SUPPLEMENTARY MATERIAL

Ion-imprinted polymeric materials for selective adsorption of heavy metal ions from aqueous solution

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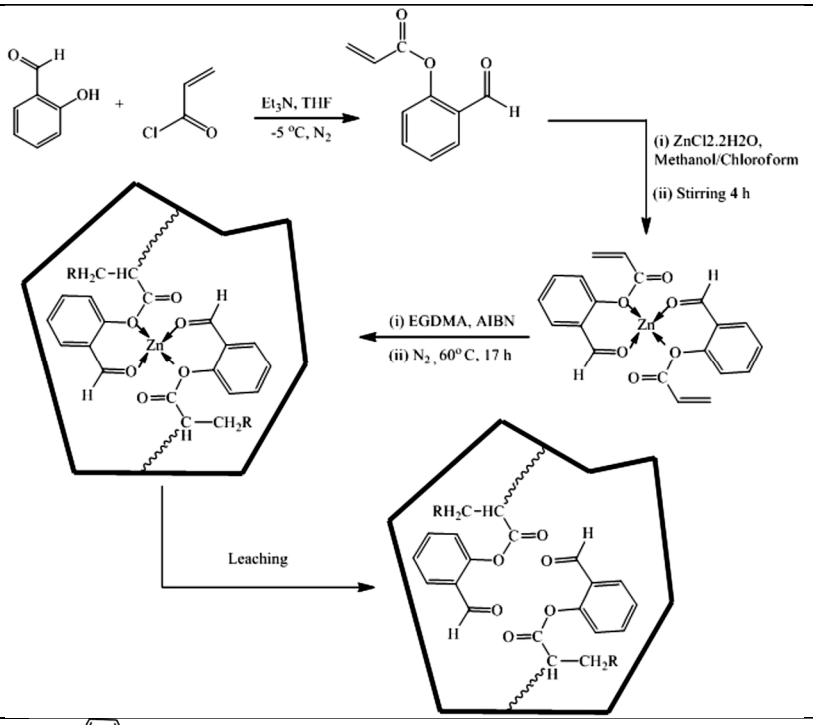
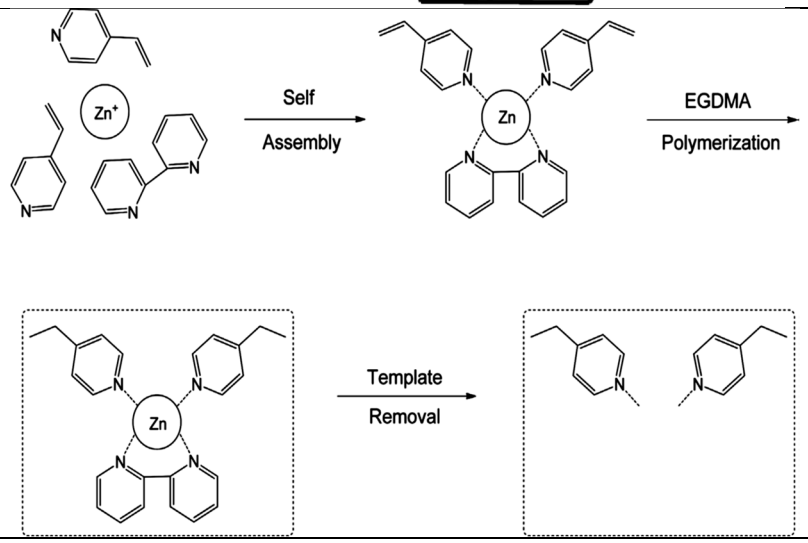
The number of references is the same as in the main text.

Table S1. Sorption of Zn(II) ions by IIPs.

Imprinted HMI	Polymeric material	q_m, mg/g	Comments	Ref. Sec. 3.5.
Zn(II)	1-VI-HEMA-EGDMA	5.29	Batch adsorption Conditions: pH 7.0; 298 K; 10 min Fitted by Langmuir/PSO Selectivity: k' of ZnIIP was: 22.57, 5.44 and 46.17 for Zn(II)/Cu(II), Zn(II)/Ni(II) and Zn(II)/Co(II) ion pairs	[84]
	Morin ligand MAA-*co*-EGDMA	45	Batch adsorption Conditions: pH 6.0; 1.2 g L^{-1}; 3 min Fitted by Langmuir Selectivity: k': 30.7, 23.9, 26.4, 42.6 and 26.8 with competitor ions Cu(II), Co(II), Ni(II), Pb(II) and Cd(II),	[85]
	2,2'-bipyridyl ligand 4-VP-*co*-EGDMA	13.77	Batch adsorption Conditions: pH 6.2 Reusability: 10 % decrease of the original sorption capacity after 10 repeated cycles. Selectivity coefficients for Zn(II)/Cu(II) and Zn(II)/Ni(II) were 8.52 and 52.	[90]
	Zincon ligand GO/magnetic CS cross-linked with GA modified with AA ST-EGDMA	71.4	Batch adsorption Conditions: pH 8.5; 0.2 g L^{-1}; 298 K; 120 min Fitted by Langmuir/PSO Reusability: regenerated up to nine cycles without loss of sorption capacity Determination of Zn(II) in various matrices.	[91]
	CS-MA cross-linked with EGDMA and TEOS	3.06	Batch adsorption Conditions: pH 7.0; 2 g L^{-1}; 298 K; 120 min Fitted by Langmuir/PSO	[92]
	CS/ATT/A-187	46.75	Batch adsorption Conditions: pH 6.0; 1 g L^{-1}; 298 K; 360 min Fitted by Langmuir/PSO	[93]

