

Preparation zwitterionic polymer based on L-cysteine for recovery application of precious metals

Huseyin Akbulut, Shuhei Yamada and Takeshi Endo^{*a}

^{* a} Molecular Engineering Institute, Kinki University, 11-6 Kayanomori, Iizuka, Fukuoka 820-8555, Japan. E-mail: tendo@moleng.fuk.kindai.ac.jp;
Fax: +81-948-22-7210; Tel: +81-948-22-7210

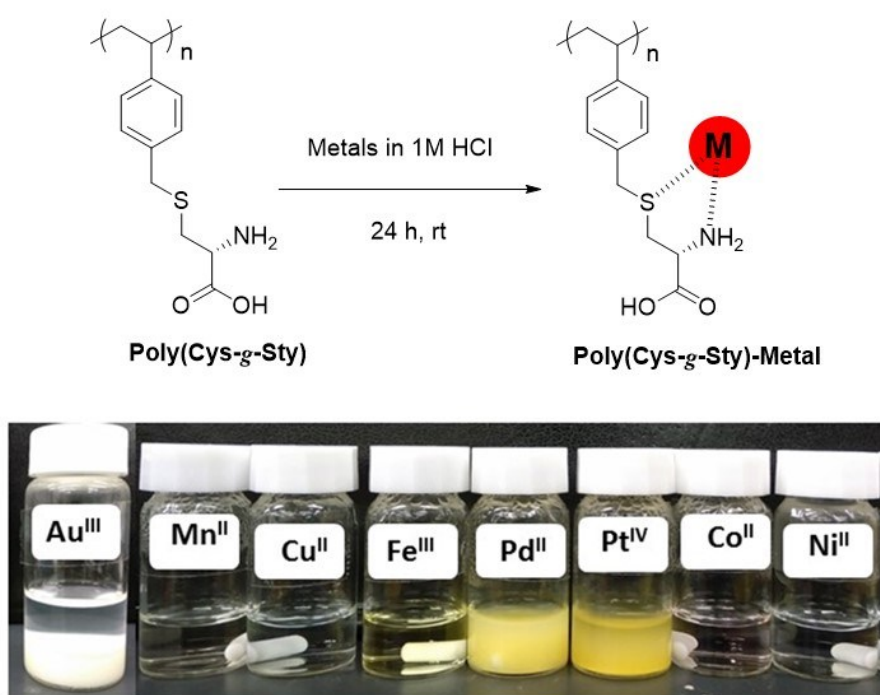


Fig. S1 Conditions: aqueous 1M HCl solution of metal ions: 25 ml of [Pd^{II}] = 0.494 g.L⁻¹, [Pt^{IV}] = 0.870 g.L⁻¹, [Au^{III}] = 0.692 g.L⁻¹, [Co^{II}] = 0.472 g.L⁻¹, [Ni^{II}] = 0.400 g.L⁻¹, [Zn^{II}] = 0.483 g.L⁻¹, [Mn^{II}] = 0.332 g.L⁻¹, [Cu^{II}] = 0.419 g.L⁻¹; that of Poly(Cys-g-Sty): 10 mg in 25 ml aqueous HCl solutions ; temperature: 25 °C.

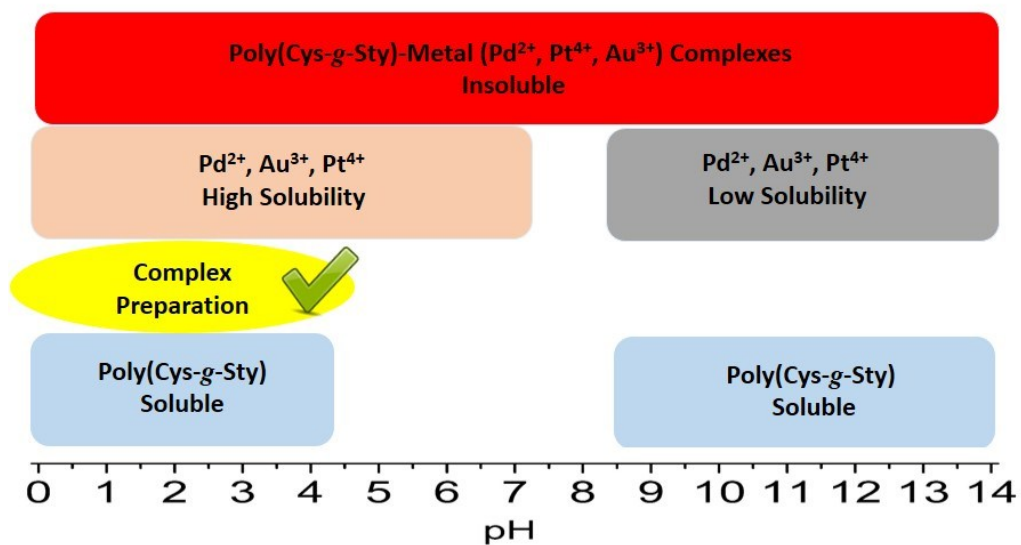
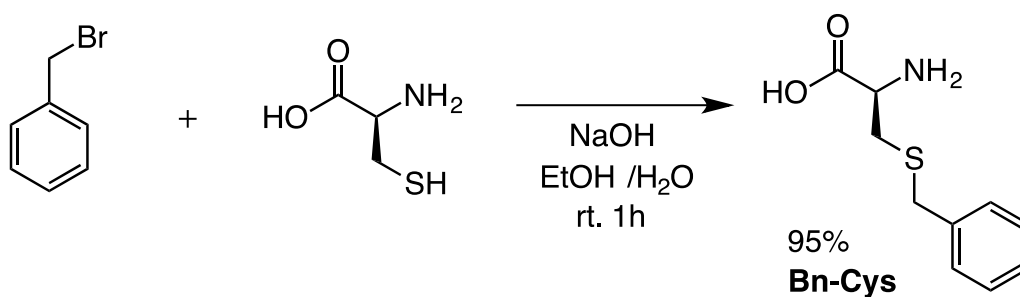


