Electronic Supplementary Information

CuS-Pt (IV)-PEG-FA nanoparticles for targeted Photothermal and chemo-therapy

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Calculation of the photothermal conversion efficiency

The photothermal conversion efficiency of CuS was determined according to previous method.[1,2] Detailed calculation was given as following:

Based on the total energy balance for this system:

$$\sum_i m_i C_{p,i} \frac{dT}{dt} = Q_{NPs} + Q_s - Q_{loss} \quad (1)$$

m and C_p are the mass and heat capacity of solvent (water). T is the solution temperature.

Q_{NPs} is the photothermal energy input by CuS:

$$Q_{NPs} = I(1 - 10^{-A_\lambda})\eta \quad (2)$$

I is the laser power, A_λ is the absorbance of CuS at the wavelength of 808 nm, and η is the conversion efficiency from the absorbed light energy to thermal energy.

Q_s is the heat associated with the light absorbance of the solvent, which is measured independently to be $Q_s = (5.4 \times 10^{-4}) I\ J\ s^{-1}$ using pure water without CuS.

Q_{loss} is thermal energy lost to the surroundings:.

$$Q_{loss} = hA\Delta T \quad (3)$$

h is the heat transfer coefficient, A is the surface area of the container, and ΔT is the

temperature change, which is defined as $T - T_{surr}$(T and T_{surr} are the solution temperature and ambient temperature of the surroundings, respectively).

At the maximum steady-state temperature, the heat input is equal to the heat output, that is:

$$Q_{NPs} + Q_s = Q_{loss} = hA\Delta T_{max} \qquad (4)$$

ΔT_{max} is the temperature change at the maximum steady-state temperature. According to the Eq.2 and Eq.4, the photothermal conversion efficiency (η) can be determined:

$$\eta = \frac{hA\Delta T_{max} - Qs}{I(1 - 10^{-A_\lambda})} \qquad (5)$$

In this equation, only hA is unknown for calculation. In order to get the hA, we herein introduce θ, which is defined as the ratio of ΔT to ΔT_{max}:

$$\theta = \frac{\Delta T}{\Delta T_{max}} \qquad (6)$$

Substituting Eq.6 into Eq.1 and rearranging Eq.1:

$$\frac{d\theta}{dt} = \frac{hA}{\sum_i m_i C_{p,i}}\left[\frac{Q_{NPs} + Q_s}{hA\Delta T_{max}} - \theta\right] \qquad (7)$$

When the laser was shut off, the $Q_{NPs} + Q_s = 0$, Eq.7 changed to:

$$dt = -\frac{\sum_i m_i C_{p,i}}{hA}\frac{d\theta}{\theta} \qquad (8)$$

Integrating Eq.8 gives the expression:

$$t = -\frac{\sum_i m_i C_{p,i}}{hA}\ln\theta \qquad (9)$$

Thus, hA can be determined by applying the linear time data from the cooling period *vs* $-\ln\theta$(Figure 3d). Substituting hA value into Eq.5, the photothermal conversion efficiency (η) of CuS solution can be calculated.