Abbreviations: AA - acrylic acid; ATT - attapulgite; A - 187-3-glycidoxypropyltrimethoxysilane; CS - chitosan; EGDMA - ethyleneglycol dimethacrylate; GO - graphene oxide; GA - glutaraldehyde; HEMA - 2-hydroxyethyl methacrylate; MAA - methacrylic acid; MA - methacrylamide; ST - styrene; TEOS - tetraethylortosilicate; 1-VI - 1-vinylimidazole; 4-VP - 4-vinylpyridine.

Table S2. Zn(II) Imprinted Polymeric Solid Phase Extractors.

Complexing Reagent	Zn(II) Imprinted Polymeric Solid Phase Extractors	Refs.
Salicylic acrylate		[87]
2,2′-Bipyridyl/4-VP		[90]

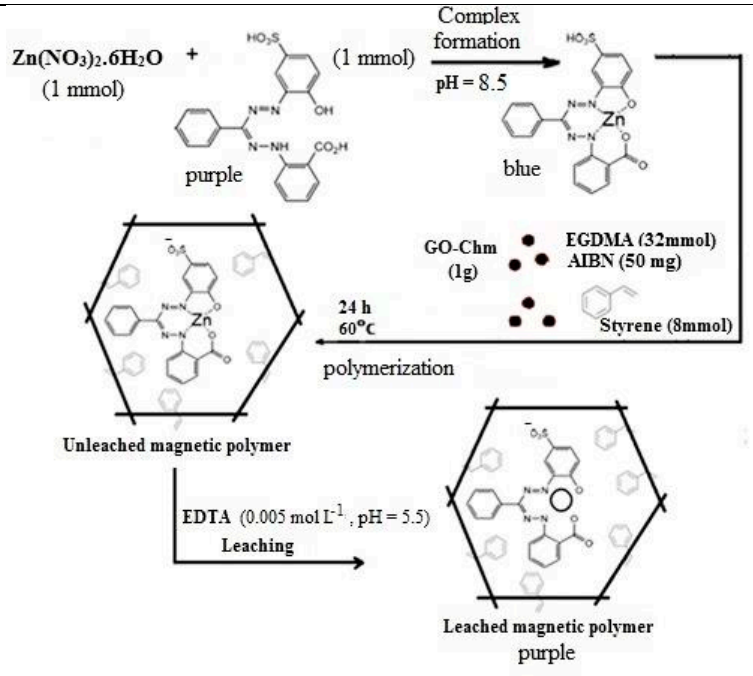
Zn(II) complexed with zincon-IIP grafted on GO/magnetic CS nanocomposite		[91]

Table S3. Selective extraction of Co(II) ions.

Template ions	Polymeric material	pH	Contact time, min	q_m, mg/g	Interfering ions	k	Remarks on adsorption process	Ref.
Co(II)	P(MAA)/DPA composites		20	15.39	Ni(II) Fe(III) Mg(II)	18.46 13.77 30.11	Batch adsorption; Reusability: 7 cycles	[95]
Co(II)	P(4-VP)/DPA composites		30	14.04	Ni(II) Fe(III) Mg(II)	9.39 38.53 10.41	Batch adsorption; Reusability: 7 cycles	[95]
Co(II)	Fe_3O_4/SiO_2/P(1-VI) composites	7	180	23.09	Cu(II) Cd(II) Zn(II) Pb(II)	19.99 50.28 11.02 7.56	Batch adsorption; Fitting: Langmuir/PSO; Reusability: 4 cycles	[96]
Co(II)	P(AAPTS)/Fe_3O_4@TiO_2@SiO_2 composites	8	30	35.21	Pb(II) Ni(II) Cd(II)	41.17 79.74 56.48	Batch adsorption; Fitting: Langmuir; Reusability: 7 cycles	[97]
Co(II)	P(B2MP-*co*-GG)/Fe_3O_4 composites	8	20	33.4	Fe(II) Cu(II) Mg(II) Zn(II) Ni(II)	5.25 4.05 6.06 11.81 4.48	Batch adsorption; Fitting: Langmuir/PSO; Reusability: 6 cycles	[98]

Co(II)	8-HQ/γ-Fe_2O_3-CS biocomposites	8	10	100	Cd(II) Ni(II) Pb(II)	11 42 2	Batch adsorption; Fitting: Langmuir/PSO; Reusability: 3 cycles	[99]
Co(II)	CS/zeolite composite cryo-beads	4	1440	120.4–126.6	Cu(II) Ni(II) Cd(II) Fe(III)	9.543 6.660 20.320 225.391	Batch adsorption; Fitting: Sips and Double Langmuir; Reusability: 5 cycles	[100]
Co(II)	CS/zeolite composite cryo-beads	6	1440	86.2–102.3	Cu(II) Ni(II) Cd(II) Fe(III)	1.589 1.087 2.025 14.692	Batch adsorption; Fitting: Sips and Double Langmuir; Reusability: 5 cycles	[100]

Abbreviations: PMMA – *N*-(pyrrolidin-2-ylmethyl) methacrylamide; AAPTS – 3-(2-aminoethylamino) propyltrimethoxysilane; B2MP – bis(2-methacryloxyethyl) phosphate; GG – glycylglycine; 8 - HQ–8-hydroxyquinoline; DPA – dipicolinic acid.

