

506 **Supplemental information**

507 Table S1: Kinetic parameters of Cd(II) and Cu(II) adsorption on PS and Na-PS.

	$q_{e.exp}$ (mg g ⁻¹)	Pseudo first order quation			Pseudo second order quation			Elovich model			
		q_f (mg g ⁻¹)	K_f (g mg ⁻¹ min ⁻¹)	R^2	q_s (m g ⁻¹)	K_s (g mg ⁻¹ min ⁻¹)	R^2	a	b	R^2	
Cd(II)	PS										
	1×10 ⁻³ M	2.65	2.7	0.85	0.98	2.67	-7.39	0.99	4865	5.52	0.38
	2×10 ⁻³ M	4.34	4.25	0.9	0.98	4.32	0.13	0.99	6132	3.44	0.43
	3×10 ⁻³ M	5.29	5.3	0.93	0.99	5.29	0.28	0.99	31190	3.05	0.42
	Na-PS										
	1×10 ⁻³ M	3.02	3.06	0.96	0.99	3.03	-5.57	0.99	29482	5.45	0.38
	2×10 ⁻³ M	4.79	4.79	0.89	0.97	4.8	0.24	0.99	7853	3.09	0.38
3×10 ⁻³ M	5.83	5.89	0.99	0.99	5.85	4.34	0.99	84368	2.9	0.41	
Cu(II)	PS										
	1×10 ⁻³ M	3.05	2.79	0.63	0.93	3.08	0.06	0.99	23.7	3.17	0.92
	2×10 ⁻³ M	5.3	4.83	0.52	0.95	5.34	0.03	0.99	19.2	1.66	0.87
	3×10 ⁻³ M	6.7	6.08	0.62	0.94	6.76	0.02	0.99	42.1	1.42	0.8
	Na-PS										
	1×10 ⁻³ M	3.08	3.06	0.96	0.99	3.11	0.09	0.99	981	4.45	0.93
	2×10 ⁻³ M	5.44	4.79	0.89	0.98	5.48	0.04	0.99	81.6	1.89	0.79
3×10 ⁻³ M	6.99	6.34	0.62	0.95	7.04	0.02	0.99	49.3	1.38	0.82	

508 Note: $q_{e.exp}$ is experimental data; PS means Pisha sandstone; Na-PS means Pisha sandstone modified with Na⁺.

Table S2: Isothermal parameters of Cd(II) and Cu(II) adsorption on PS and Na-PS.

Metal		$q_{e.exp}$ (mg g ⁻¹)	Langmuir model			Freundlich model			Temkin model		
			q_m (mg g ⁻¹)	K (dm ³ mg ⁻¹)	R^2	K_f	$1/n$	R^2	A (mg L ⁻¹)	B	R^2
Cd(II)	PS	11.97	12.79	0.01	0.96	0.46	0.50	0.99	19.59	0.51	0.83
	Na-PS	11.24	12.81	0.01	0.99	0.89	0.41	0.96	10.92	0.49	0.93
Cu(II)	PS	18.16	19.49	0.01	0.96	1.78	0.37	0.99	3.66	0.36	0.85
	Na-PS	19.58	21.37	0.01	0.95	1.93	0.38	0.96	1.90	0.34	0.80

509 Note: $q_{e.exp}$ is experimental data; PS means Pisha sandstone; Na-PS means Pisha sandstone modified with Na⁺.