Separation Cd(II) and Ni(II) in binary solution by competitive adsorption combining with acid leaching experiments

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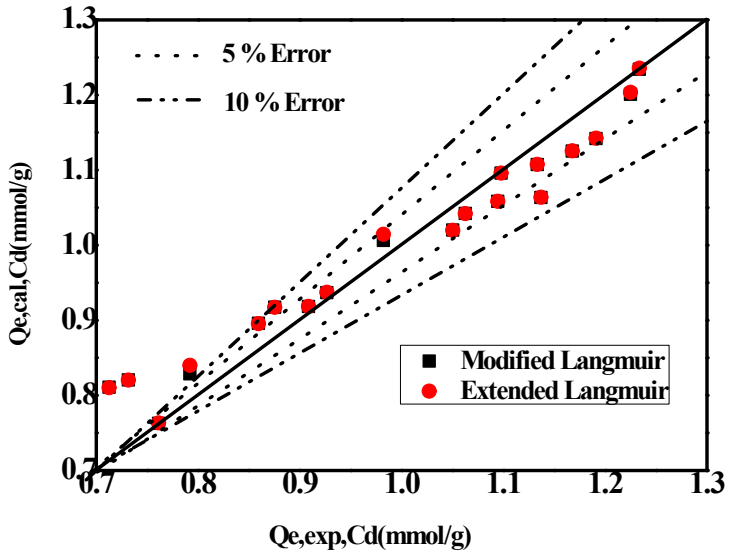

Fig.S1. Comparison of the experimental and calculated Q_e values of cadmium(II) ions in a binary mixture of Cadmium(II) and Nickel(II) ions

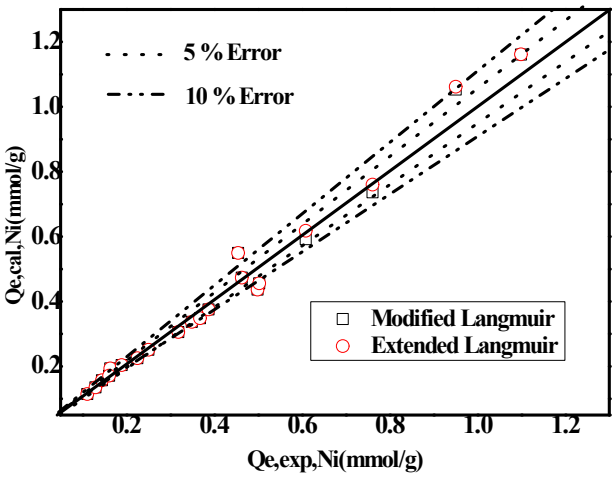

Fig.S2. Comparison of the experimental and calculated Q_e values of nickel (II) ions in a binary mixture of cadmium(II) and nickel(II) ions

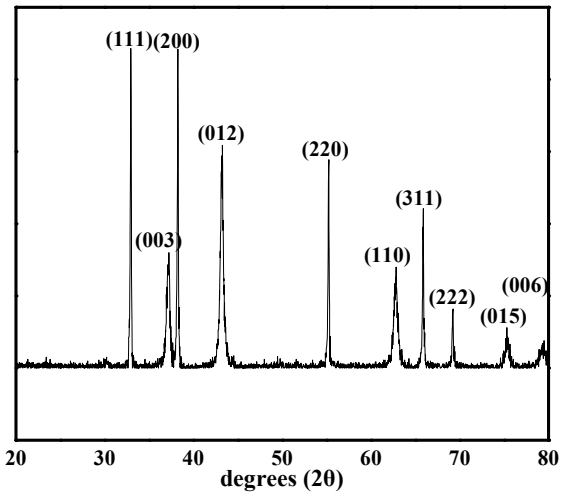

Fig.S3 The powder X-ray diffraction patterns of the mixture of the oxides of Cd(II) and Ni(II)

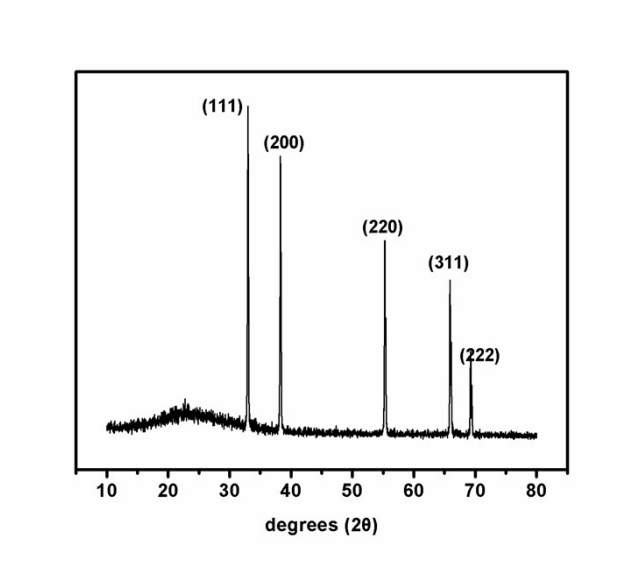

Fig. S4. The powder X-ray diffraction patterns of recovered cadmium oxide

Table S1 Adsorption isotherm parameters for Cd(II) and Ni(II) onto NaS-MS in single-component system (original pH 6.0, adsorbent dose = 1 g L^{-1}, T=303 K, t =1.5 h)

Component	Langmuir			Freundlich		
	Q_{max} (mmol/g)	K_L (L/mmol)	R^2	K_F[(mmol/g)(L /mmol)$^{1/n}$]	n	R^2
Cd(II)	1.25	216.05	0.99	1.64	6.17	0.81
Ni(II)	1.18	566.67	0.99	1.83	3.51	0.79

Table S2 Summary of the concentration of heavy metals during the separation process and the recovery of Cd(II)

(Original pH 4.0~6.0, adsorbent dose = 0.6 g L^{-1}, T=303 K, t =1.5 h)

Initial concentration		Molar ratio	Filtrate I		Filtrate II		Filtrate III		Light green solution		Filtrate IV		Recovery
C_{0Cd} (mg/L)	C_{0Ni} (mg/L)	C_{0Cd}/C_{0Ni}	C_{Cd} (mg/L)	C_{Ni} (mg/L)	C_{Cd} (mg/L)	C_{Ni} (mg/L)	C_{Cd} (mg/L)	C_{Ni} (mg/L)	C_{Cd} (mg/L)	C_{Ni} (mg/L)	C_{Cd} (mg/L)	C_{Ni} (mg/L)	of Cd(II)
1093.24	526.30	1.08/1	595.58	439.91	314.2	2.92	1.36	2.92	18.22	58.91	6.18	45.90	83 %
2186.50	526.30	2.16/1	1023.59	416.60	919.92	4.88	8.43	4.88	9.65	34.88	1.42	23.98	98.4 %
1093.24	1052.6	1/1.84	720.48	912.83	362.04	12.14	5.48	12.14	25.73	113.37	0.62	89.72	97 %
1093.24	1578.9	1/2.77	876.77	1392.44	274.34	10.33	3.30	10.33	13.77	180.54	0.31	154.1	94 %
1093.24	2105.2	1/3.69	873.15	1594.47	268.36	22.6	3.23	22.6	16.76	156.94	0.33	145.1	96 %