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Properties and mechanism for selective adsorption of Au (III) on an ionic liquid adsorbent by grafting N-methyl imidazole onto chloromethylated polystyrene beads

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The elemental analysis of the CMPS-IL was shown in **Table S1**. The grafting rate of N-methyl imidazole can be deduced from the nitrogen and carbon contents of the CMPS-IL. It was calculated by using equation (1):

$$\text{grafting rate} = \frac{27N}{7C - 12N}\% \quad (1)$$

Table S1 The elemental analysis of CMPS-IL

		N(%)	C(%)	H(%)	grafting rate(%)
CMPS-IL	1-1	9.38	62.64	5.384	77.6
	1-2	9.36	62.59	5.374	

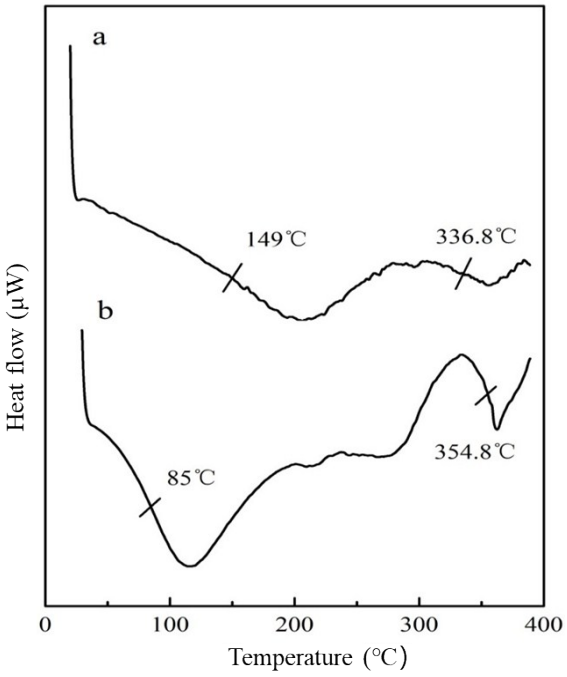

Fig. S1 DSC curves of (a) CMPS;(b) CMPS-IL

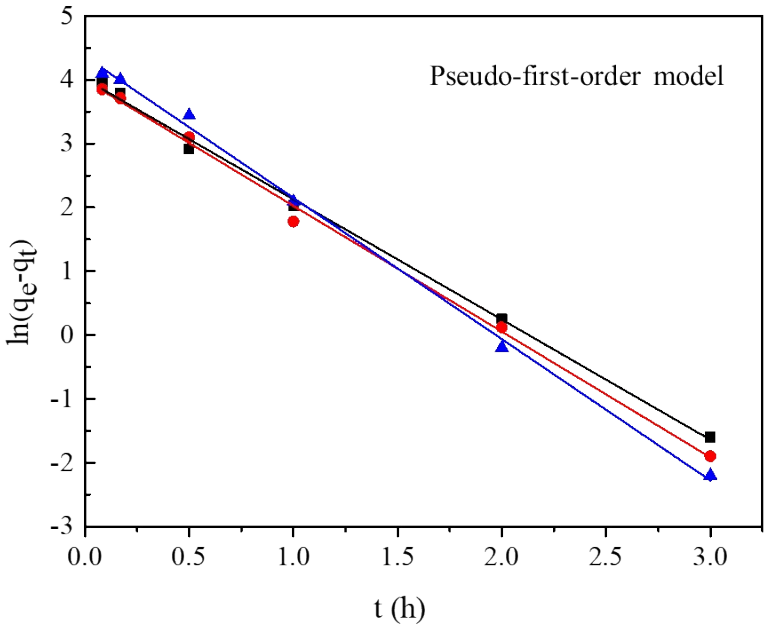

Fig. S2 Pseudo first-order model of CMPS-IL for Au(III) at different temperatures(■ for 298K; ● for 308K; ▲for 318K)

Table S2. Kinetic parameters obtained from pseudo-first- and -second-order models of CMPS-IL for Au(III) at different temperatures

T(K)	$q_{e.exp}$ (mg g^{-1})	Pseudo-first-order model			Pseudo-second-order model		
		$q_{e.cal}$ (mg g^{-1})	k_1 (h^{-1})	R^2	$q_{e,cal}$ (mg g^{-1})	k_2 (g mg^{-1} h^{-1})	R^2
298	58.71	52.14	2.149	0.998	64.52	0.058	0.999
308	60.92	47.38	2.018	0.976	66.27	0.064	0.999
318	65.98	57.77	2.367	0.986	71.33	0.064	0.999

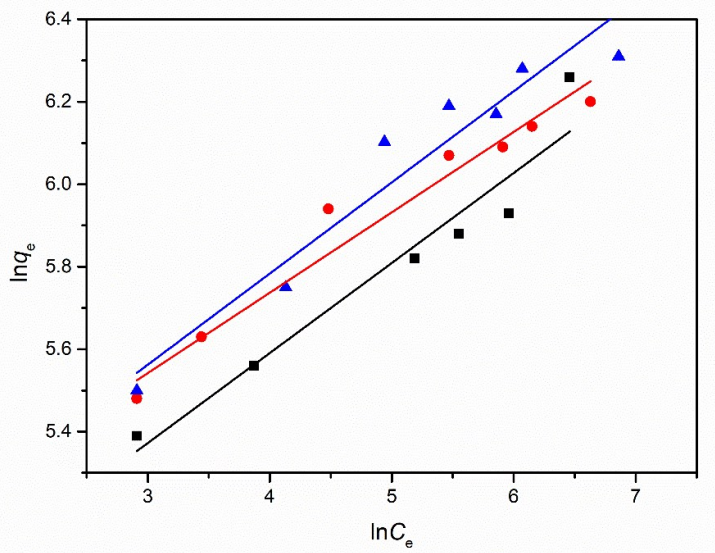

Fig. S3 Freundlich model of CMPS-IL for Au(III) at different temperatures(■ for 298K; ● for 308K; ▲ for 318K)