Fig. S2 The illustration of solubility for metal ions, polymer-metal complexes, and polymer in the pH range.



Scheme S1. Synthesis of model compound **Bn-Cys**.

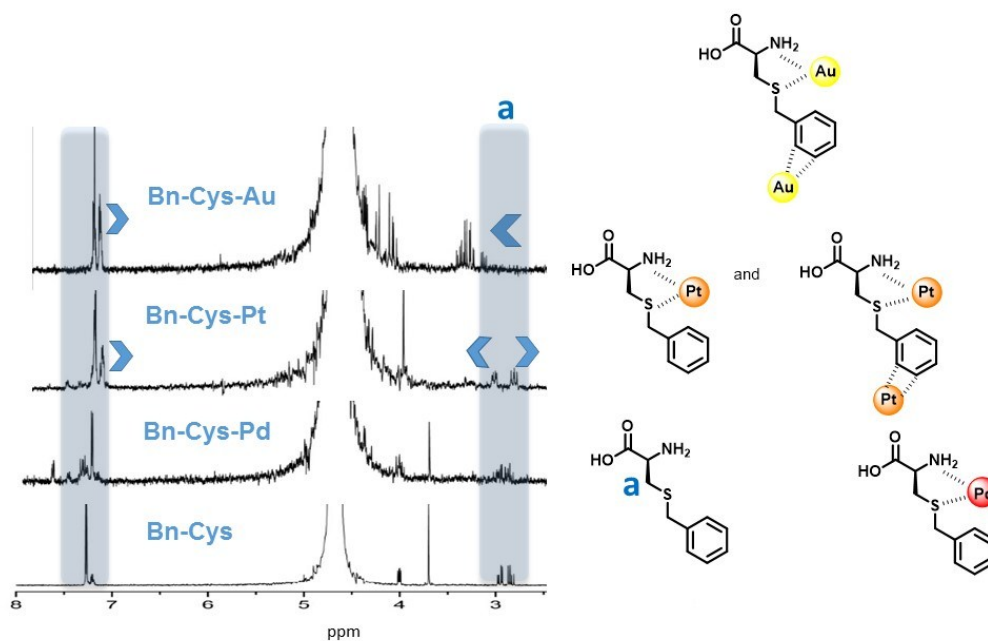


Fig. S3 Investigation on metal adsorption of **Bn-Cys** by ^1H -NMR spectra in D_2O .