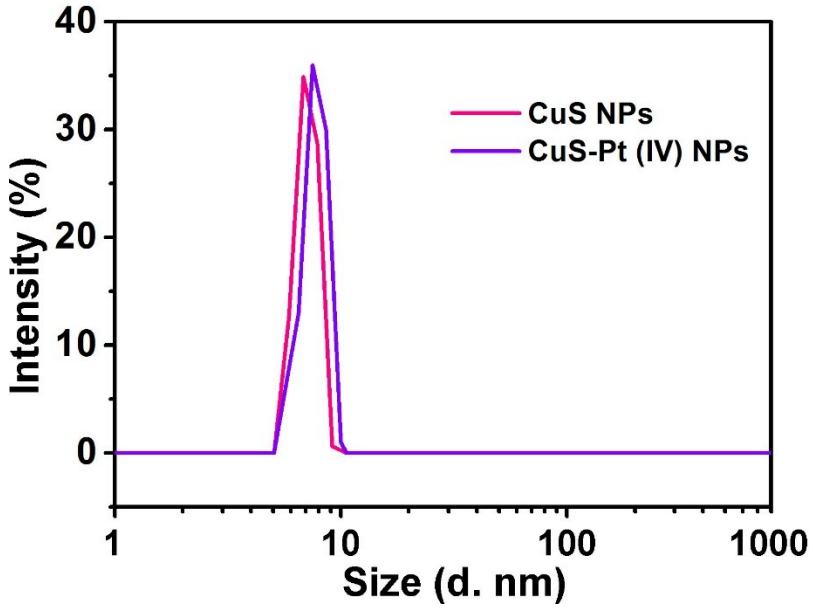

Fig. S1 The dynamic light scattering properties of CuS NPs and CuS-Pt (IV) NPs dispersed in deionized water.

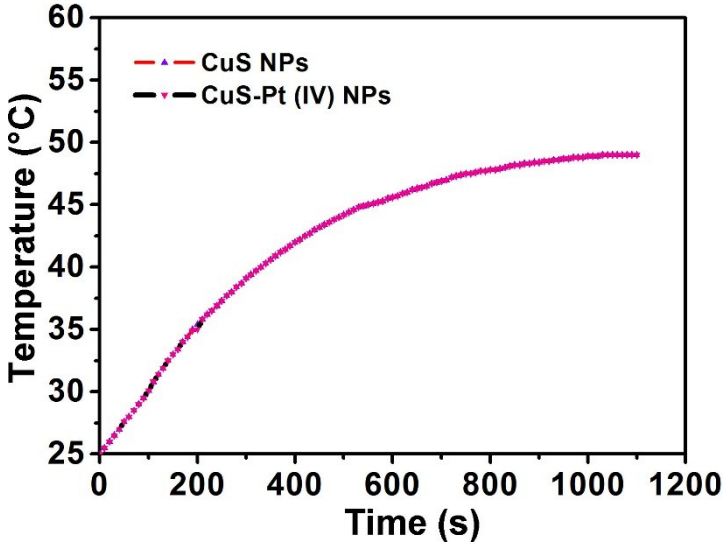

Fig. S2 Temperature elevation curves of CuS NPs and CuS-Pt (IV) NPs.

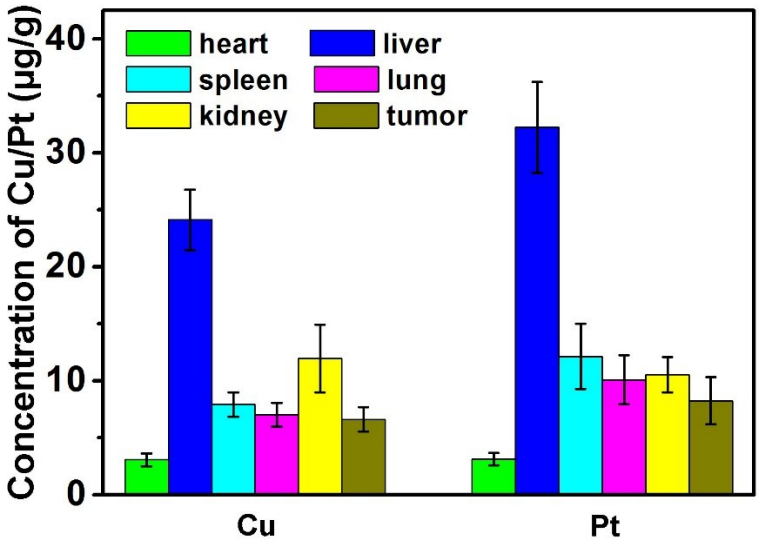

Fig. S3 The biodistribution of Cu and Pt in major organs of mice after injection of CuS-Pt NPs intravenously for 12 h.

References

1. Y. Liu, K. Ai, J. Liu, M. Deng, Y. He and L. Lu, *Adv. Mater.*, 2013, **25**, 1353-1359.

2. D. K. Roper, W. Ahn and M. Hoepfner, *J. Phys. Chem. C*, 2007, **111**, 3636-3641.