Supporting Information

Polycatechol Nanosheet: A Superior Nanocarrier for Highly Effective Chemo-Photothermal Synergistic Therapy in Vivo

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Calculation of the photothermal conversion efficiency of CuS/PCCNS.

The photothermal conversion efficiency of CuS/PCCNS was determined according to wang's report.[28] Detailed calculation was given as following:

The total energy balance of system obeys the following relation:

$$Q = Q_{NPs} + Q_0 - Q_{loss} = \sum_{i=1}^{n} m_i C_{p,i} \frac{dT}{dt} \qquad (1)$$

where Q is the energy required for the system, m and C_p are the mass and heat capacity of each i component of the sample cell, and T is the solution temperature. Q_0 is the heat energy of the quartz cell and solvent without nanoparticles, which is measured independently to be 20.0 mW.

Q_{NPs} is the heat generated by NPs under laser irradiation:

$$Q_{NPs} = I\eta\left(1 - 10^{-A_{980}}\right) \qquad (2)$$

Where I is the laser power, A_{980} is the extinction value of sample at 980 nm, and η is the photothermal conversion efficiency.

Q_{loss} is the energy transferred from system to environment:

$$Q_{loss} = hA\left(T_{\max} - T_0\right) \qquad (3)$$

where h is the heat transfer coefficient, A is the surface area of the sample well, T_{max} is the equilibrium temperature, T_0 is the ambient temperature.

When the system is heated to a maximum value in temperature (T_{max}), a heat transfer equilibrium with the environment can be established:

$$Q_{NPs} + Q_0 = Q_{loss} \quad (4)$$

Substituting Equation 2 and Equation 3 into Equation 4, the photothermal conversion efficiency (η) can be determined:

$$\eta = \frac{hA\left(T_{\max} - T_0\right) - Q_0}{I\left(1 - 10^{-A_\lambda}\right)} \times 100\% \quad (5)$$

When the laser is shut down, $Q_{NPs} + Q_0 = 0$, and Equation 1 changed to:

$$Q_{loss} = -\sum_{i=1}^{n} m_i C_{p,i} \frac{dT}{dt} = hA\left(T_{\max} - T_0\right) \quad (6)$$

we herein introduce ϑ, which is defined:

$$\theta = T_{\max} - T_0 \quad (7)$$

Substituting Equation 7 into Equation 6:

$$dt = -\frac{\sum_{i=1}^{n} m_i C_{p,i}}{hA} \frac{d\theta}{\theta} \quad (8)$$

Integrating Equation 8 gives the expression:

$$t = -\frac{\sum_{i=1}^{n} m_i C_{p,i}}{hA} ln\theta + b \quad (9)$$

Therefore, *hA* can be determined by applying the linear time data from the cooling period vs $-ln\vartheta$ (Figure 2C and D).

$$hA = \frac{m_s C_s + m_w C_w}{k} \quad (10)$$

Where the m_s of the sample solution is 1.0 g, and its C_s value is approximated to be 4.2 J g^{-1} K^{-1}. The m_w of quartz cell is 6.08 g, and its C_w value is approximated to be 0.839 J g^{-1} K^{-1}. *k* is the slope of the linear Equation in Figure 2D, which is 280.

$$hA = \frac{1.0 \times 4.2 + 6.08 \times 0.839}{280} = 0.0332 \tag{11}$$

Finally, substituting *hA* value into Equation 5, the *η* can be calculated as following:

$$\eta = \frac{hA\left(T_{\max} - T_0\right) - Q_0}{I\left(1 - 10^{-A_\lambda}\right)} \times 100\% \tag{5}$$

$$= \frac{0.0332 \times \left(54.3 - 28.3\right) - 0.02}{2.0 \times \left(1 - 10^{-1.1}\right)} \times 100\%$$

$$= 45.7\%$$

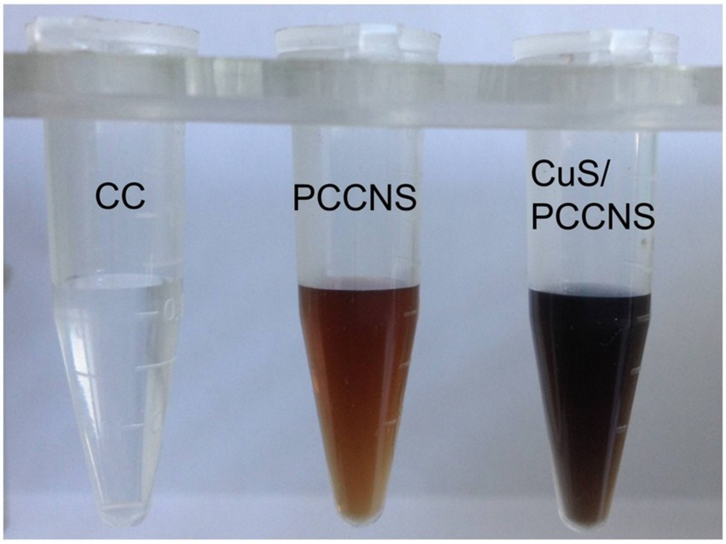

Fig. S1 Photos of CC, PCCNS and CuS/PCCNS nanocomposites in water solution.

