Supporting Information

Selective Recovery of Gold from E-wastewater Using Poly-m-phenylenediamine Nanoparticles and Assembled Membrane

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Including 8 pages, 8 figures and 1 table

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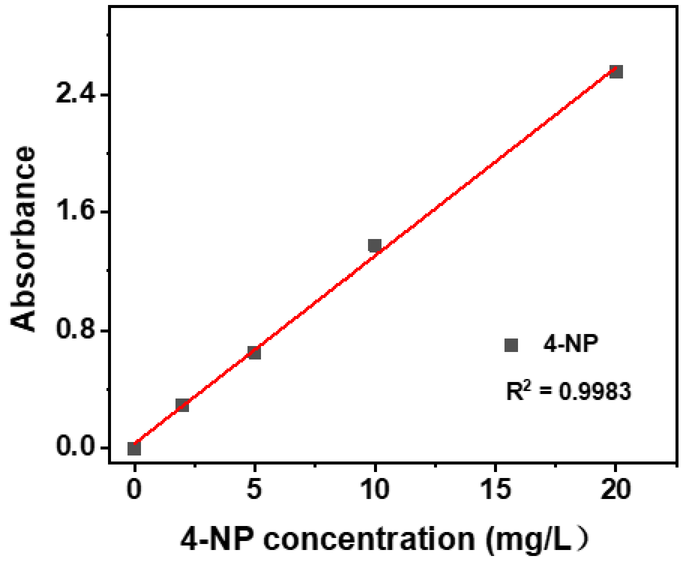

Figure S1. The linear correlation of 4-NP concentration with UV-vis absorbance.

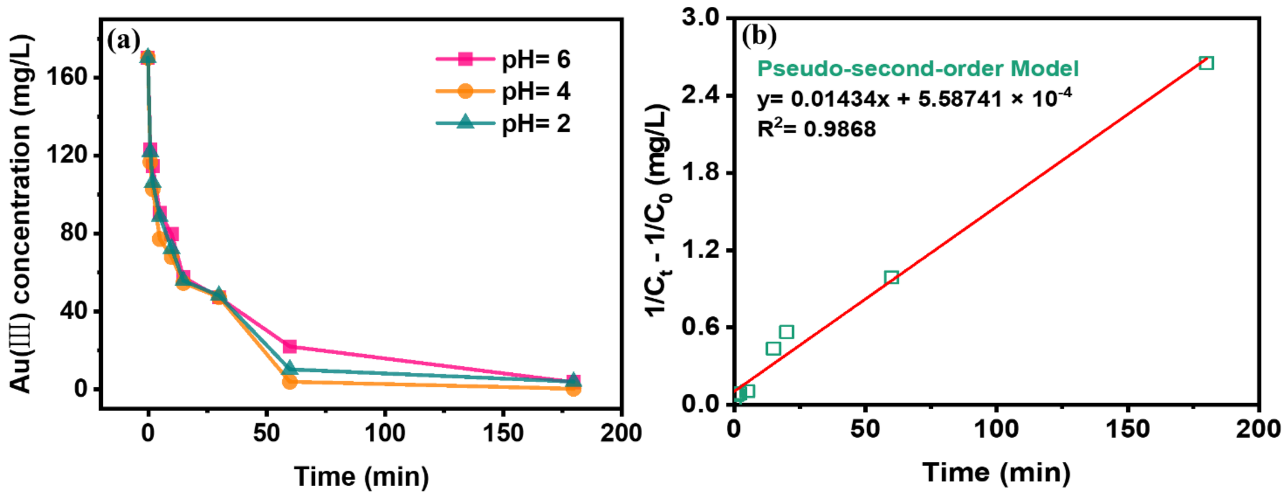

Figure S2. Effects of pH on the Au(III) adsorption by PmPD particles, with initial Au(III) concentration of 160 mg/L. (a) adsorption isotherms; and (b) linear fitting by Second-order kinetics model at pH 2.