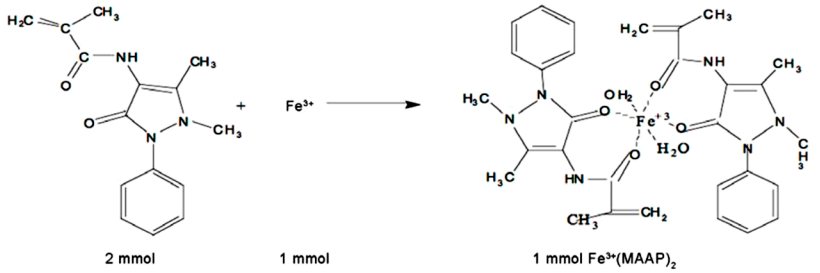
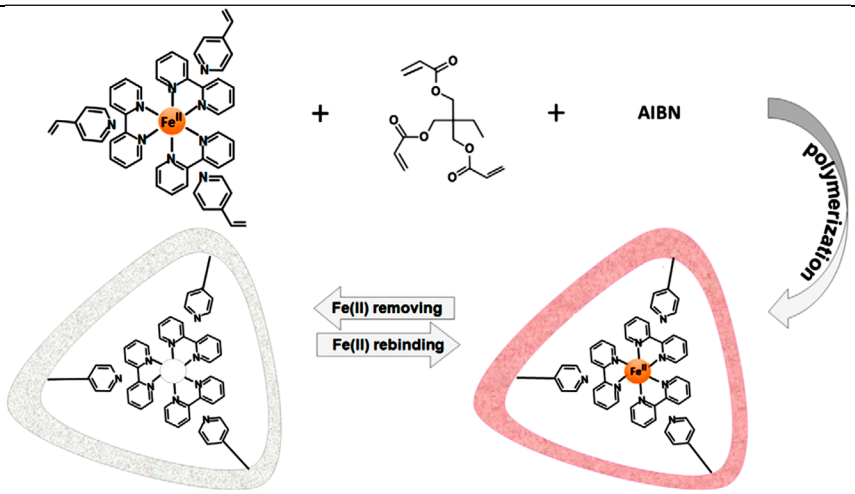
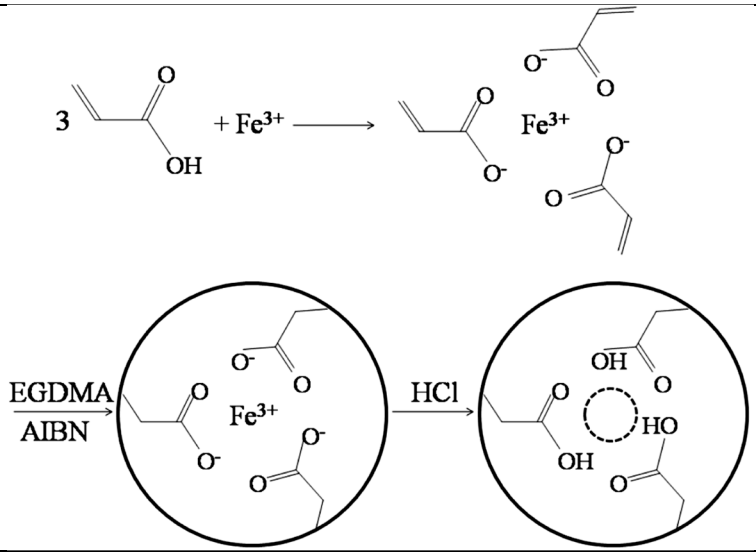
Table S4. Selective extraction of Fe(III).

Template ions	**Polymeric material**	**pH**	**Contact time, min**	**q_m, mg/g**	**Interfering ions**	***k***	***k′***	**Remarks on adsorption process**	**Ref.**
Fe(III)	HEMA+EGDMA +MAC- Fe^{3+} (HEMAC-Fe^{3+}) (monolith)	5.0		0.92	Fe(II) Cd(II) Ni(II)		24.8 37 59.7	Column adsorption; flow rate 0.5 mL min-1 Fitted by Langmuir	[114]
Fe(III)	MAAP-Fe^{3+}-NIPAAm	4.0	30	14.23	Ni(II) Co(II) Mn(II) Zn(II) Al(III) Cu(II)		83.4 66.4 62.5 41.2 16.3 14.8	Batch adsorption Fitted by Langmuir	[115]
Fe(III)	(DHBPT)2-Fe(III) +MAA+EGDMA	4.5	15	40.41	Mn(II) Cd(II) Cu(II) Pb(II) Zn(II) Ni(II) Al(III) Cr(III) Fe(II)		2.98 2.36 1.61 1.64 1.71 2.66 2.4 3.5 2.49	Batch adsorption Reusability: sorption capacity loss of 3% at the end of the 6 sorption/desorption cycle	[116]
Fe(III)	2,2′-bipyridyl-Fe(II) complex	7.0	30	1.58	Mn(II) Pb(II)		19.5 67.5	Batch adsorption Fitted by Langmuir	[119]