Table S3. Adsorption isotherm parameter values obtained for Langmuir and Freundlich isotherm models, and thermodynamic parameters for Au(III) adsorption on CMPS-IL at different temperatures

		Langmuir isotherm model			Freundlich isotherm model			Thermodynamic		
T(K)	$q_{m,exp}$ (mg g^{-1})	b (L mg^{-1})	$q_{m,cal}$ (mg g^{-1})	R^2	K_f	1/n	R^2	ΔG (kJ mol^{-1})	ΔH (kJ mol^{-1})	ΔS (J mol^{-1} K^{-1})
298	410.9	0.01636	416.7	0.994	60.79	0.2721	0.949	-0.002		
308	475.0	0.02609	476.2	0.996	84.51	0.2538	0.897	-1.239	36.88	123.7
318	516.5	0.03433	520.8	0.998	75.17	0.2917	0.894	-2.476		

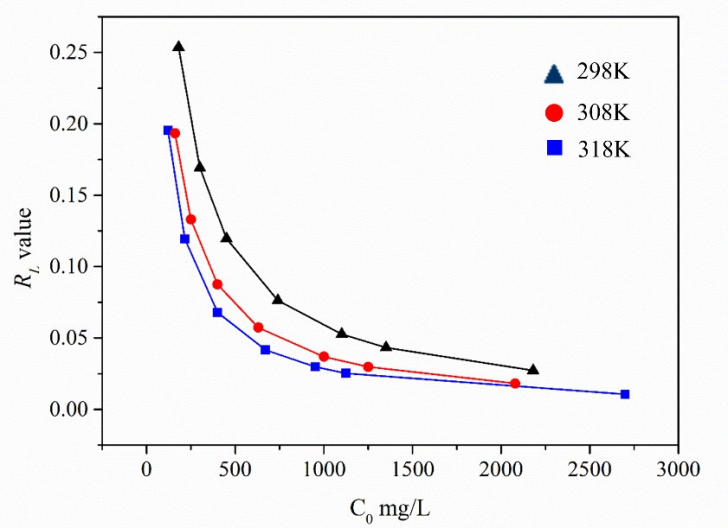

Fig. S4 Effect of temperature and initial Au(III) concentration on the separation factor (R_L).

Table S4. Selectivity coefficient ($\beta_{Au/M}$) data and extraction efficiency (E_{Au}) data towards different ions.

M	$\beta_{Au/M}$	E_{Au}（%）
Au(III)-Fe(III)	1.76×10^5	98.8
Au(III)-Cu(II)	1.57×10^5	96.1
Au(III)-Co(II)	1.17×10^6	96.3
Au(III)-Ni(II)	2.62×10^4	95.7
Au(III)-Cd(II)	2.83×10^4	96.7

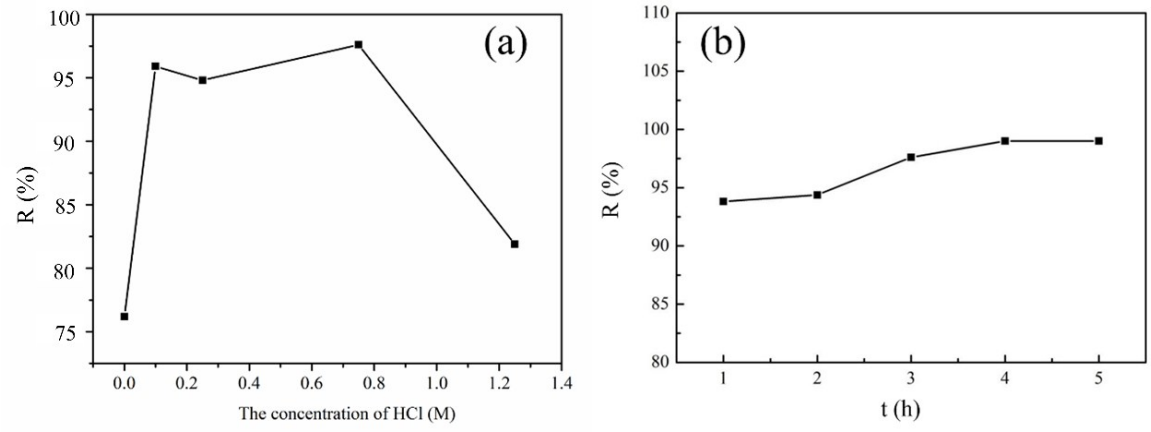

Fig. S4 (a) Recovery of Au(III) with HCl of different molarities in 0.25 M thiourea (at 298 K for 3 h); (b) Effect of time on desorption efficiency (40 mg of Au(III) saturated CMPS-IL, 50mL of the mixture of HCl-thiourea with molar ratio=3:1, 298K)