Supplementary material (ESI) for Nanoscale

Electronic Supporting Information

for

Optically Active Red-emitting Cu Nanoclusters Originating from Complexation and Redox Reaction between Copper (Ⅱ) and D/L-Penicillamine

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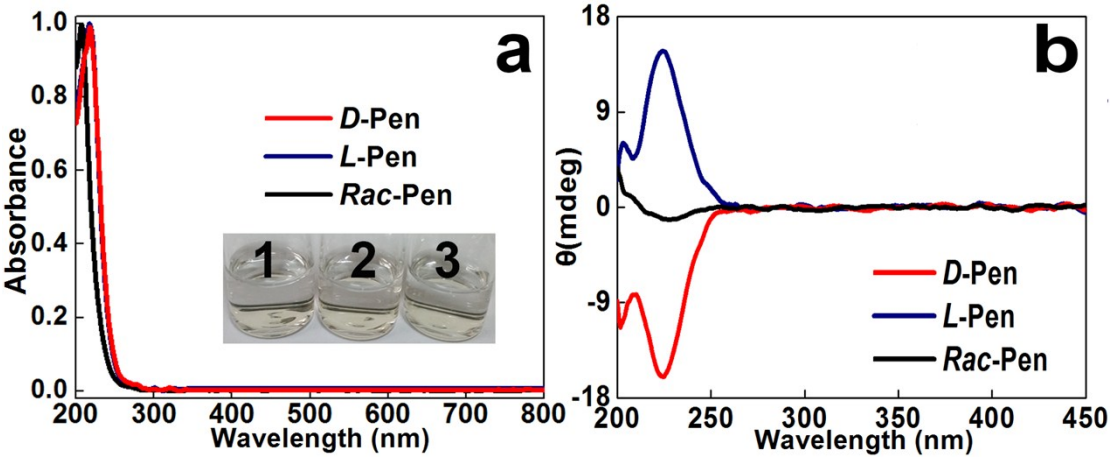

Figure S1 The absorption (a) and CD (b) spectra of D-, L- and *Rac*-Pen, inset shows the photographs of D-, L- and *Rac*-Pen solution under daylight.

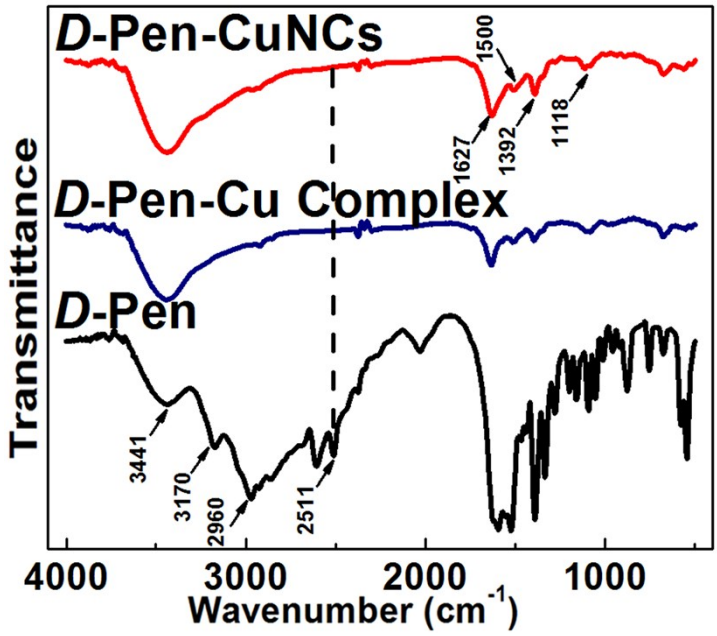

Figure S2 The FT-IR spectra of D-Pen-CuNCs, D-Pen-Cu Complex, and D-Pen.