	4-VP-TMPTMA								
Fe(III)	AA-Fe(III) + EGDMA	3.5		114.25	Cr(III)	492.18	50.87	Batch adsorption Fitted by Langmuir/PSO	[120]
Fe(III)	BMAOP-Fe(III) + EGDMA	2.0	180	15.71	Cr(III) Co(II) Ni(II) Cu(II) Zn(II)	701 6926 1302 1171 2726	2.44 4.38 4.17 1.78 4.15	Batch adsorption Fitted by Freundlich/PSO Reusability: no obvious decrease of the sorption capacity after six cycles.	[121]
Fe(III)	Fe(III)-P(HEMA-MAGA) +EGDMA	4.0	60	204.8	Cd(II) Co(II) Cr(III) Ni(II) Pb(II) Zn(II) Mn(II)		196.5 241.2 218.3 191.5 164.7 147.2 252.8	Batch adsorption	[123]
Fe(III)	Fe(III)-P(HEMA-MAGA) +EGDMA	2.5	60	83.33	Zn(II) Cr(III) Al(III)		8.85 4.91 6.29	Batch adsorption Fitted by Langmuir/PSO Reusability: preservation of removal capacity up to 97.13% after ten cycles	[124]

Abbreviations: BMAOP – bis(2-methacryloxyethyl)phosphate; DHBPT - 3,6-bis (3,5-dimethyl-1-H-pyrzol-1-yl)-1,2-dihydro-1,2,4,5-tetrazine); MAAP - methacryloylaminoantipyrine; MAC - N-methacryloyl-(L)-cysteine methyl ester; MAGA - N-methacryloyl-(L)-glutamic acid; MMA - methyl methacrylate; NIPAAm - N-isopropyl acrylamide; TMPTMA - trimethylolpropane trimethacrylate.

Table S5. Fe(III) Imprinted Polymeric Solid Phase Extractors.

Complexing Reagent	Fe(III) Imprinted Polymeric Solid Phase Extractors	Refs.
Methacryloyl antipyrine		[115]
2,2′-bipyridyl		[119]
AA		[120]

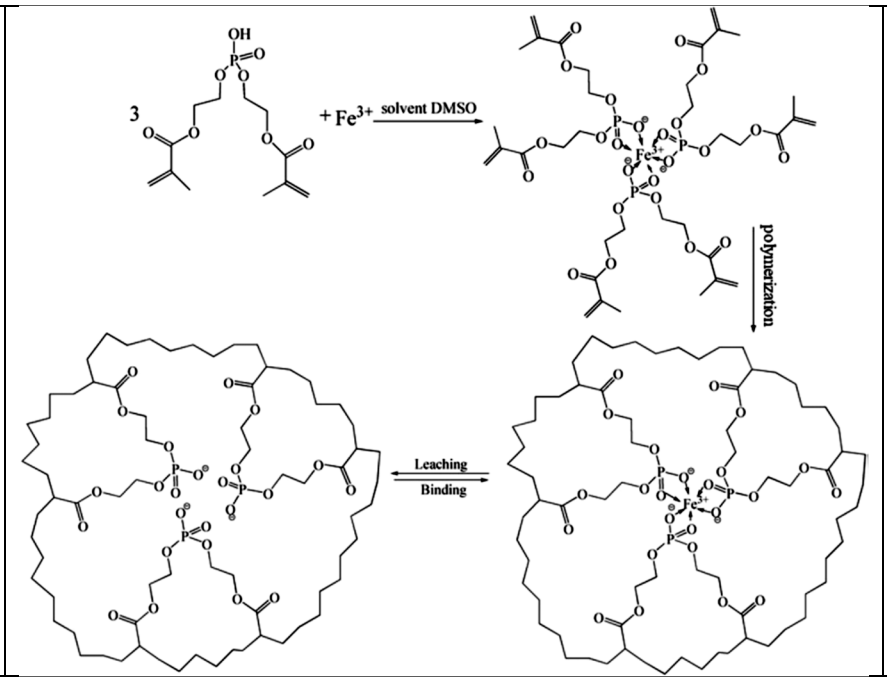
Bis(2-methacryloxyethyl) phosphate		[121]

Table S6. Selective extraction of Hg(II).

