

Sustainable magnetic cellulose–alginate beads for selective biosorption of Cd (II) and Ni (II) ions from contaminated waters

Corresponding author: Vinicius A. M. Gomes - Rodovia Celso Garcia Cid, Pr 445 Km 380, Campus Universitário. 86057-970- Londrina (PR) – Brazil, CP 10.01.

Orcid: <https://orcid.org/0000-0003-3583-1130>; Email: vinicius-augusto2011@live.com

SUPPLEMENTARY INFORMATION

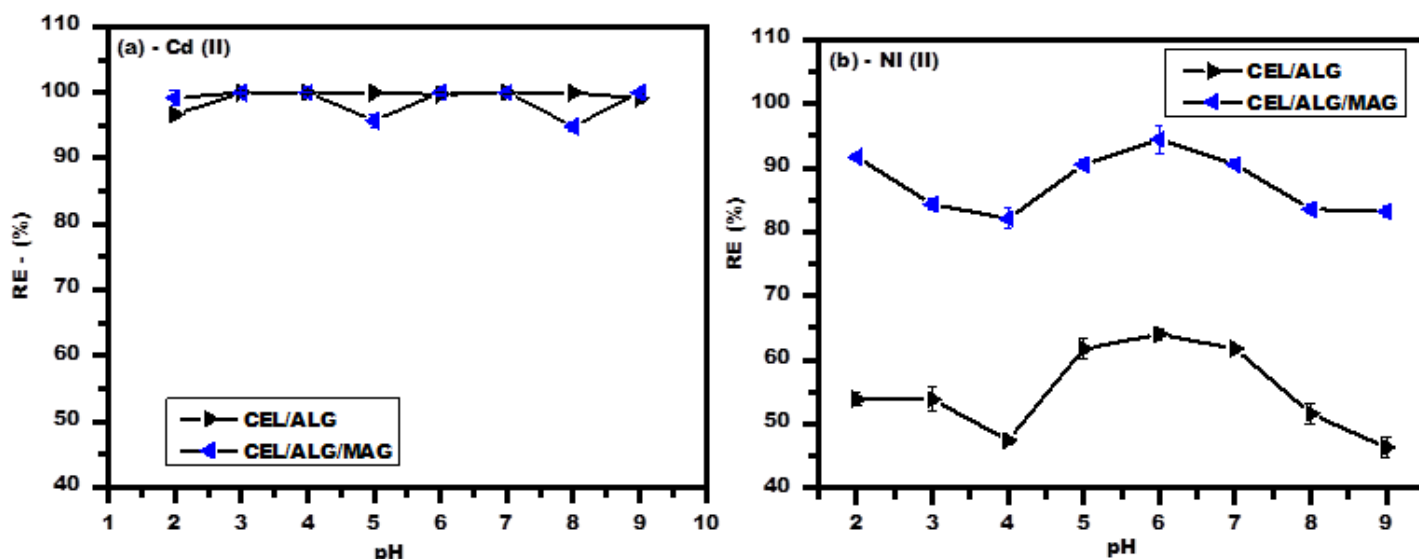


Fig. S11 (a) pH variation using 10 mL of Cd (II) solution (10 mg L⁻¹), contact time of 480 min at 22°C, and a mass of 0.2 g for CEL/ALG/MAG and 0.3 g for CEL/ALG. (b) pH variation using 10 mL of Ni (II) solution (5.22 mg L⁻¹), contact time of 480 minutes at 22°C, with 0.3 g of CEL/ALG and 0.4 g for CEL/ALG/MAG.

Table S11 pH variation of the metal ion solutions Cd (II) (10 mg L⁻¹) and Ni (II) (5.22 mg L⁻¹), using the adsorbents CEL/ALG/MAG (0.2 g for Cd (II) and 0.4 g for Ni (II)) and 0.3 g of CEL/ALG (for both metal ions), with a contact time of 480 min at 22°C.

Initial pH of metal ion solution	Cd (II)		Ni (II)	
	CEL/ALG – 0.3 g	CEL/ALG/MAG - 0.2 g	CEL/ALG – 0.3 g	CEL/ALG/MAG - 0.4 g
	RE (%)	RE (%)	RE (%)	RE (%)
2	96.65 ^c ± 0.74	99.18 ^{a,b} ± 2.02	53.87 ^b ± 1.84	91.65 ^a ± 0.46
3	100.00 ^{a,b} ± 0.77	100.00 ^a ± 0.29	53.87 ^b ± 3.19	84.32 ^{b,c} ± 1.60
4	100.00 ^{a,b} ± 0.39	100.00 ^a ± 1.56	47.47 ^b ± 1.06	82.07 ^c ± 2.76
5	100.00 ^{a,b} ± 0.18	95.73 ^{b,c} ± 1.63	61.76 ^a ± 2.76	90.53 ^{a,b} ± 1.38
6	99.69^{a,b} ± 0.74	100.00^a ± 0.49	64.02^a ± 1.60	94.47^a ± 3.68
7	100.00 ^a ± 0.47	100.00 ^a ± 0.68	61.65 ^a ± 0.16	90.53 ^{a,b} ± 1.38
8	100.00 ^{a,b} ± 0.20	94.87 ^c ± 1.25	51.61 ^b ± 2.73	83.57 ^{b,c} ± 1.41
9	99.09 ^b ± 1.14	100.00 ^a ± 0.35	46.32 ^b ± 2.66	83.19 ^c ± 1.60