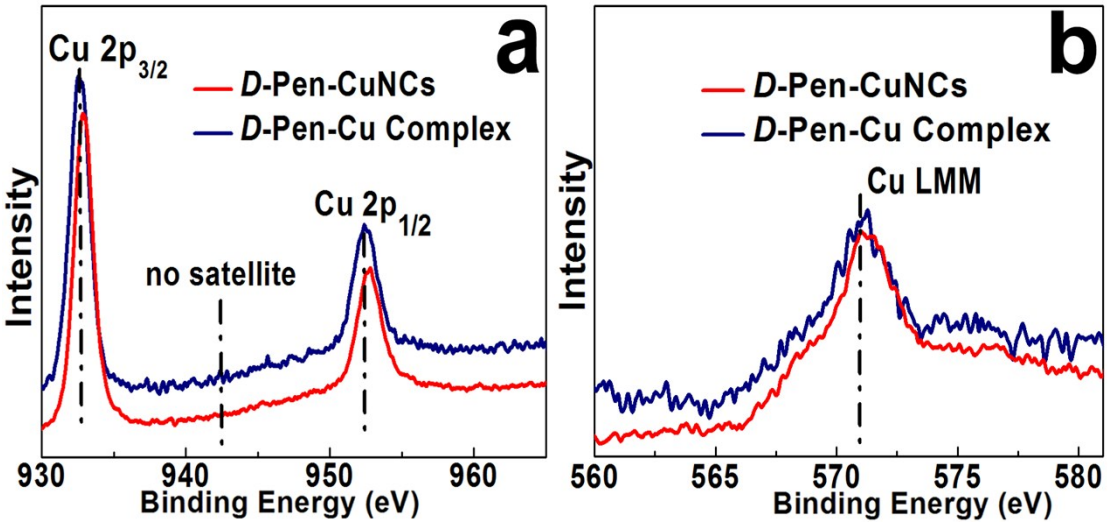

Figure S3 (a) The XPS of Cu 2p electrons for D-Pen-CuNCs and D-Pen-Cu Complex; (b) the corresponding AES spectrum in the Cu LMM region of D-Pen-CuNCs and D-Pen-Cu Complex.

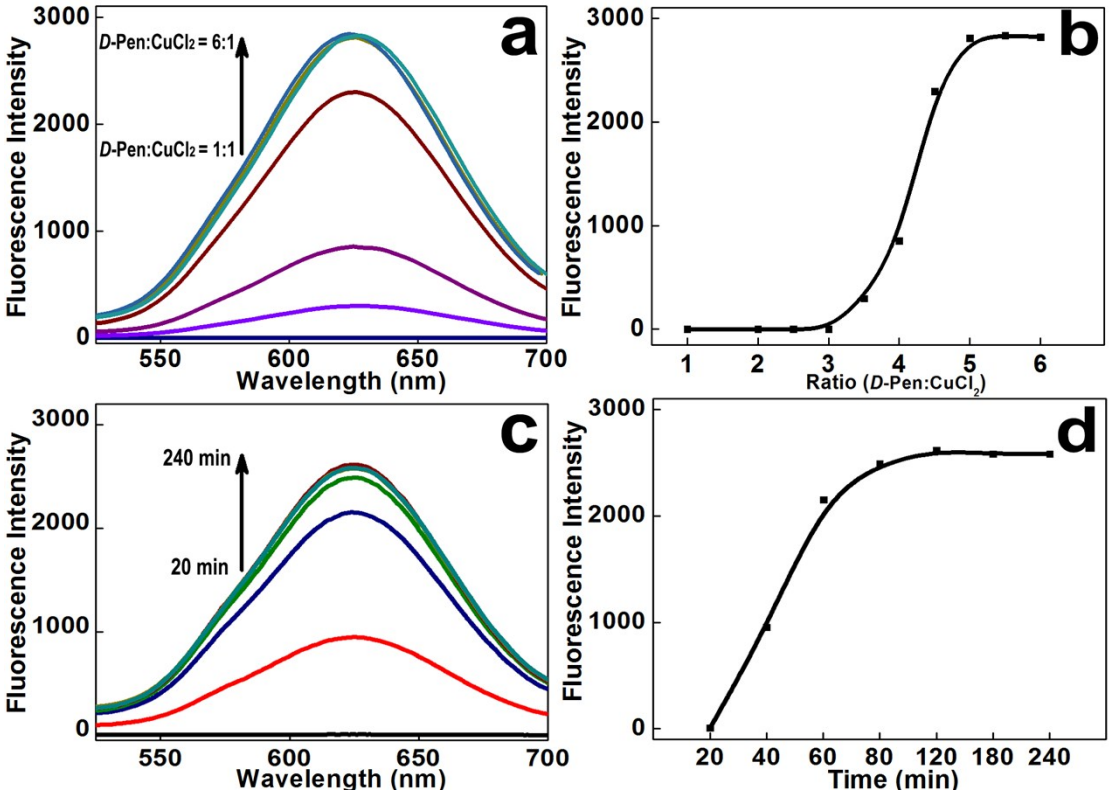

Figure S4 (a) PL spectra of the resultant D-Pen-CuNCs with the increasing ratio of D-Pen to copper (Ⅱ); (b) Plots of PL intensity of D-Pen-CuNCs at 625 nm *versus* the ration of D-Pen to copper (Ⅱ); (c) PL spectra of the resultant D-Pen-CuNCs with the prolonging reaction time at a fixed concentration of D-Pen and copper (Ⅱ); (d) Plots of PL intensity of D-Pen-CuNCs at 625 nm *versus* the reaction time.

