

## Annex C. Kinetics data

**Table 1.1.** Parameters of kinetics fitting for Cd<sup>2+</sup> adsorption on biochar

Model	Parameter	H <sub>2</sub> O <sub>2</sub> -biochar	Biochar
Pseudo-first order model	k1 (1/min)	0.0065	0.0038
	qe (mg/g)	58.154	76.646
	R <sup>2</sup>	0.6312	0.7227
Pseudo-second order model	k2 (1/min)	0.0002	0.00008
	qe (mg/g)	0.683	0.663
	R <sup>2</sup>	0.7689	0.8044
Intraparticle diffusion model	Kid (mg/g min)	1.087	0.877
	B (mg/g)	2.704	1.294
	R <sup>2</sup>	0.7521	0.8556

**Table 1.2.** Parameters of kinetics fitting for Cr<sup>3+</sup> adsorption on biochar

Model	Parameter	H <sub>2</sub> O <sub>2</sub> -biochar	Biochar
Pseudo-first order model	k1 (1/min)	0.006	0.003
	qe (mg/g)	68.553	80.134
	R <sup>2</sup>	0.6897	0.6647
Pseudo-second order model	k2 (1/min)	0.0002	0.0005
	qe (mg/g)	0.873	0.548
	R <sup>2</sup>	0.8139	0.7505
Intraparticle diffusion model	Kid (mg/g min)	1.115	0.794
	B (mg/g)	1.205	0.854
	R <sup>2</sup>	0.7929	0.7985

**Table 1.3.** Parameters of kinetics fitting for Cu<sup>2+</sup> adsorption on biochar

<b>Model</b>	<b>Parameter</b>	<b>H<sub>2</sub>O<sub>2</sub>-biochar</b>	<b>Biochar</b>
Pseudo-first order model	k1 (1/min)	0.0064	0.0043
	qe (mg/g)	58.329	68.601
	R <sup>2</sup>	0.6877	0.6557
Pseudo-second order model	k2 (1/min)	0.0002	0.0001
	qe (mg/g)	0.737	0.637
	R <sup>2</sup>	0.8479	0.7482
Intraparticle diffusion model	Kid (mg/g min)	1.036	0.926
	B (mg/g)	3.314	2.217
	R <sup>2</sup>	0.781	0.8021

**Table 1.4.** Parameters of kinetics fitting for Ni<sup>2+</sup> adsorption on biochar

<b>Model</b>	<b>Parameter</b>	<b>H<sub>2</sub>O<sub>2</sub>-biochar</b>	<b>Biochar</b>
Pseudo-first order model	k1 (1/min)	0.0063	0.0028
	qe (mg/g)	65.720	80.907
	R <sup>2</sup>	0.689	0.6778
Pseudo-second order model	k2 (1/min)	0.0002	0.00005
	qe (mg/g)	0.822	0.557
	R <sup>2</sup>	0.8147	0.7556
Intraparticle diffusion model	Kid (mg/g min)	1.117	0.749
	B (mg/g)	1.634	0.953
	R <sup>2</sup>	0.7934	0.8207

**Table 1.5.** Parameters of kinetics fitting for  $\text{Pb}^{2+}$  adsorption on biochar

<b>Model</b>	<b>Parameter</b>	<b>H<sub>2</sub>O<sub>2</sub>-biochar</b>	<b>Biochar</b>
Pseudo-first order model	k1 (1/min)	0.0108	0.0073
	qe (mg/g)	45.078	57.386
	R <sup>2</sup>	0.641	0.6317
Pseudo-second order model	k2 (1/min)	0.0009	0.0003
	qe (mg/g)	0.798	0.780
	R <sup>2</sup>	0.7688	0.7667
Intraparticle diffusion model	Kid (mg/g min)	1.216	1.163
	B (mg/g)	3.158	2.190
	R <sup>2</sup>	0.7307	0.7422

**Table 1.6.** Parameters of kinetics fitting for  $\text{Zn}^{2+}$  adsorption on biochar

<b>Model</b>	<b>Parameter</b>	<b>H<sub>2</sub>O<sub>2</sub>-biochar</b>	<b>Biochar</b>
Pseudo-first order model	k1 (1/min)	0.0067	0.0029
	qe (mg/g)	58.114	78.712
	R <sup>2</sup>	0.6706	0.6359
Pseudo-second order model	k2 (1/min)	0.0002	0.00005
	qe (mg/g)	0.711	0.536
	R <sup>2</sup>	0.8349	0.6787
Intraparticle diffusion model	Kid (mg/g min)	1.08	0.772
	B (mg/g)	2.931	1.167
	R <sup>2</sup>	0.7635	0.8159