Template ions	Polymeric material	pH	Contact time, min	q_m, mg/g	Interfering ions	k	k'	Remarks on adsorption process	Ref.
Hg(II)	Ligand-1-(2-thiazolylazo)-2-naphtol MAA-TMPTMA microbeads	7.0	15	6.42	Cu(II) Ni(II) Co(II) Pb(II) Cd(II) Zn(II) $CH_3Hg(I)$	113.9 233.3 376.9 73.1 132.4 445.5 1633		Batch sorption;	[125]
Hg(II)	Ligand-1-pyrrolidinedithiocarboxylic acid MAA-TMPTMA nanoparticles	7.0	30	12.84	Cd(II) Cu(II) Fe(III) Mn(II) Ni(II) Pb(II) Zn(II) $CH_3Hg(I)$		143 450 400 695 776 330 860 1100	Batch sorption; Fitted by Langmuir/PSO Reusability: 5% lower sorption capacity after 100 cycles	[127]
Hg(II)	Dithizone/Hg(II) complex APTES-TEOSI	7.0	80	4.45	Zn(II) Cd(II) Pb(II) MeHg(I) EtHg(I)	33.54 26.63 22.09 19.06 21.56		Batch sorption; Fitted by Langmuir/PSO Reusability: 5% loss of the sorption capacity after ten sorption/desorption	[128]

								cycles	
Hg(II)	PB-CS	5.0	80	315	Pb(II) Co(II) Zn(II) Cu(II) Cd(II)		17,87 14.4 12.45 15.37 16.07	Batch sorption; Fitted by Langmuir/PSO Reusability: > 95% of the initial sorption capacity after five sorption/desorption cycles	[132]
MeHg(I)	MBT-MeHg(I) complex + AA-EGDMA	8.0		0.457	Hg(II) Cd(II) Pb(II) Zn(II)		0.86 260 288 1510	Batch sorption; Fitted by Freundlich/PSO	[136]

Abbreviations: APTES - 3-aminopropyltriethoxysilane; MBT - 2-mercaptobenzothiazole; PB - ligand Schiff base prepared from 4-amino-3-hydroxybenzoic acid and 2-pyridinecarboxaldehyde; RT - room temperature; TEOSI - triethoxysilane.

Table S7. Selective extraction of Cr(III) and Cr(VI).

Imprinted HMI	Polymeric material	q_m, mg/g	Comments	Ref.
Cr(III)	APTES as silane coupling agent; Cr(III)-IIP prepared by sol–gel reaction coupled with surface imprinting on the surface of mesoporous SBA-15.	38.5	Batch adsorption; Conditions: pH 6.0; 298 K; 120 min. Fitted by Langmuir/PSO; Selective adsorption of Cr(III) in competition with: Co(II), Cr(VI), Sr(II), Zn(II), Cu(II), Pb(II), Ni(II), in binary systems.	[137]
	Cr(III)-(phen)$_2$/(ST+EGDMA), acetonitrile as porogen		Dynamic adsorption; Conditions: pH 4.5; 298 K; flow rate 1 mL min^{-1} Reusability: 100 cycles Selectivity coefficient in competition with Fe(III), Mn(II) and Cu(II): 9.6; 4.4; 16.7, respectively.	[139]
	Azo dye functionalized CS cross-linked with glyoxal	250	Batch adsorption; Conditions: pH 5.0; 303 K; 1 g L^{-1}; 180 min. Fitted by Langmuir/PSO; Reusability: 96% of original capacity after fifth cycle Selective adsorption of Cr(III) in competition with: Cu(II), Ni(II), Co(II),	[141]

			Fe(III), Eu(III), Al(III), in binary systems	
	ALG/PVA/ALG-AuNPs membrane	1.75	Batch adsorption; Conditions: pH 6.0; 313 K; 20 h. Fitted by Langmuir/PFO; Reusability: four sorption/desorption cycles Selectivity: high selectivity towards Cr(III) in presence of Cr(VI): sorption: > 97%/<5%	[142]
Cr(VI)	4-VP-DMAEMA-EGDMA	286.56	Batch adsorption; Conditions: pH 2.0; 298 K; 1 g L^{-1}; 10 min. Fitted by Langmuir/PSO; Reusability: 5% decrease of the sorption capacity at the end of the fifth cycle Selectivity constant in the presence of Cu(II), Cd(II) and Cr(III): 135.78; 145.44; 69.91	[143]
	Quaternary PP-*g*-DMAEMA fibers	156.5	Batch adsorption; Conditions: pH 2.0; 298 K; 3 g L^{-1}; 240 min. Fitted by Freundlich/PSO; Reusability: small decrease of the original sorption capacity after five sorption/desorption cycles Selectivity for $Cr_2O_7^{2-}$ in competition with HPO_4^{2-}, NO_3^-, SO_4^{2-}, with k' of 36.7, 39.9 and 1.46, respectively.	[144]
	Pebax/CS/GO/APTES nanofibers	521.7	Batch adsorption; Conditions: pH 3.0; 298 K; 0.5 g L^{-1}; 120 min. Fitted by Redlich-Peterson/PSO; Relative selectivity in respect with: Pb(II), Cu(II) and Ni(II) has been 11.53, 13.86 and 16.86, respectively.	[145]
	PP fibers-*g*-AA, amidated with TETA cross-linked with GA	167	Batch adsorption; Conditions: pH 3.0; 303 K; 60 min. Fitted by Freundlich/PSO; Reusability: adsorption capacity towards Cr(VI) was > 82% after 10 sorption/desorption cycles	[148]
	Pre-complex (Cr(VI)+4-VP) + (Fe_3O_4/SiO_2) + (HEMA+EGDMA)	44.86	Batch adsorption; Conditions: pH 3.0; 298 K; sorbent dose: 1.7 g L^{-1}; 20 min. Fitted by Langmuir/PSO;	[149]