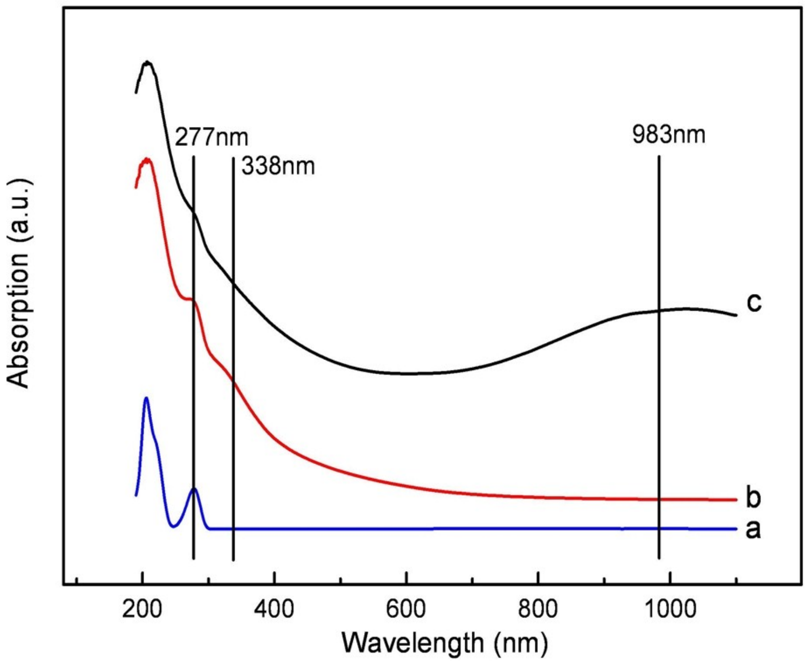

Fig. S2 UV–vis absorption spectra of CC (a), PCCNS (b) and CuS/PCCNS nanocomposites (c).

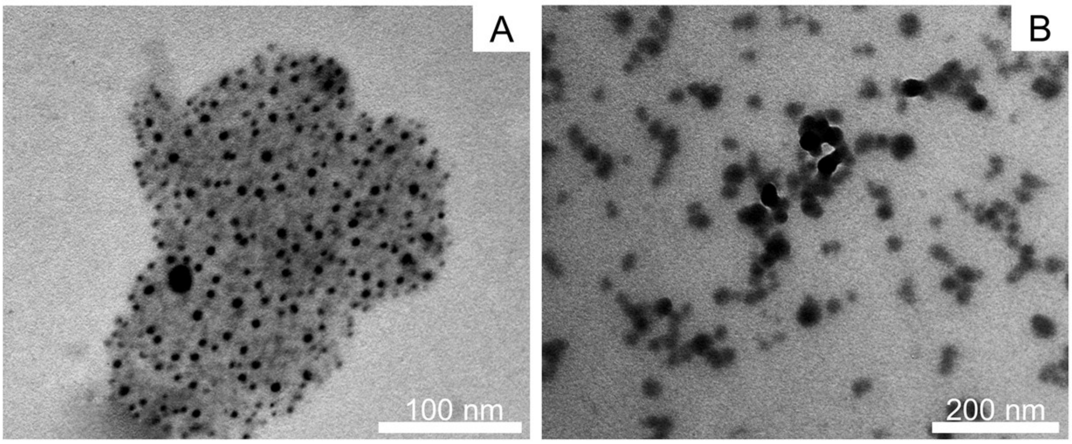

Fig. S3 TEM images of polycatechol after polymerization reaction at (A) 10°C and (B) 30°C.