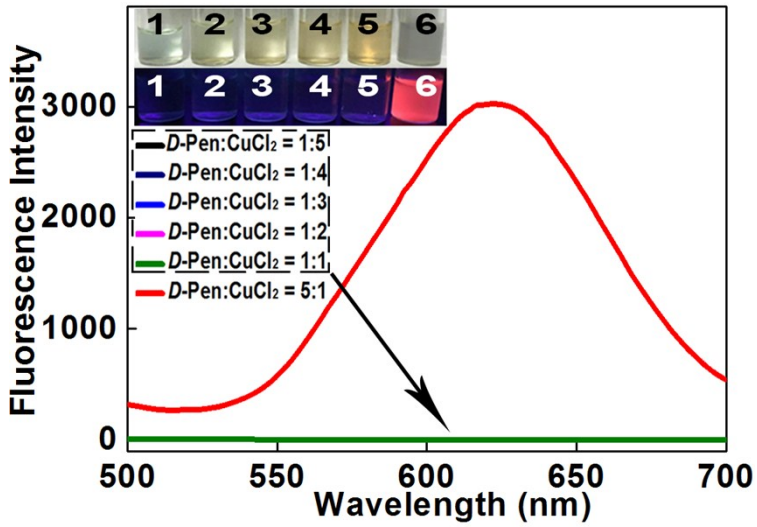

Figure S5 Comparison of PL spectra between the resultant complexes with the different ratios of D-Pen to excessive copper (Ⅱ) and the resultant D-Pen-CuNCs with a fixed 5:1 ratio of D-Pen to copper (Ⅱ). The inset displays the photographs of the corresponding complexes (1-5) and CuNCs (6) under the irradiation of visible and 365 nm UV light.

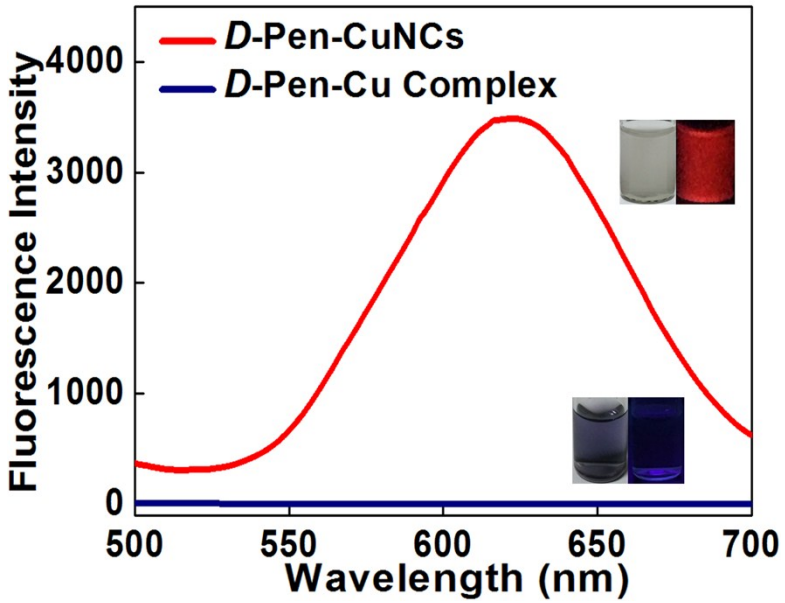

Figure S6 Comparison of PL spectra between D-Pen-CuNCs and D-Pen-Cu Complex. The insets display the photographs of the corresponding CuNCs and Cu complex solution under the irradiation of visible and 365 nm UV light.