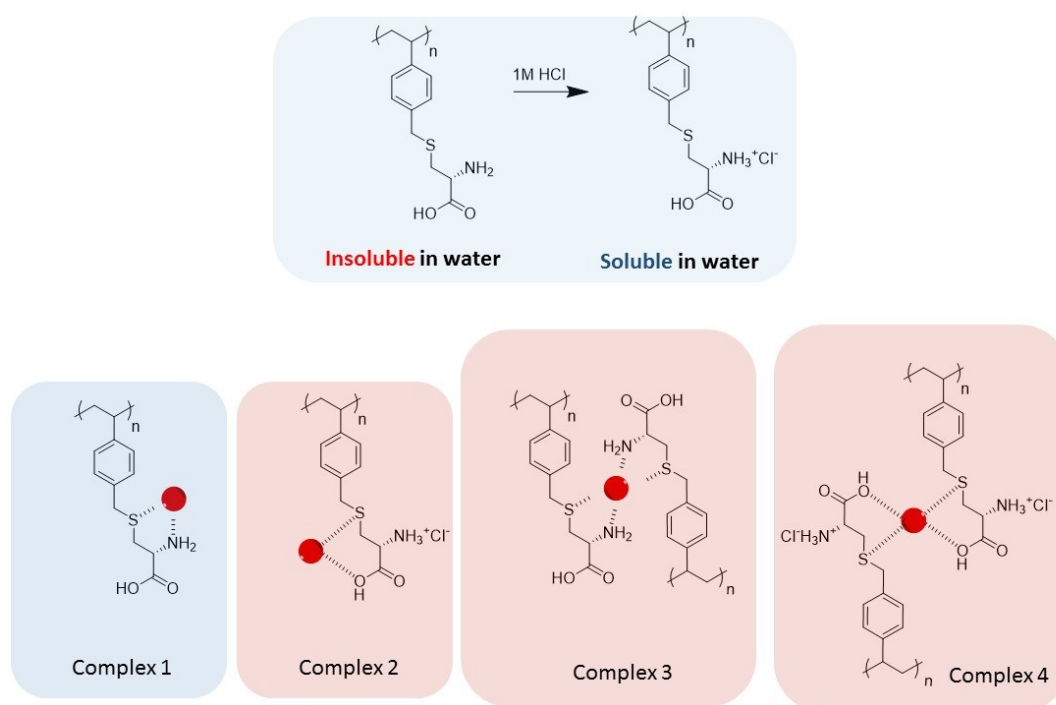


Fig. S4 Another possible metal-polymer complex structures.

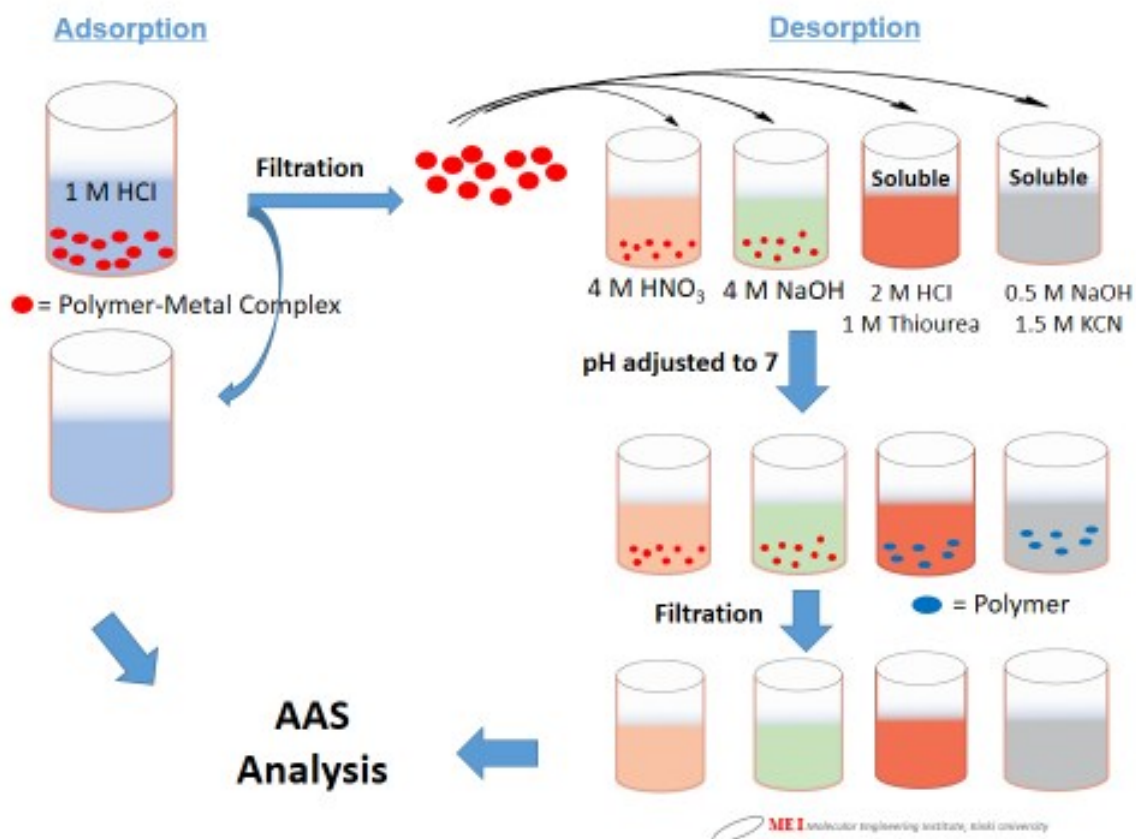


Fig. S5 The schematic illustration of adsorption and desorption process of **Poly(Cys-g-Sty)**.

Table S1. Desorption efficiencies of polymer-metal complexes with different desorption agents.

Desorption Agent	Desorption efficiency (%)		
	Pd ²⁺	Pt ⁴⁺	Au ³⁺
4 M HNO ₃	0	6.33	0
4 M NaOH	0	0	0
2 M HCl - 1 M Thiourea	80.2	45.2	17.6
0.5 M NaOH - 1 M KCN	>99	>99	>99

Table S2. Adsorption and desorption efficiency after every cycles.

Number of Cycle	Adsorption efficiency (%)			Desorption efficiency (%)		
	Pd ²⁺	Pt ⁴⁺	Au ³⁺	Pd ²⁺	Pt ⁴⁺	Au ³⁺
1	99	88	>99	>99	>99	>99
2	31.7	0	14	>99	0	68
3	26.2	0	0	>99	0	0
4	12	0	0	>99	0	0