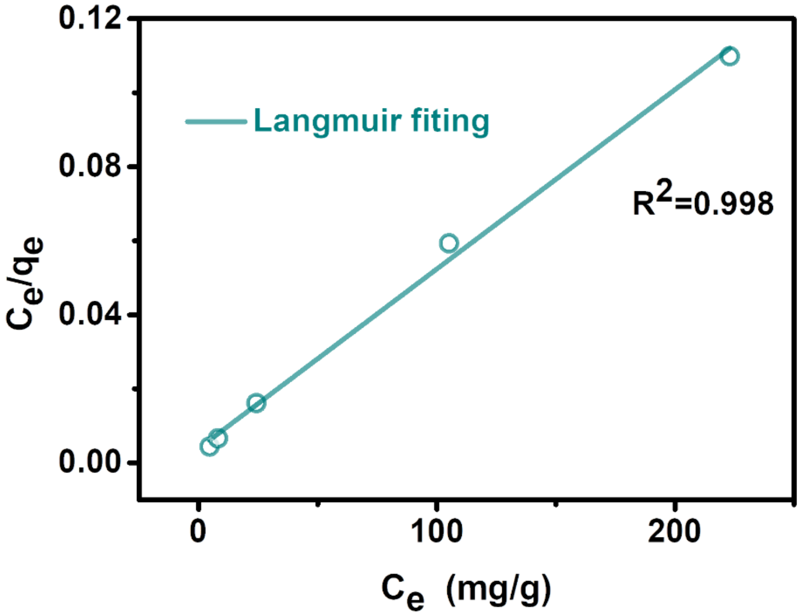

Figure S3. Langmuir model fitting for the Au (III) adsorption isotherm.

Table S1. Au(III) recovery performance of PmPD as compared to other absorbants, with regarding to the adsorption capacity (Q_{max}) and distribution coefficient (K_d).

Adsorbents	pH	Q_{max} (mg/g)	K_d (mL/g)	Refs.
CNT-MoS2	4.8	2495.00	560000.00	(Liu et al, 2021)
POSS-2	6.89	1486.50	59619.00	(Chen et al, 2021)
Chitosan derivatives	4	1630.04	1021121.92	(Wang et al, 2012)
UiO-66-BTU	2	658.30	1601841.39	(Guo et al, 2021)
CuS nanoparticles	1	574.70	3120000.00	(Yao et al, 2019)
PEC		1004.70	3315510.00	(Bratskaya et al, 2016)
TSC-CCB	6	1584.66	122177.29	(Lin et al, 2018)
MoS2 nanoflacks	2	1133.00	195329.20	(Feng et al, 2018)
D301-g-THIOPGMA	2	971.50	27202.00	(An et al, 2016)
Chitosan	2	650.10	34000000.00	(Chen et al, 2011)
This work	2	2063.09	16667000.00	

