

Enhanced removal of Cd(II) from aqueous solution using CaCO₃ nanoparticles modified sewage sludge biochar

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Table S1 Kinetic parameters for Cd(II) adsorption on SSB and CMSSB materials

Adsorbent	Pseudo-first-order ^a		Pseudo-second-order ^b		Elovich equation ^c		
	q _e (mg·g ⁻¹)	R ²	q _e (mg·g ⁻¹)	R ²	α [mg/(g·min)]	β (g·mg ⁻¹)	R ²
SSB	9.60	0.935	10.0	0.970	6.68×10 ⁵	1.568	0.990
CMSSB	32.1	0.964	33.3	0.984	1.06×10 ⁷	0.522	0.998

a: The kinetic model as proposed $\log(q_e - q_t) = \log q_e - k_1 \cdot t / 2.303$, q_e and q_t are the amounts of Cd(II) adsorption (mg·g⁻¹) at equilibrium and at any instant of time t (min), respectively, and k_1 is the rate constant of pseudo-first-order adsorption (min⁻¹).

b: The kinetic model as proposed $t/q_t = 1/(k_2 \cdot q_e^2) + t/q_e$, q_e and q_t are the amounts of Cd(II) adsorption (mg·g⁻¹) at equilibrium and at any instant of time t (min), respectively, and k_2 is the equilibrium rate constant of pseudo-second-order adsorption (g/(mg·min)).

c: The kinetic model as proposed $q_t = (1/\beta) \cdot \ln(\alpha \cdot \beta) + (1/\beta) \cdot \ln(t)$, q_t are the amounts of adsorbed Cd(II) at time t , α is the initial adsorption rate of the Elovich equation (mg/(g·min)) and β is the desorption constant related to the extent of surface coverage and activation energy for chemisorption (g·mg⁻¹).

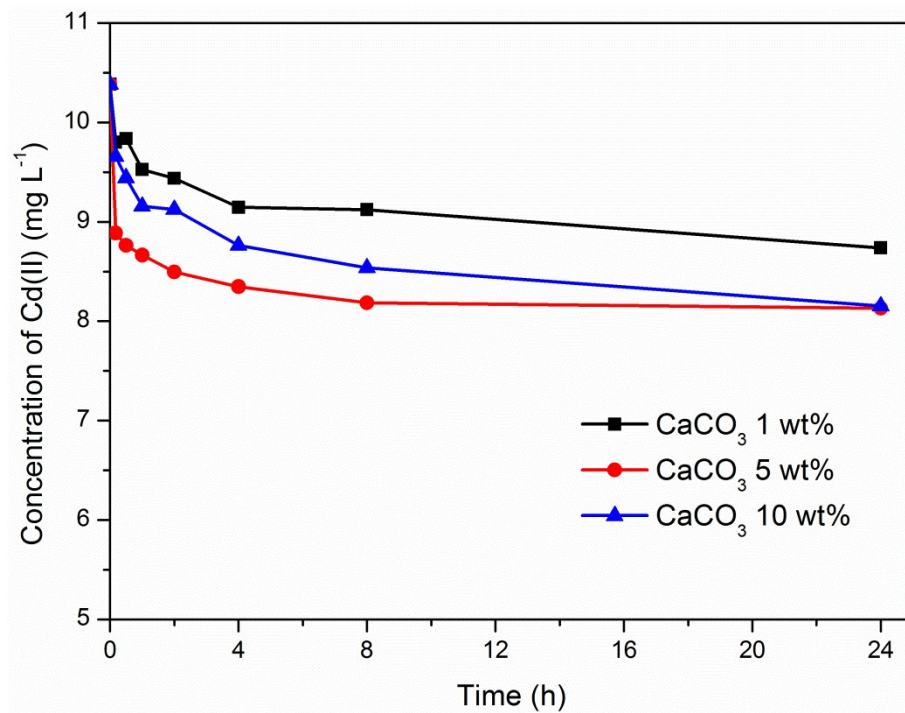


Fig. S1 Adsorption kinetics of Cd(II) onto the CMSSB materials with different CaCO₃/SSB ratio (wt/wt): adsorbent dose, 0.1 g·L⁻¹; Cd(II) concentration, 10.4 mg·L⁻¹; initial pH 6.0.

