at least 6 measurements per micrograph were performed to determine their elemental compositions. The average data is reported.

Fourier transform infrared spectroscopy (FTIR) analysis

FTIR was used to identify important functional groups in raw, ash and sample surfaces by recording the infrared spectrum of respective samples. The FTIR measurements of samples were carried out using a Fourier transform infrared spectroscopy (FTIR-PerkinElmer Spectrum 10.5.2, UK). Here, KBr powder was used as background and approximately 1 mg of dried sample was gently mixed with 100 mg of KBr powder, then pressed to form pellets. The FTIR spectra analysis was operated at 4 cm^{-1} resolution in the region of 400–4000 cm^{-1} with a total of 64 scans. Background FTIR spectrum of air was collected before collecting the sample FTIR spectra.

Brunauer-Emmett-Teller surface area (BET)

Specific surface area of biochars were calculated via the BET method, with the aid of a Nova Station A (Quantachrome Instruments version 11.0, USA). Prior to analysis, to avoid errors in the computed values, samples were dried at 105 ºC overnight to evaporate water, then degassed by nitrogen purge for a minimum of 7 h at 200 ºC to drive off any impurities from the particle surfaces and from within pores. The surface areas of samples were then analyzed by adsorption of nitrogen at 77 K.

X-ray diffraction (XRD)

The purities of samples were confirmed by ambient pressure X-ray powder diffraction. Data were collected in reflection mode, on a Bruker D8 Advance Diffractometer (Bruker AXS GmbH, Karlsruhe, Germany) equipped with CuKα_1 radiation (λ= 1.5406 Å) at 40 kV, 40 mA in a 2θ range of 25° to 80°."

Supplementary Figures

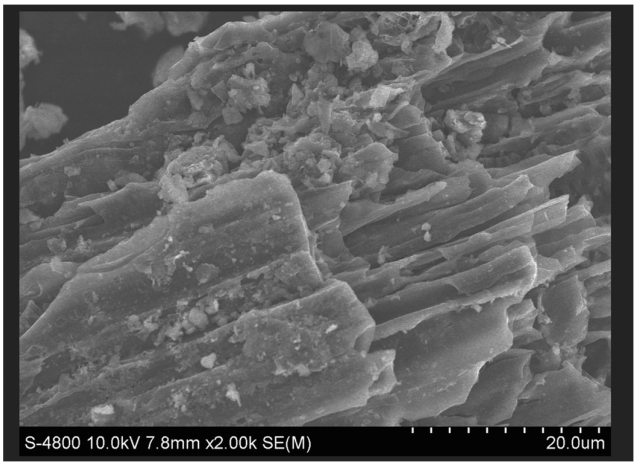

Figure S1. SEM images of the rice straw biochar (RSB) prepared by fast pyrolysis with a residence time of 120 min at 500°C (scale bar: 20 μm).

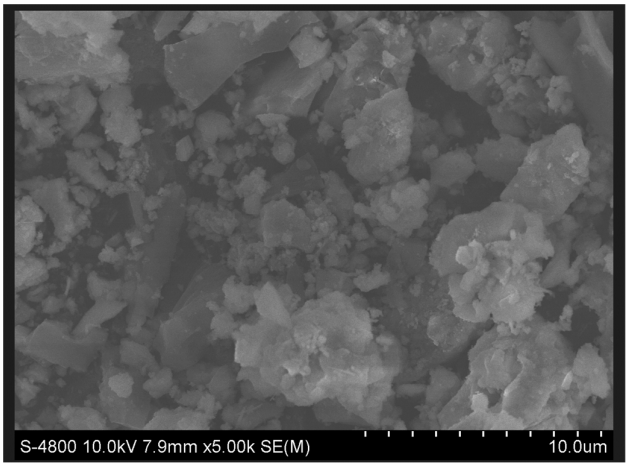

Figure S2. SEM images of the magnetic rice straw biochar (MRSB) prepared by precipitation of iron oxide using an aqueous Fe^{3+}/Fe^{2+} solution onto the biochar surface followed by NaOH treatment (scale bar: 10 μm).

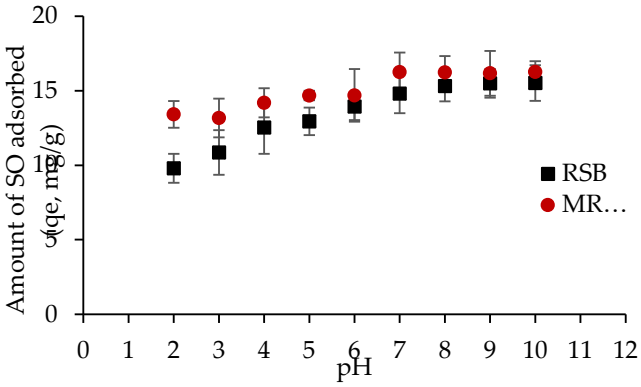

Figure S3. The effects of pH on SO adsorption by RSB and MRSB.