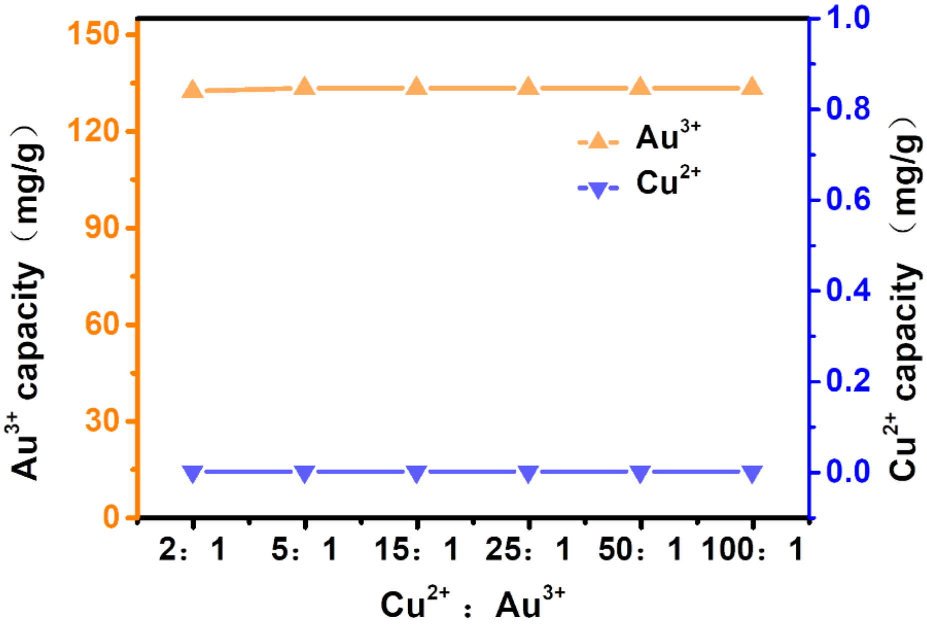

Figure S4. Recovery of Au(III) at different mass ratios of Cu and Au.

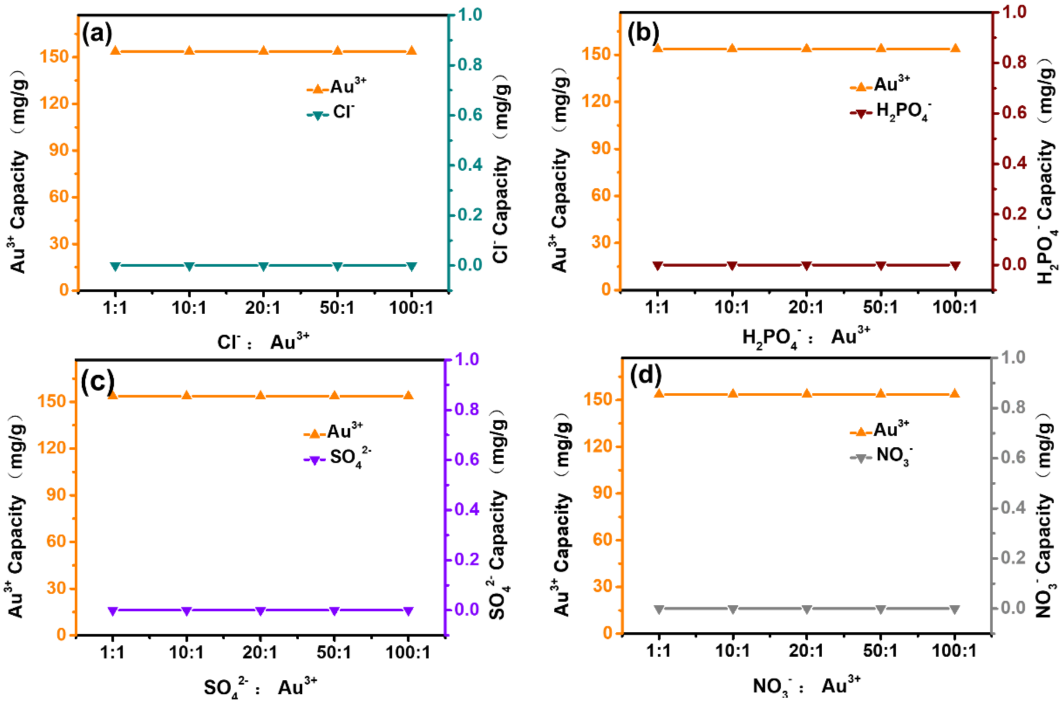

Figure S5. Recovery of Au(III) and coexisting anions by PmPD particles from water containing all ions in different concentrations: removal capacity of Au(III) as compared to Cl^- (a), $H_2PO_4^-$ (b), NO_3^- (c), SO_4^{2-} (d). The concentration of Au(III) was added in 50 mg/L.