RE - Removal efficiency. Mean values ± standard deviation. Superscript letters in the column refer to significant differences ($P < 0.05$) based on Tukey's test.

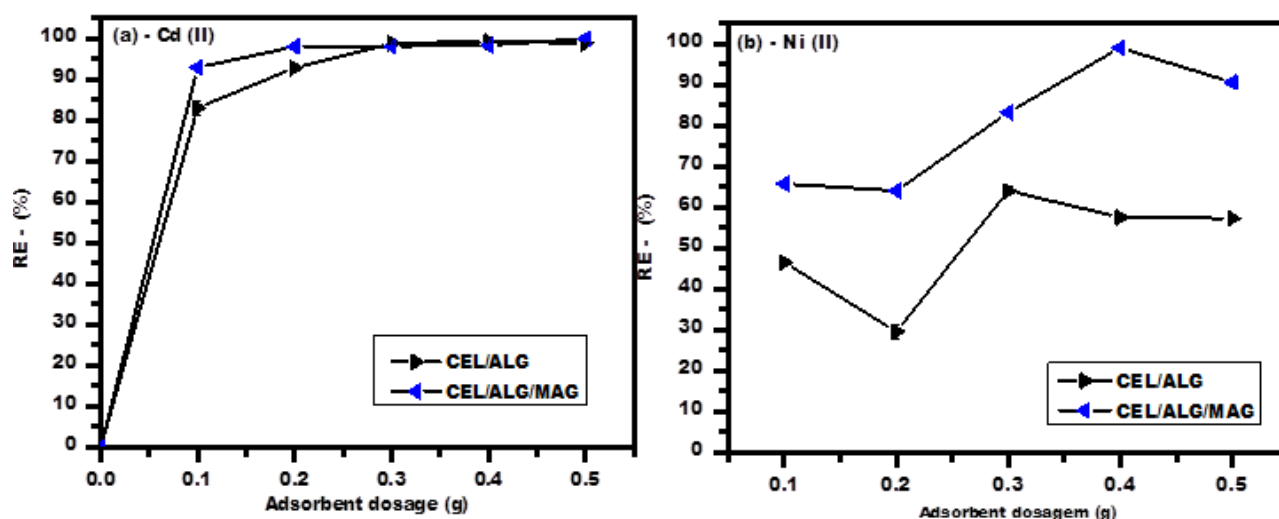


Fig. SI2 Variation of adsorbent dosage in the non-competitive adsorption of 10 mg L⁻¹ of Cd(II) (a) and 5.22 mg L⁻¹ of Ni(II) (b) at 22°C, contact time of 480 min, and without pH adjustment

Table SI2 Results obtained from the variation of the dosage of the produced adsorbents in the non-competitive sorption of Cd (II) (10 mg L⁻¹) and Ni(II) (5.22 mg L⁻¹), without pH adjustment and with a contact time of 480 min at 22°C.

Adsorbent mass (g)	RE (%) – 10 mL Cd(II) (10 mg L ⁻¹)		RE (%) – 10 mL Ni (II) (5.22 mg L ⁻¹)	
	CEL/ALG	CEL/ALG/MAG	CEL/ALG	CEL/ALG/MAG
0.1	83.00 ^c ± 3.02	92.86 ^b ± 0.57	45.53 ^c ± 1.38	65.71 ^d ± 0.46
0.2	92.77 ^b ± 0.53	97.97^a ± 0.63	29.62 ^d ± 3.22	64.02 ^d ± 0.92
0.3	98.79^a ± 0.29	98.05 ^a ± 0.41	64.02^a ± 1.60	83.19 ^c ± 0.92
0.4	99.19 ^a ± 0.14	98.32 ^a ± 0.12	57.53 ^b ± 1.15	98.98^a ± 0.16
0.5	98.85 ^a ± 0.30	99.33 ^a ± 0.74	57.25 ^b ± 0.92	90.53 ^b ± 1.38

RE - Removal efficiency. Mean values ± standard deviation. Superscript letters in the column refer to significant differences ($P < 0.05$) based on Tukey's test.