			Reusability: no loss of the sorption capacity after five cycles Relative selectivity in respect with Ni(II), Cd(II), Cu(II), NO_3^-, SO_4^{2-} and PO_4^{3-}: 4.89, 3.29, 4.06, 2.95, 2.2; 2.45, respectively.	
	4-VP-*co*-EGDMA	3.28	Batch adsorption; Conditions:pH 2.0; 3.2 g L^{-1}; 313 K; 30 min. Fitted by Freundlich/PSO; Reusability: good stability after 10 cycles	[151]
	1-VI-*co*-MAA-*co*-EGDMA	76.92	Batch adsorption; Conditions: pH 2.0; 10 g L^{-1}; 323 K; 15 min. Fitted by Langmuir/PSO; Reusability: sorption capacity decreased with 1.87% at the end of tenth cycle.	[153]
	CMC/ECH/EDA	177.62	Batch adsorption; Conditions: pH 2.0; 1 g L^{-1}; 298 K; 120 min. Fitted by Langmuir/PSO; Reusability: almost no decrease of the sorption capacity after the fifth cycle of adsorption/desorption	[154]

Abbreviations: DMAEMA - 2-(dimethylamino)ethyl methacrylate; CMC - carboxymethylcellulose; EDA - ethylene diamine; phen - 1,10-phenantroline; NPs – nanoparticles; PP - polypropylene; ALG - alginate.

Table S8. Sorption of other transition metal ions by IIPs.

Imprinted TMI	Polymeric material	q_m, mg/g	Comments	Ref.
Mn(II)	MAA-*co*-MBAA On the surface of MWCNT	-	Batch adsorption Conditions: pH 5.0; RT; 100 min Fitted by Langmuir/PSO Reusability: low decrease of the sorption capacity after five cycles. Selectivity: the adsorption capacity decreased in the order: Mn(II) > Cr(III) > Fe(II) > Co(II); detection limit of Pt/MWCNT-IIP for Mn(II) was 0.0138 mM	[158]
Mo((VI)	Mo (VI)-ICTGBs	~300	Batch adsorption Conditions: pH 6.0; 2 g L^{-1}; RT; 500 min Fitted by Freundlich/PSO	[159]

			Reusability: reused up to 10 times with 300 mg g^{-1} > Q > 250 mg g^{-1} Selectivity for Mo(VI) in the presence of Cr(VI), As(V), V(VI)	
	MAA-*co*-EGDMA Fe_3O_4/SiO_2	31.08	Batch adsorption Conditions: 1 g L^{-1}; 3 M HCl; 298 K; 120 min Fitted by Langmuir/PSO Reusability: can be reused at least 5 times without significant loss of adsorption capacity. Selectivity: k' for Mo(VI) in the presence of Ni(II), Cd(II), Mn(II), Zn(II) and Cu(II) were 10.08, 7.11, 5.12, 11.31, and 7.88, respectively.	[160]
	ALG-cl-GA With PVA as thickener	114.4	Batch adsorption Conditions: 2 g L^{-1}; pH 3; 303 K; 72 h Fitted by Langmuir/PSO Reusability: reused up to three cycles. Selectivity at pH 3: k' = 2.43-3.71, for Re(VII), Cu(II), Fe(III), Zn(II) and Mn(II), and 47.16 for Mo(VI).	[161]
Re(VII)	I-EDA-CS	418.98	Batch adsorption Conditions: 1 g L^{-1}; pH 3; 303 K Fitted by Langmuir/PSO Reusability: almost no loss of the sorption capacity after six cycles Selectivity for Re(VII) in the presence of Cu(II), Zn(II), Fe(III), and Mn(II), at pH 3.0: 1.4, 1.51, 3.46, and 1.83.	[162]
	I-CTS-KIT-6	368.8	Batch adsorption Conditions: 1 g L^{-1}; pH 3.0; 303 K Fitted by Langmuir/PSO Reusability: the sorbent preserved its capacity after six sorption-desorption cycles. Selectivity: the adsorption efficiency for Zn(II), Cu(II), Mn(II) and Fe(III) in the presence of Re(VII) was < 5%.	[163]
Ru(III)	Ru(III)-BnTSn complex 4-VP-*co*-ST-*co*-DVB	0.237	Column adsorption Conditions: pH 8,0; flow rate 0.2 mL min^{-1}; Selectivity in the presence of Pt(IV), Pd(II), Rh(II), Co(II) as competitors: k values in the range 5.4-12.5	[165]