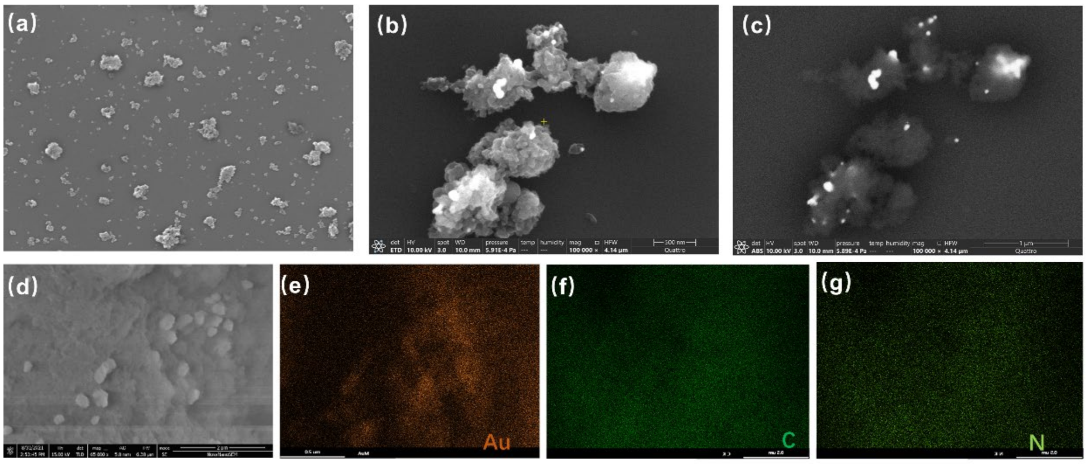

Figure S6. SEM and EDS images of PmPD before and after Au(III) adsorption; (a) SEM general images of PmPD before adsorption Au(III) ; (b-c) SEM images of PmPD after adsorption Au(III) ; (d-g) EDS elements distribution of Au, C, N after Au(III) adsorption.

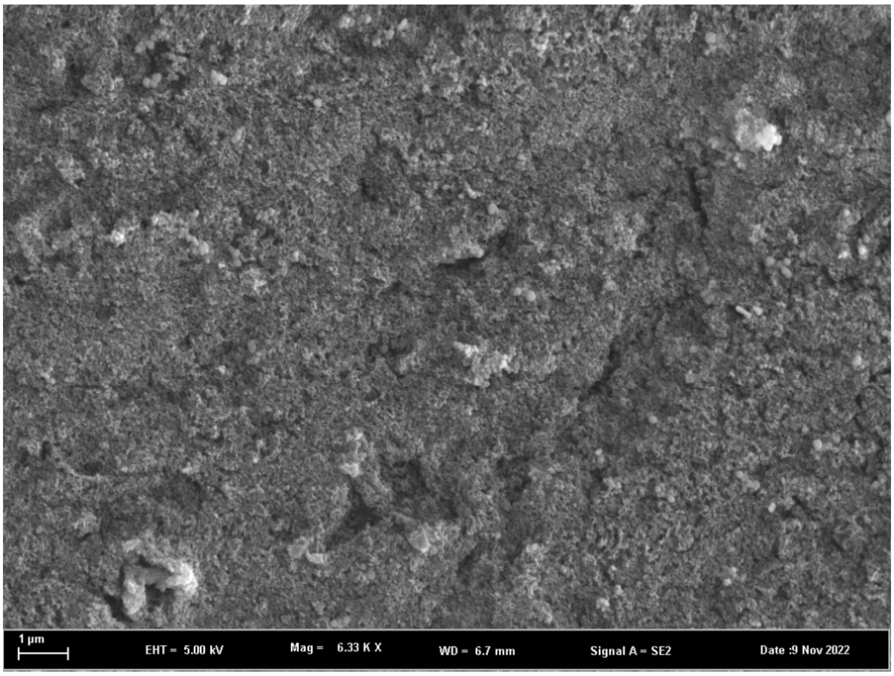

Figure S7. The SEM image of the PmPD membrane surface.