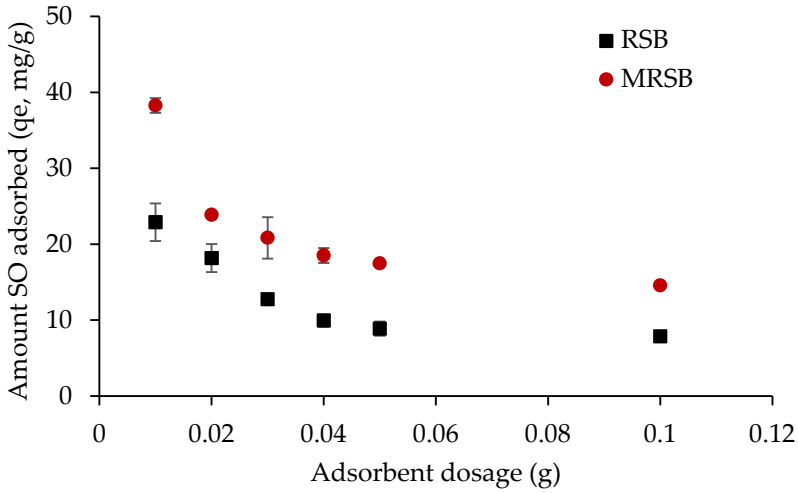

Figure S4. The effects of RSB and MRSB dosage on SO adsorption.

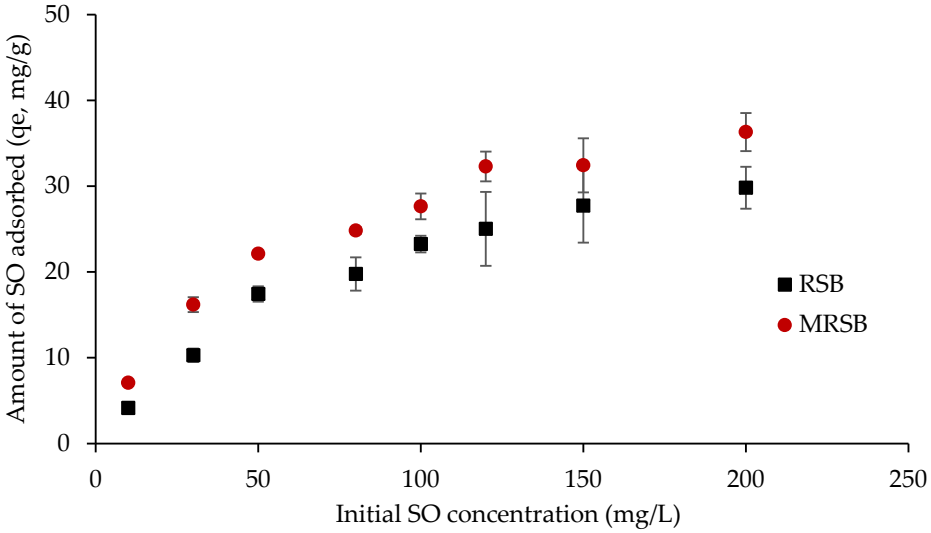

Figure S5. The effects of initial SO concentration on adsorption by RSB and MRSB.

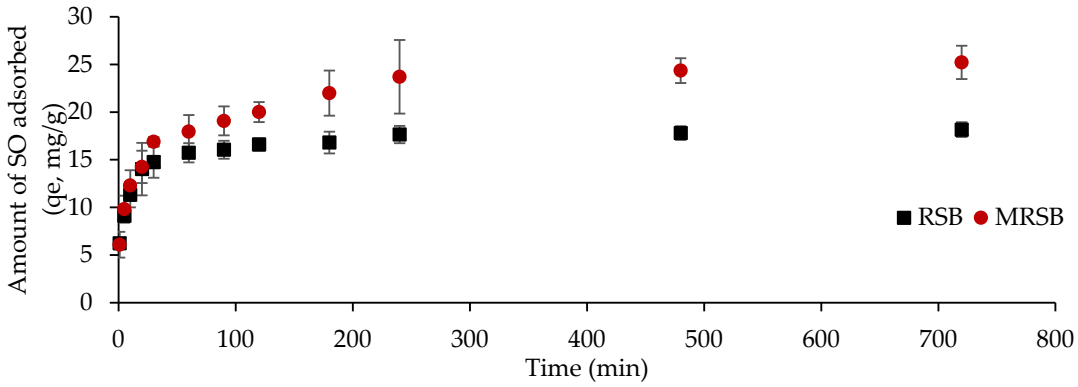

Figure S6. The effects of contact time on SO adsorption onto RSB and MRSB.