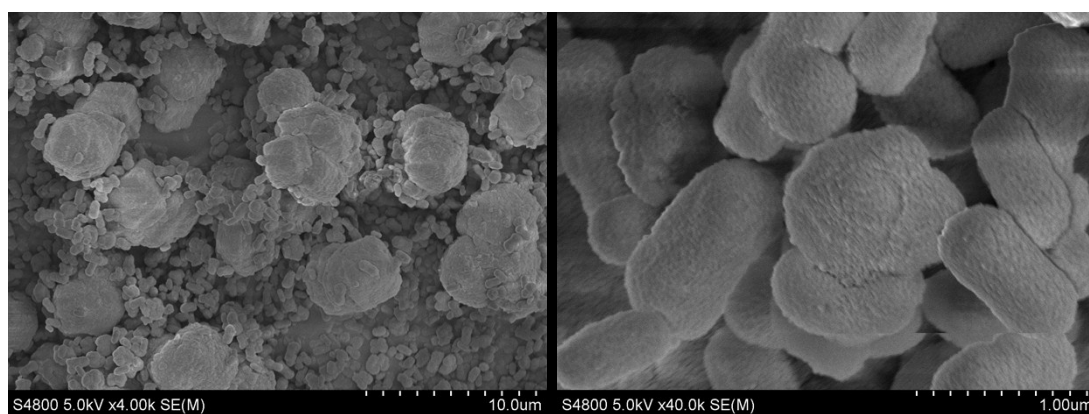


Fig. S2 SEM images of the as-obtained calcite in the absence of SSB.