Text S1 In this study, for the measurement of pore volume of materials on the catalytic film, a commonlyused method of "water-filling"[1] is adopted to take an average value after three measurements. The specific operation method is as follows: the mass of nylon blank base film is measured as m_0, and the mass after wetting it completely with water is m_1. Then, the dispersion of nanomaterials containing 15 mg PmPD was pumped on the nylon membrane and the Au@PmPD membrane was obtained by 100 mL $HAuCl_4$ solution, and the mass m_2 and m_3 of the dry and wet states were weighed respectively. The effective pore volume (V_e) of the material in Au@PmPD film can then be obtained:

$$V_e = \frac{(m_3 - m_2) - (m_1 - m_0)}{\rho_{water}} \tag{5}$$

In a membrane catalytic reaction, the catalytic reaction time (R_t, s) of pollutants in the membrane is calculated as:

$$R_t = \frac{V_e \times 60}{v} \tag{6}$$

where v is the flow rate of the transmembrane solution, mL/min.

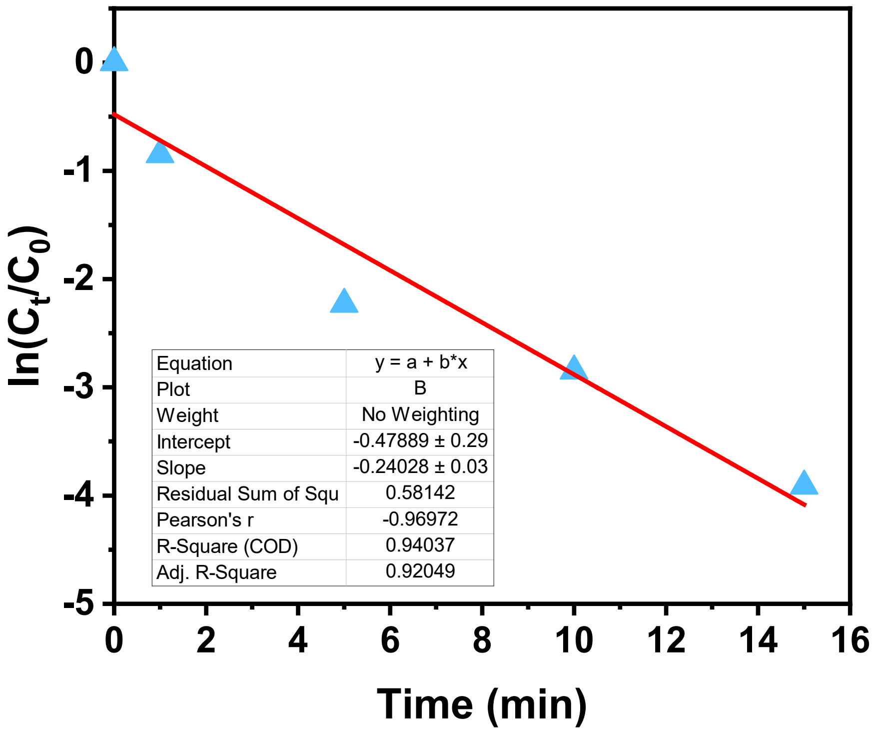

Figure S8. Plot of 4-NP concentration evolution ln (C_t/C_0) versus reaction time as obtained from the dispersion of Au@PmPD.

Reference

(1) Zhang, S.; Zhu, Z.; Sun, M.; Weon, S.; Zhao, Y.; Stavitski, E.; Elimelech, M.; Kim, J-H. Membrane-Confined Iron Oxychloride Nanocatalysts for Highly Efficient Heterogeneous Fenton Water Treatment. Environ. Sci. Technol 2021, 55, 9266–9275.