Supplementary material for

Efficient and selective adsorption of Au(III), Pt(IV), Pd(II) by radiation-crosslinked poly(ionic liquid) gel

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S1. Adsorption capacity and efficiency

The following Eq. (S1) and Eq. (S2) were used to calculate the adsorption capacity (Q_e, mg/g) and efficiency (E, %):

$$Q_e = \frac{(C_0 - C_e) \times V}{m} \tag{S1}$$

$$E\ (\%) = \frac{(C_0 - C_e)}{C_0} \times 100 \tag{S2}$$

Where C_0 (mg/L) and C_e (mg/L) were the concentrations of the metal ions before and after adsorption, respectively; V (L) was the volume of the absorbed solution; m (g) was the mass of the adsorbents. All results were obtained from two parallel data.

S2. Kinetic Model Fitting

The pseudo-first-order and pseudo-second-order kinetic models shown in Eq. (S3) and (S4) were used to fit the kinetic data:

Pseudo-first-order:

$$Q_t = Q_e \times (1 - e^{-k_1 t}) \tag{S3}$$

Pseudo-second-order:

$$\frac{t}{Q_t} = \frac{1}{k_2 Q_e^2} + \frac{t}{Q_e} \tag{S4}$$

Where k_1 (min^{-1}) and k_2 ($mg \cdot g^{-1} min^{-1}$) were the rate constants of the pseudo-first-order and pseudo-second-order kinetic models, respectively. Q_t (mg/g) was the corresponding adsorption capacity of Au(III) or Pt(IV) or Pd(II) at a certain time, and Q_e (mg/g) was the theoretical equilibrium adsorption capacity of the three metal ions.

S3. Isotherm Model Fitting

The isotherms data was fitted by Langmuir and Freundlich isotherm models as shown in the following equations (Eq. (S5) and (S6)):

Langmuir:

$$\frac{C_e}{Q_e} = \frac{C_e}{Q_{max}} + \frac{1}{Q_{max} K_L} \tag{S5}$$

Freundlich:

$$\log Q_e = \log \mathrm{K_f} + \frac{1}{\mathrm{n}} \log C_e \tag{S6}$$

Where C_e (mg/L) was the concentration of metal ions in the solution after adsorption equilibrium, and Q_e (mg/g) was the corresponding adsorption capacity at adsorption equilibrium. Q_{max} (mg/g) represented the theoretical maximum adsorption capacity obtained by Langmuir model fitting. K_L, K_f, and n were constants of adsorption properties.