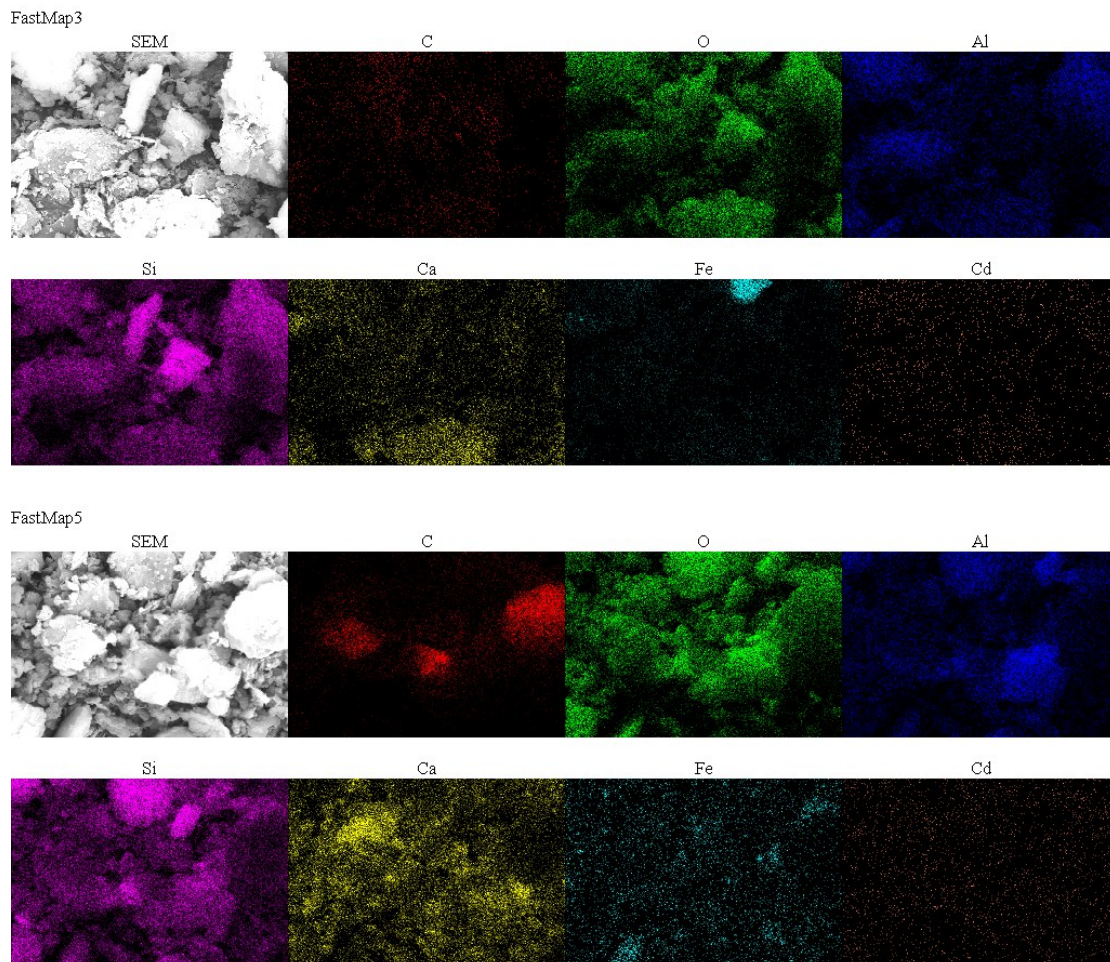


Fig. S3 SEM images and elemental mapping of SSB and CMSSB samples.

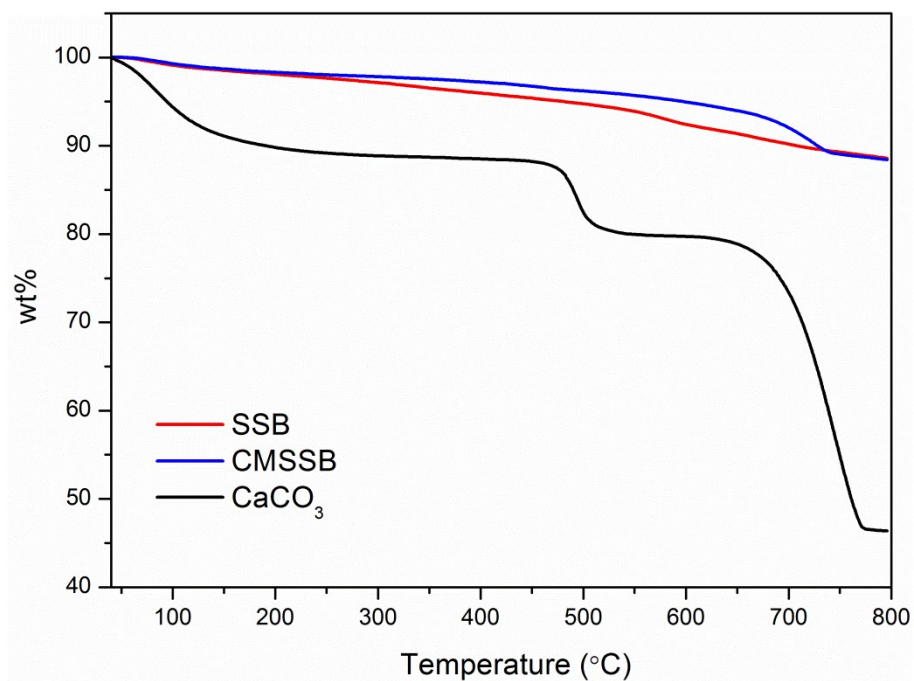


Fig. S4 TG curves of the samples at a heating rate of 10 °C/min in N₂.

