

Quantitative evaluation and *in vivo* visualization of bioaccumulation of Hg²⁺ into rotifer by novel aggregation-induced emission fluorogen nanoparticles

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Supporting information

1. Response of AIE to Hg²⁺ in salt water

The photoluminescence (PL) intensity of AIE with Hg²⁺ affected by the salinity, reaction time and concentrations of AIE and Hg²⁺.

Salinity effect: The effect of PL intensity with different salinity in AIE and Hg²⁺ reaction is shown in Fig. S1. With fixed AIE and Hg²⁺ concentrations at 10 μM and at time elapse of 30 min, the fluorescence intensity decreased with increasing salinity from 0 to 35.

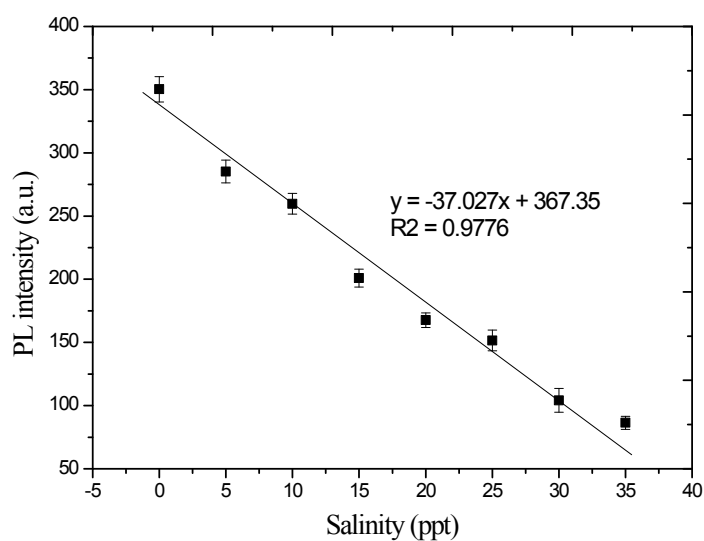


Fig. S1. Photoluminescence (PL) intensity of Hg²⁺ and AIE at the concentration of 10 μM at salinity of 0, 5, 10, 15, 20, 25, 30, 35 after 30 min.

Time effect: The effect of time elapse on PL intensity associated with AIE and Hg²⁺ reaction is shown in Fig. S2. With fixed AIE and Hg²⁺ concentrations at 10 μM and time elapse at 1, 5, 15, 30 and 45 min, the fluorescence intensity increased with reaction time during the initial 30 min, and reached a plateau at 30 min. A slight decrease was observed from 30 min to 45 min.

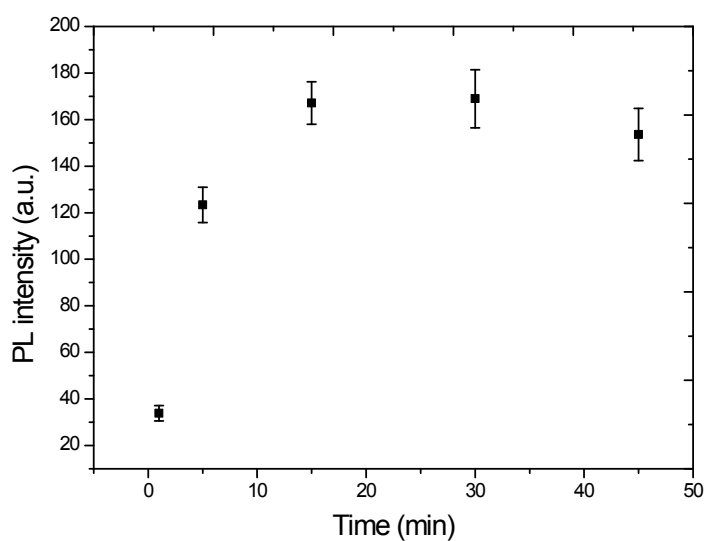


Fig. S2. Photoluminescence (PL) intensity of AIE concentration of 10 μM and Hg^{2+} concentration of 10 μM at different time elapse of 1, 5, 15, 30, 60 and 90 min.