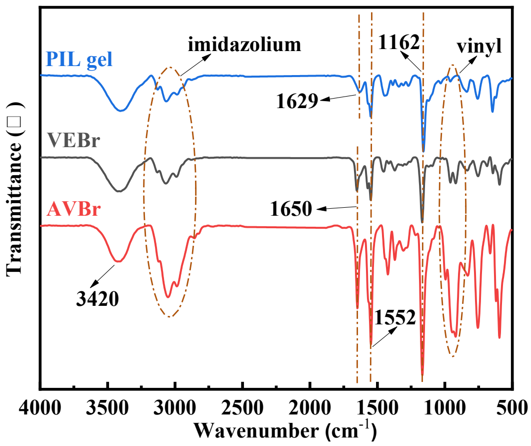

Fig. S1 FTIR spectra of VEBr, AVBr, and PIL gel

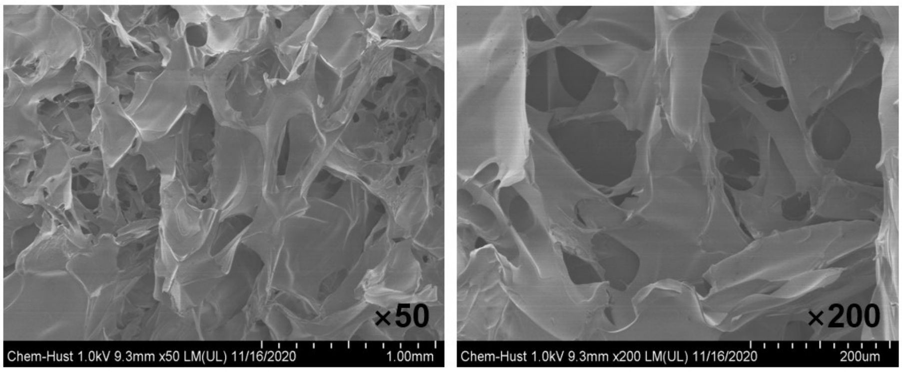

Fig. S2 SEM images of the freeze-dried PIL gel

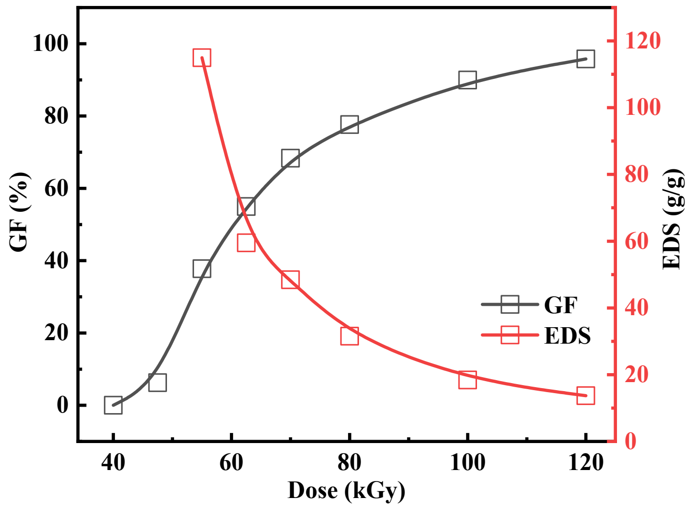

Fig.S3 GF and EDS of PIL gel

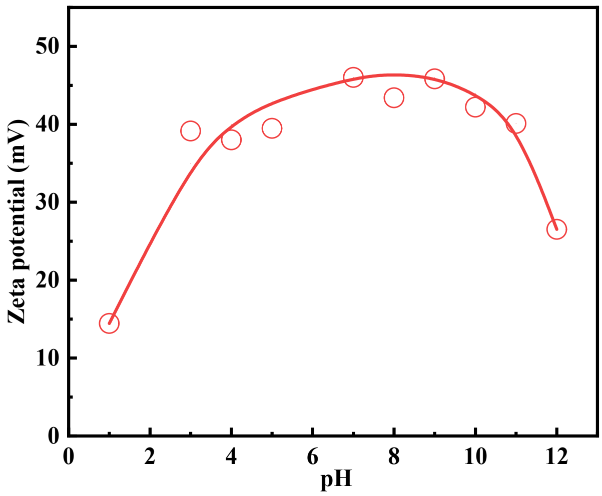

Fig. S4 zeta potential of PIL gel

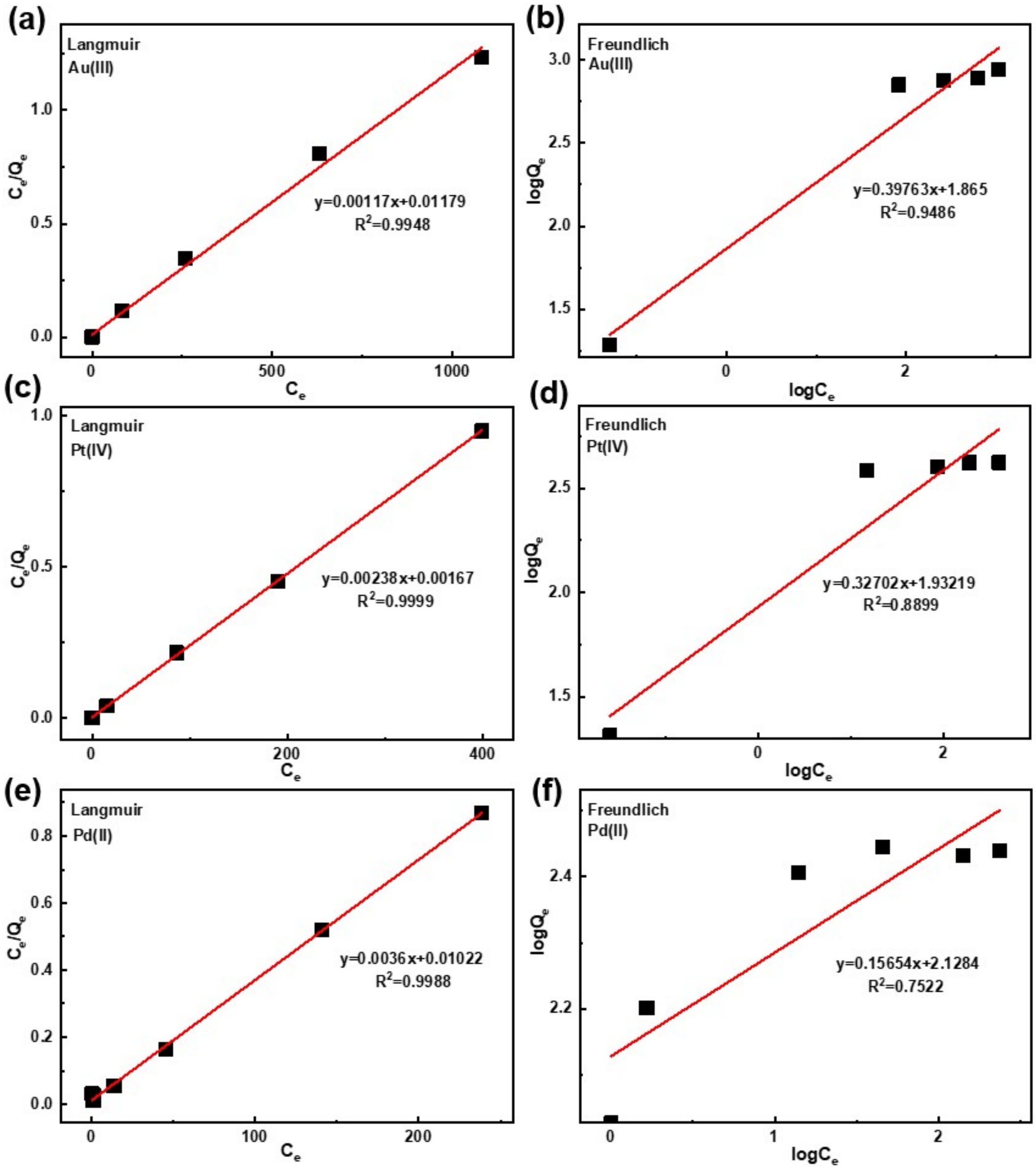

Fig. S5 Langmuir and Freundlich isotherm models fitting curves

Table S1 The composition of slag leaching solution before and after adsorption

Element	Feed (mg/L)	Raffinate (mg/L)
Au	0.386	0.123
Al	351.855	391.2753
Ca	261.9151	287.8875
Fe	114.6942	123.0444
Mg	158.5719	182.817
Mn	13.4882	14.9922
Ni	0.1206	0.1458
Zn	1.2318	1.3554