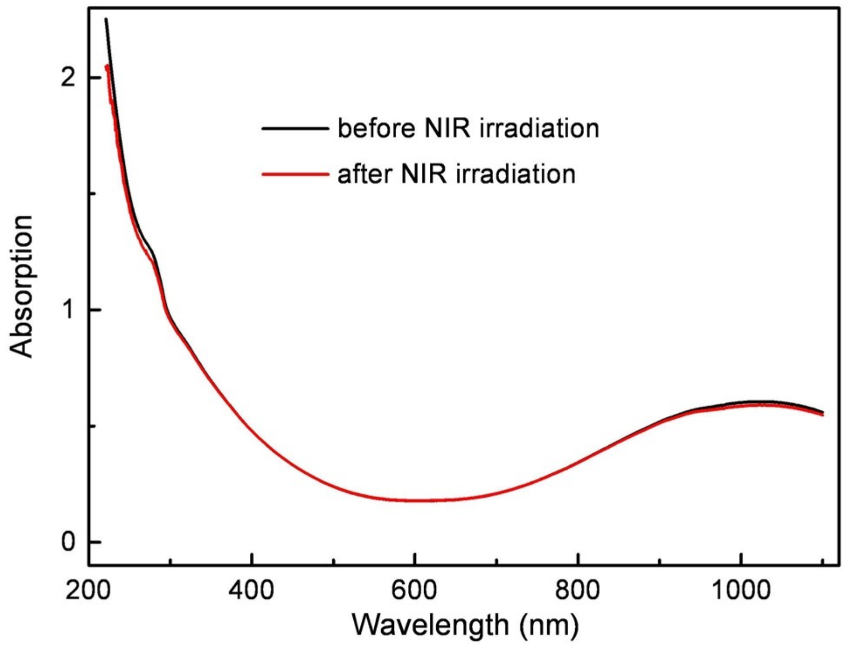

Fig. S4 UV–vis absorption spectra of CuS/PCCNS nanocomposites before (black line) and after (red line) NIR irradiation.

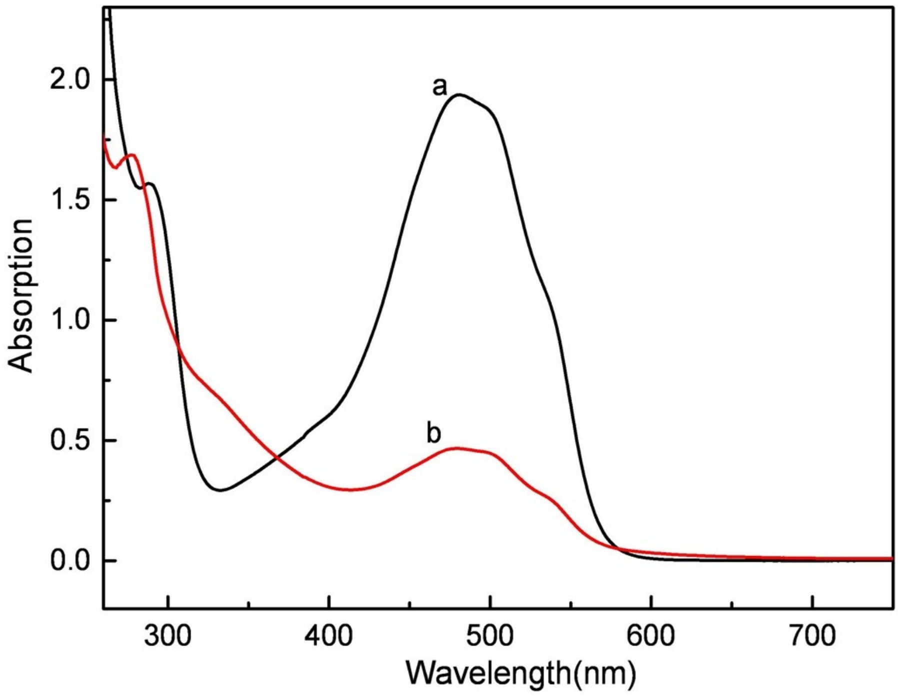

Fig. S5 UV-vis of before (a) and after (b) Dox loading onto CuS/PCCNS nanocomposites in aqueous solution.