	P(MMA-HEMA) blended with PVDF	42.31	Batch adsorption Conditions: 1 g L^{-1}; pH 2.0; 298 K; 2 h Fitted by Langmuir/PSO Reusability: sorption capacity was 40.25 mg g^{-1} after 8 cycles Selectivity: k' was 4.14 in the presence of Ni(II) as interfering ion	[167]
	Ru-PTCS	249	Batch adsorption Conditions: 1 g L^{-1}; pH 4; 303 K; 180 min Fitted by Langmuir/PSO Reusability: 96% of sorption capacity after 8 sorption-desorption cycles Selectivity: in multicomponent systems with Pd(II), Pt(IV), Co(II), Fe(III), Ni(II), Cu(II), Mn(II), Zn(II), Ca(II) as competitors: k values in the range 5.47-12.37; k' values > 6.	[168]
	Ru-IIP PDEA-*b*-P(DEA-*co*-AM) in P(AM-*co*-MBAA)	15.46	Batch adsorption Conditions: 5 g L^{-1}; pH 1.5; 308 K; 300 min Fitted by Langmuir/PFO Reusability: sorption capacity slightly decreased in the first 8 cycles, and significantly in the later three cycles. Selectivity: *k'* values of Ru(III)/Ni(II), Ru(III)/Fe(III) and Ru(III)/Cu(II) systems were 3.102, 2.738 and 3.032.	[169]

Abbreviations: AAm - acrylamide; BnTSn - benzaldehyde thiosemicarbazone; cl - cross-linked; DEA - N,N-diethylacrylamide; DVB - divinylbenzene; EDA - ethylene diamine; ICTGBs - ion imprinted chitosan gel beads; MBAAm - N,N'-methylene-bis-acrylamide; MWCNTs - multiwalled carbon nanotube; PVA - poly(vinyl alcohol); PVDF - polyvinylidene fluoride; Ru-PTCS - 2-pyridylthiourea-chitosan imprinted with Ru(III); TEA - triethanol amine.

Table S9. Selective sorption of Ag(I), Au(III) and Pd(II) ions by IIP materials.

Imprinted HMI	**Polymeric material**	**q_m, mg/g**	**Comments**	**Ref.**
Ag(I)	CS hydrogels	≈ 120	Batch adsorption; Conditions: pH 5.6; 298 K; 4h; Selectivity coefficient (k): Cu(II) = 4.21	[170]
	CS/TEA hydrogel beads	510	Batch adsorption; Conditions: pH 5, 298 K, 1h for the CS/TEA hydrogel and 10h for the CS/TEA gel beads; Selectivity coefficients (k): CS/TEA hydrogel beads: Cu(II) = 3.72; Pb(II) = 28.56; Zn(II) = 30.64;	[173]
	CS/TEA gel beads	350		

			CS/TEA gel beads: Cu(II) = 3.95; Pb(II) = 39.4; Zn(II) = 37.9; Reusability: 20 cycles	
	CS gel beads	89.2	Batch adsorption; Conditions: pH 5, 298K, 48h; Fitting: Langmuir/IPD; Selective for Ag(I) over Cu(II); Sorption of Ag(I) proceeds by ion exchange from pH 1 to pH 3, and by complexation from pH 3 to pH 5.	[171]
	CS-P(DVB-GMA-ST) particles	166	Batch adsorption; Conditions: pH 5, 318 K, 8h; Fitting: Langmuir/PSO; Relative selectivity coefficients (k'): Cu(II) = 3.67-4.72, Zn(II) = 4.07-6.22	[172]
Au(III)	Ethylenediamine N-(2-(1-imidazolyl)ethyl-modified CS resin	810.67	Batch adsorption; Conditions: pH 3; Fitting: Langmuir/PSO; Relative selectivity coefficients (k'): Cu(II) = 4.263; Ni(II) = 3.405 Regenerated with 0.7 M TU – 2 M HCl solution; Reusability: 5 cycles (95%).	[174]
	Poly(ethylene glycol) diacrylate cross-linked (4-Acryloylmorpholine)-*co*-(2-hydroxyethyl acrylate) hydrogel	78.43	Batch adsorption; Conditions: pH 1, 3h; Relative selectivity factors (α_r): Fe(III) = 50378, Hg(II) = 72588, Zn(II) = 40381. Reusability: 5 cycles; Regenerated with 0.8 M TU – 2 M HCl solution	[175]
	TU-functionalized ALG beads	184.82	Batch adsorption; Conditions: pH < 2.36, 323 K, 6h; Fitting: Freundlich/PFO, PSO; Selective for Au(III) in mixture with Cu(II), Co(II), Ni(II) and Pb(II); Reusability: 5 cycles; UV light induced the photo-reduction of Au(III) ions to Au NPs.	[176]
	2-mercaptobenzaldehyde-CS sorbent		Batch adsorption; Conditions: pH 4, 303 K, 1h; Fitting: Langmuir; Relative selectivity coefficients (k'): Cu(II) = 4.51, Ni(II) = 3.57, Cr(III) = 4.47, Pd(II) 5.13; Regeneration with 0.5 M TU + 1 M H_2SO_4; Reusability: 7 cycles (≈ 95%).	[177]
Pd(II)	CS fibers	150.3	Batch adsorption; Mixtures; Conditions: pH 1, 298 K;	[178]

