

## Supplementary material

# Removal of Metals by Biomass Derived Adsorbent in Its Granular and Powdered Forms: Adsorption Capacity and Kinetics Analysis

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### Zinc

Table S1: Parameters of the kinetic models for the S1-Zn system.

Model	Parameters	S1-Zn			
		Green Alga	Roots	Stems	Leaves
<b>Pseudo First Order</b>	$k_1$ (min <sup>-1</sup> )	-0.001	0.011	0.003	-0.001
	$q_e$ adj (mg g <sup>-1</sup> )	0.686	1.007	0.977	0.741
	$R^2$	0.514	0.634	0.284	0.285
<b>Weber e Morris</b>	$K_d$ (mg g <sup>-1</sup> min <sup>-1</sup> )	-0.059	0.079	0.069	-0.034
	C (mg g <sup>-1</sup> )	3.340	4.300	6.633	7.449
	$R^2$	0.642	0.878	0.220	0.281
<b>Elovich</b>	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.000	$8.965 \times 10^3$	$1.271 \times 10^5$	0.000
	$\beta$ (g mg <sup>-1</sup> )	-3.272	2.831	2.294	-6.484
	$R^2$	0.835	0.856	0.431	0.285

Table S2: Parameters of the kinetic models for the S2-Zn system.

Model	Parameters	S2-Zn				
		Initial zinc concentration (mg L <sup>-1</sup> )				
		2.13	21.04	51.98	61.91	104.54
<b>Pseudo First Order</b>	$k_1$ (min <sup>-1</sup> )	0.000	0.001	0.001	0.001	0.001
	$q_e$ adj (mg g <sup>-1</sup> )	0.016	0.140	0.505	0.788	2.976
	$R^2$	0.001	0.728	0.824	0.458	0.915
<b>Weber e Morris</b>	$K_d$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.000	0.004	0.013	0.022	0.059
	C (mg g <sup>-1</sup> )	0.019	0.671	1.443	1.151	0.058
	$R^2$	0.170	0.905	0.707	0.733	0.909
<b>Elovich</b>	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.025	$4.071 \times 10^2$	2.127	0.109	0.013
	$\beta$ (g mg <sup>-1</sup> )	$2.389 \times 10^2$	$1.962 \times 10^1$	4.714	2.858	1.168
	$R^2$	0.067	0.874	0.884	0.885	0.936

Table S3: Parameters of the kinetic models for the S3-Zn system

Model	Parameters	S3-Zn	
		Initial zinc concentration (mg L <sup>-1</sup> )	

		<b>2</b>	<b>5</b>	<b>98.1</b>
<b>Pseudo First Order</b>	$k_1$ (min <sup>-1</sup> )	0.001	0.002	0.002
	$q_e$ adj (mg g <sup>-1</sup> )	0.225	0.821	5.232
	$R^2$	0.243	0.815	0.871
<b>Weber e Morris</b>	$K_d$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.007	0.031	0.180
	C (mg g <sup>-1</sup> )	0.144	0.717	1.780
	$R^2$	0.400	0.799	0.840
<b>Elovich</b>	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.028	0.208	0.233
	$\beta$ (g mg <sup>-1</sup> )	$1.648 \times 10^1$	3.979	0.681
	$R^2$	0.466	0.868	0.923

### Copper

Table S4: Parameters of the kinetic models for the S1-Cu system

Model	Parameters	S1-Cu
	$k_1$ (min <sup>-1</sup> )	0.028
<b>Pseudo First Order</b>	$q_e$ adj (mg g <sup>-1</sup> )	4.248
	$R^2$	0.829
	$K_d$ (mg g <sup>-1</sup> min <sup>-1</sup> )	0.499
<b>Weber e Morris</b>	C (mg g <sup>-1</sup> )	$1.265 \times 10^2$
	$R^2$	0.889
	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	$3.971 \times 10^{31}$
<b>Elovich</b>	$\beta$ (g mg <sup>-1</sup> )	0.601
	$R^2$	0.934

Table S5: Parameters of the kinetic models for the S2-Cu system

Model	Parameters	S2-Cu	
		1	2
<b>Pseudo First Order</b>	$k^1$ (min <sup>-1</sup> )	0.070	0.005
	$q_e$ adj (mg g <sup>-1</sup> )	28.457	46.248
	$R^2$	0.717	0.433
<b>Weber e Morris</b>	$K_d$ (mg g <sup>-1</sup> min <sup>-1</sup> )	6.565	2.367
	C (mg g <sup>-1</sup> )	17.242	6.086
	$R^2$	0.691	0.698
<b>Elovich</b>	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	$2.403 \times 10^3$	$5.404 \times 10^2$
	$\beta$ (g mg <sup>-1</sup> )	0.177	0.465
	$R^2$	0.967	0.967

Table S6: Parameters of the kinetic models for the S3-Cu system

Model	Parameters	S3-Cu
<b>Pseudo First Order</b>	$k_1$ (min <sup>-1</sup> )	0.079
		0.262

	$q_e$ adj (mg g <sup>-1</sup> )	8.619	5.566
	R <sup>2</sup>	0.976	0.859
<b>Weber e Morris</b>	K <sub>d</sub> (mg g <sup>-1</sup> min <sup>-1</sup> )	1.054	1.296
	C (mg g <sup>-1</sup> )	4.560	6.796
	R <sup>2</sup>	0.698	0.439
<b>Elovich</b>	$\alpha$ (mg g <sup>-1</sup> min <sup>-1</sup> )	17.112	3.628×10 <sup>9</sup>
	$\beta$ (g mg <sup>-1</sup> )	0.473	1.922
	R <sup>2</sup>	0.880	0.815