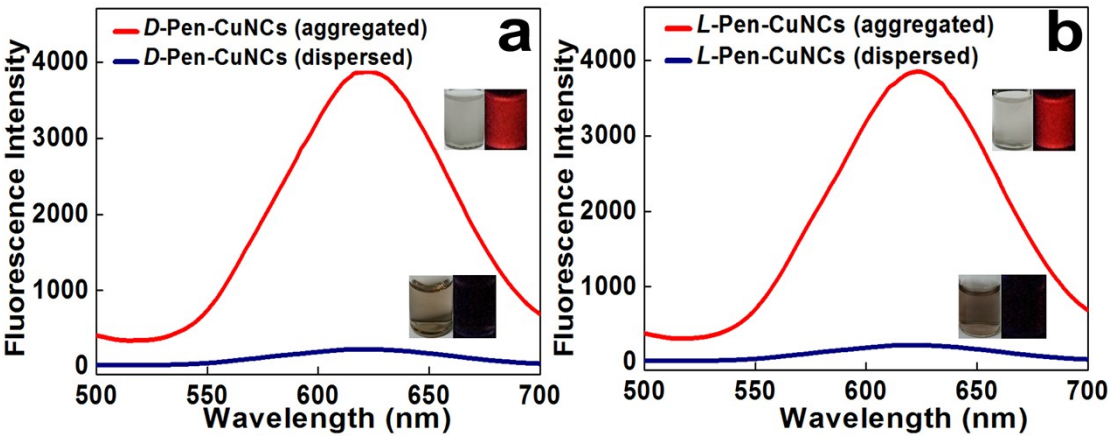

Figure S7 The PL spectra of the aggregated and dispersed D-Pen-CuNCs (a) and L-Pen-CuNCs (b); the inset displays the photographs of the corresponding aggregated and dispersed CuNCs under the irradiation of visible and UV light.

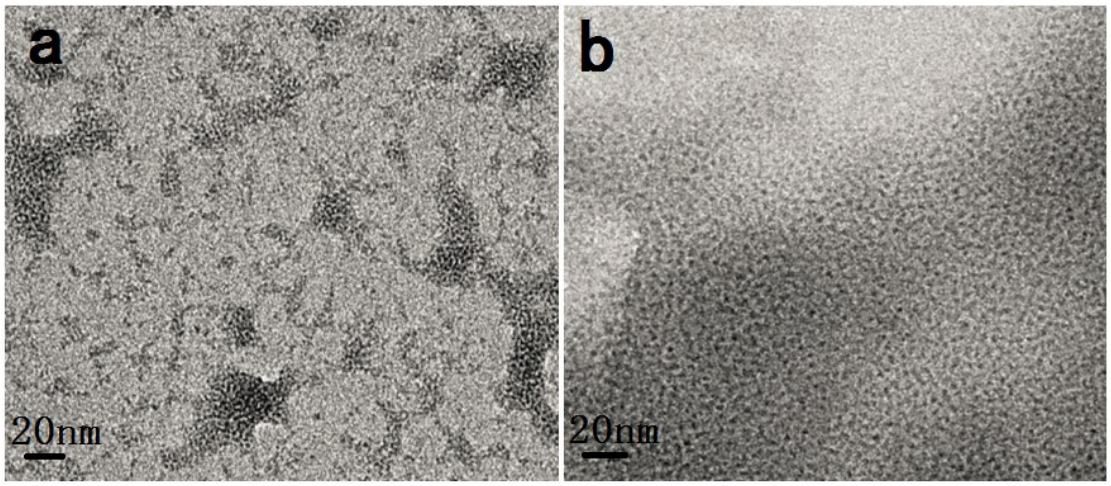

Figure S8 TEM images of the aggregated L-Pen-CuNCs on the reaction condition (a) and the dispersed species by adjusting pH to alkaline environment (b).

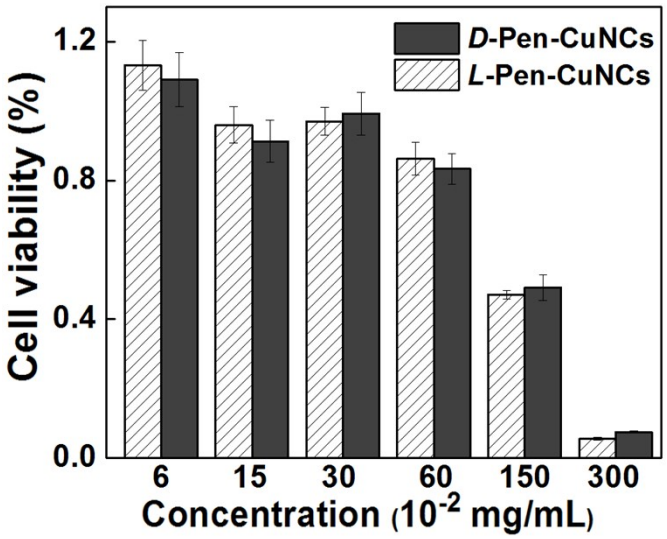

Figure S9 Cellular toxicity of D-Pen- and L-Pen-CuNCs on Hep-2 cell viability.

Table S1 The absolute PL QYs of *D*-Pen-CuNCs

	$CuCl_2$ (λex 372 nm)	$Cu(NO_3)_2$ (λex 345 nm)	$CuSO_4$ (λex 372 nm)
a	18.6%	21.4%	12.5%
b	42.8%	50.6%	42.3%

a Concentration: Cu (II) precursors, 1.0 mM; *D*-Pen, 10 mM; *b* Cu (II) precursors, 3.0 mM; *D*-Pen, 15 mM. The mixture was reacted for 2 h. The isolation and purification of the resultant CuNCs were performed through repeated centrifugation and washing steps, and then the products were used for the measurements of the PL QYs.