			Selective for Pd(II) in mixture with Co(II), Ni(II) and Pt(IV); Reusability: 5 cycles	
	CS fibers	326.4	Batch adsorption; Conditions: pH 1, 298 K, 1h, 0.4 g/L sorbent dose; Fitting: Freundlich/PSO; Selectivity coefficients (k): Pt(IV) = 2082 at pH 1, 29.12 at pH 2, and 5.48 at pH 3; Reusability: 3 cycles (95.6%)	[179]
	CS fibers	112.4	Batch/Column adsorption; Mixture; Conditions: pH 1, 298 K; Selective for Pd(II) in mixture with Co(II), Ni(II), Cu(II) and Pt(IV); Selective recovery of Pd(II) in packed columns from extremely acid (pH 0.2) hydrometallurgy wastewater.	[180]
	2-Aminobenzaldehyde-CS resin	275	Batch adsorption; Conditions: pH 5, 303K, 1h, 1 g/L sorbent dose; Fitting: Langmuir/PSO; Relative selectivity coefficients (k'): Cu(II) = 1.97, Ni(II) = 1.88, Co(II) = 2.05, Mn(II) = 2.47; Reusability: 5 cycles (96% recovery).	[181]

Abbreviations: TU – thiourea; P(DVB–GMA–St) – poly(divinylbenzene–glycidyl methacrylate–styrene); ECH – epichlorohydrin.

Table S10. Sorption of Ga(III), In(III) and Pb(II) ions by IIP materials.

Imprinted HMI	Polymeric material	q_m, mg/g	Comments	Ref.
Ga(III)	AA-*g*-CS bio-adsorbent	192.4	Batch adsorption; Conditions: pH 3, 323 K; Fitting: Langmuir/PSO; Selective for Ga(III) in binary mixtures with Si(IV), Ge(III), Zn(II) or Al(III); Reusability: 6 cycles (90.25%)	[204]
In(III)	PVPA-*g*-silica gel composite	45.07	Batch and column adsorption; Conditions: pH 3, 298 K, 10 min; Fitting: Langmuir/PSO; Selectivity coefficients: In(III)/Cu(II) = 189.17, In(III)/Pb(II) = 67.94, In(III)/Zn(II) = 886.63, In(III)/FeII) = 2479.71. Reusability: 6 cycles (in column); Column adsorption capacity: 34.57 mg/g (flow rate = 0.5 mL/min); Tested on real mining wastewater.	[205]

	P(VPA-AMT)-*g*-silica gel composite	60.62	Batch and column adsorption; Conditions: pH 3, 318 K, 16 min; Fitting: Langmuir/PSO; Selectivity coefficients: In(III)/Cu(II) = 41, In(III)/Pb(II) = 212, In(III)/Zn(II) =37, In(III)/Fe(II) = 69; Column adsorption capacity: 48.75 mg/g (flow rate = 0.5 mL/min); Reusability: 6 cycles (in column); Tested on real mining wastewater.	[206]
Pb(II)	Dithiocarbamate-CS beads	359.68	Batch adsorption; Conditions: pH 6, 303 K, 3h; Fitting: Langmuir/PSO; Relative selectivity coefficients: Pb(II)/Cd(II) = 5.08, Pb(II)/Cu(II) = 2.45, Pb(II)/Ca(II) = 3.25, Pb(II)/Mg(II) = 4.24, Pb(II)/Zn(II) = 3.20; Reusability: 10 cycles (75% recovery)	[210]
	TEPA-CS beads	259.68	Batch adsorption; Conditions: pH6, 313K, 8h; Fitting: Langmuir/PSO; Relative selectivity coefficients: Pb(II)/Cd(II) 2.17, Pb(II)/Cu(II) = 5.08, Pb(II)/Ca(II) 2.18, Pb(II)/Mg(II) = 2.29, and Pb(II)/Zn(II) = 15.41; Reusability: 10 cycles (84% recovery)	[211]
	P(MAA-EGDMA)-*g*-CS IPN hydrogel	37.5	Batch/column adsorption; Conditions: pH 6, 2h; Fitting: Langmuir/PSO; Selectivity coefficients: Pb(II)/W(VI) = 161.58, Pb(II)/Zn(II) = 31.00, Pb(II)/Cu(II) = 39.12; Pb(II)/Mn(II) = 52.75; Pb(II)/K(I) = 77.58; Pb(II)/Mg(II) = 44.98; Tested in column for selective extraction of Pb(II) from PCB recycling unit wastewater; Reusability: 5 cycles (using PCB recycling unit wastewater).	[207]
	Fe_3O_4-CS biosorbent	69.48	Batch adsorption; Conditions: pH 5, 8h; Relative selectivity coefficients: Pb(II)/Cu(II) = 2.32, Pb(II)/Cd(II) = 2.2, Pb(II)/Ni(II) = 2.05; Reusability: 5 cycles (87% recovery)	[213]

Abbreviations: PVPA – poly(vinylphosphonic acid); AMT – allyl mercaptan; TEPA – tetraethylenepentamine; PAA – poly(acrylic acid); PCB – printed circuit boards; IPN – interpenetrated polymer networks.