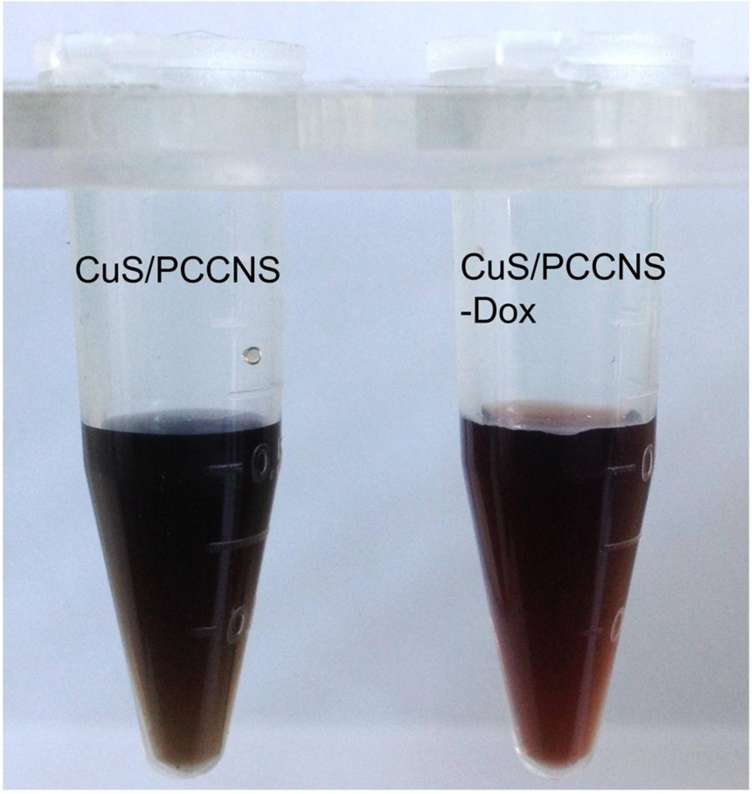

Fig. S6 Photos of CuS/PCCNS and CuS/PCCNS-Dox nanocomposites dispersed in water.

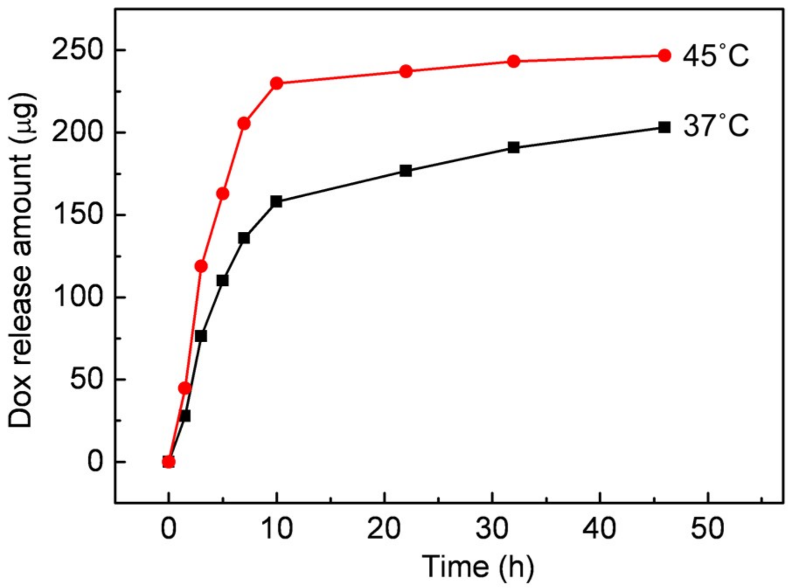

Fig. S7 Dox-release profiles from CuS/PCCNS-Dox nanocomposites at 37°C and 45°C in PBS at pH 5.5.

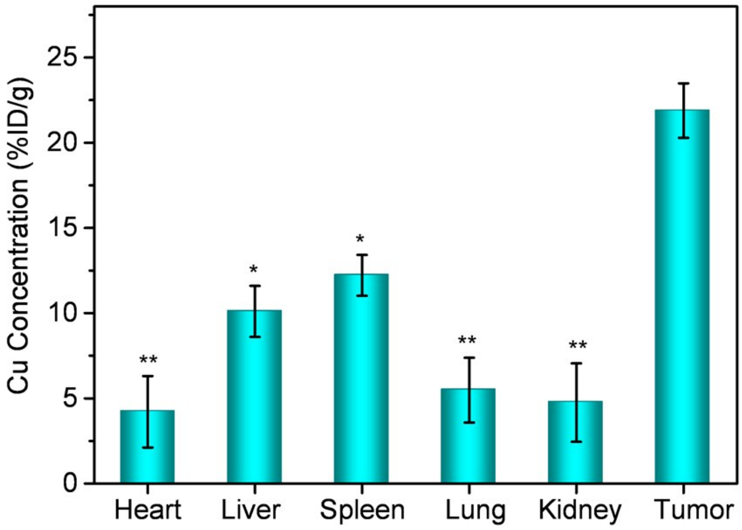

Fig. S8 Biodistribution of CuS/PCCNS after intratumoral injection into U14 tumor-bearing mice for 24 h as determined Cu concentrations by ICP-MS in various organs and tumor. The results were shown as mean values ± standard deviation (SD, n = 3). P values were calculated by the methodology of Student's t test (*p<0.05, **p<0.01, or ***p<0.001).