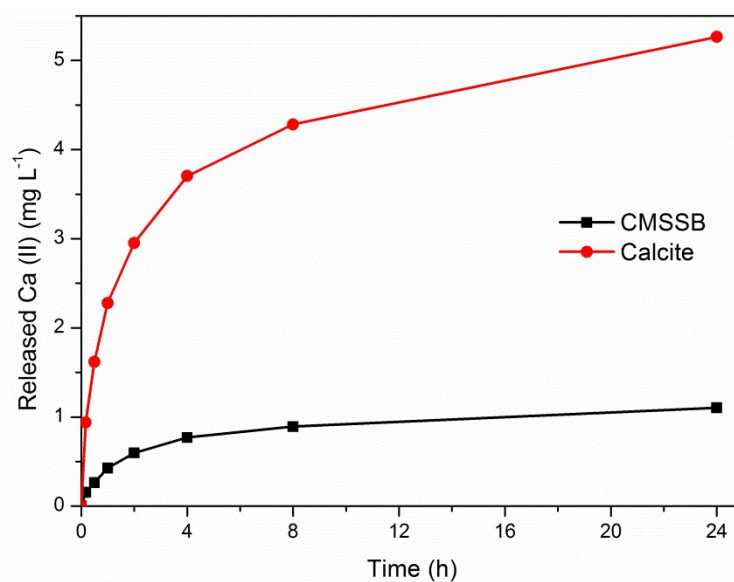


Fig. S5 Dissolution kinetics of calcite and CMSSB samples in water at pH 5.0 (adsorbents: 15 mg; water: 150 mL).

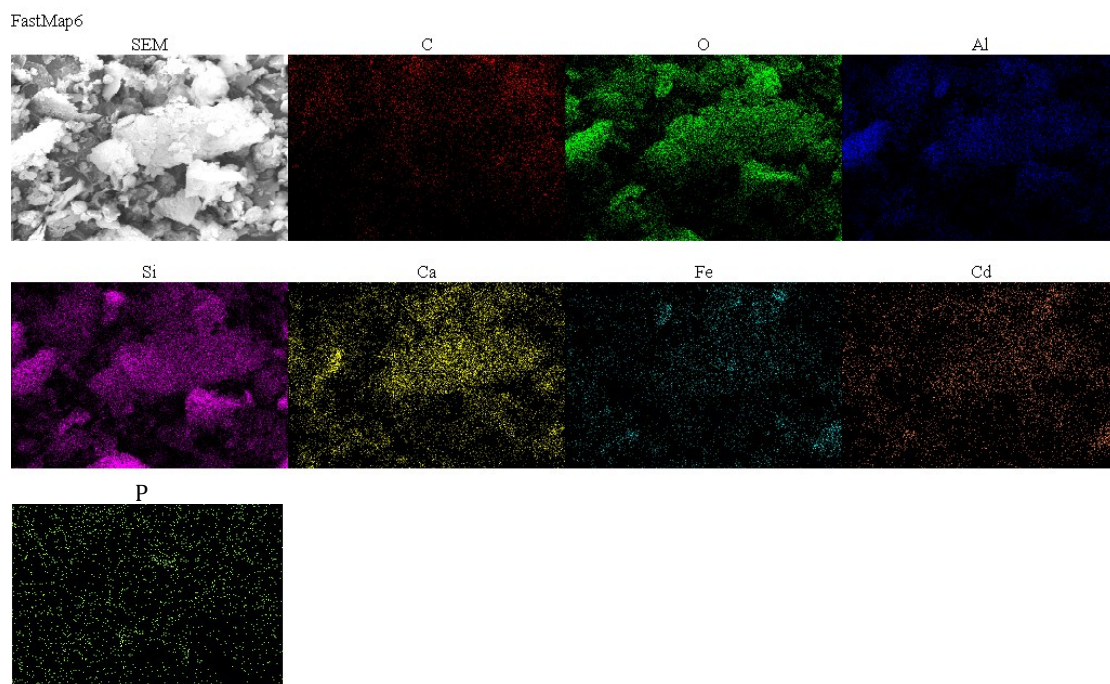


Fig. S6 SEM image and EDX elemental mapping of the Cd(II) loaded CMSSB samples.