2. Response of rotifer to Hg^{2+} in salt water

An acute toxic experiment was conducted to further determine the effect of Hg^{2+} toxicity on rotifer *B. plicatilis*. Fig. S3 shows the survival rate of rotifer after 1-h incubation at different Hg^{2+} concentrations, followed by 24-h recovery in clean water. After incubation with 1 μM Hg^{2+} , 85% rotifers survived, but rotifer survival rates reduced to 40.7% and 15.6% after Hg^{2+} incubation at 2.5 μM and 5 μM , respectively (Fig. S4).

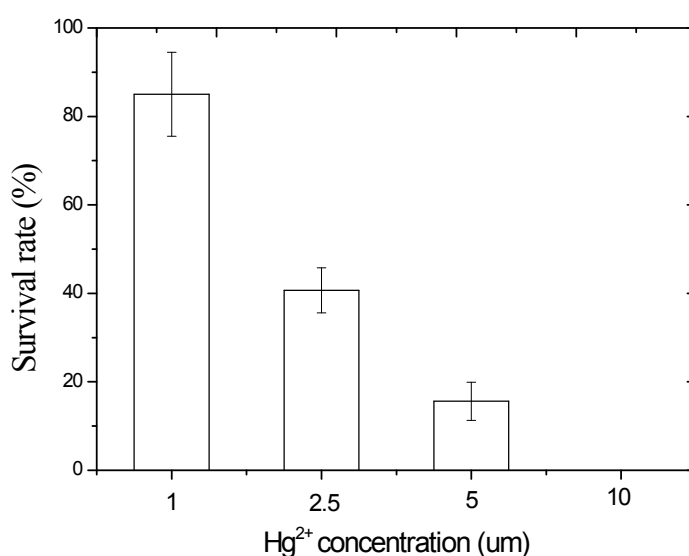


Fig. S3. Survival rate of rotifer after 1 h incubation at different Hg^{2+} concentrations (1, 2.5, 5 μM) followed by recovery in clean water for 24 h.

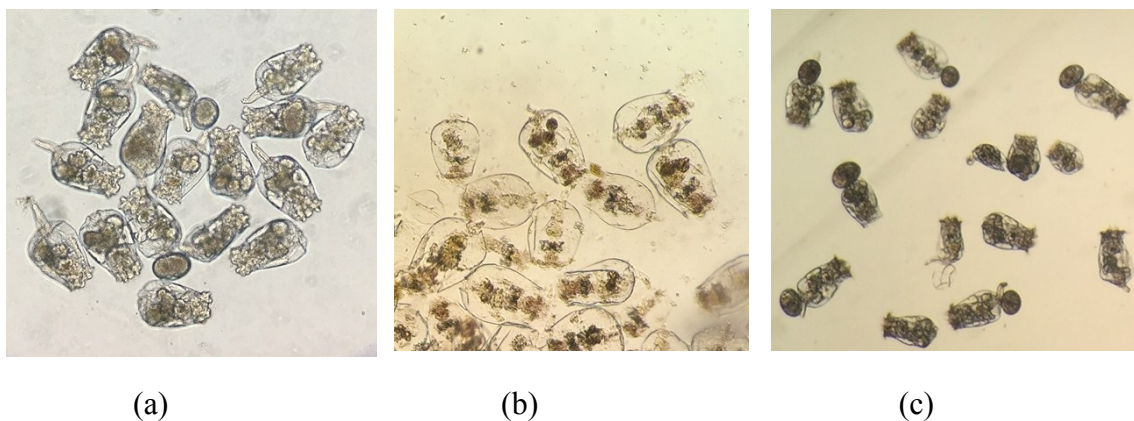


Fig. S4. Images of rotifers (a) live, (b) dead and (c) live with eggs.

3. AIEgen nanoparticles characterization

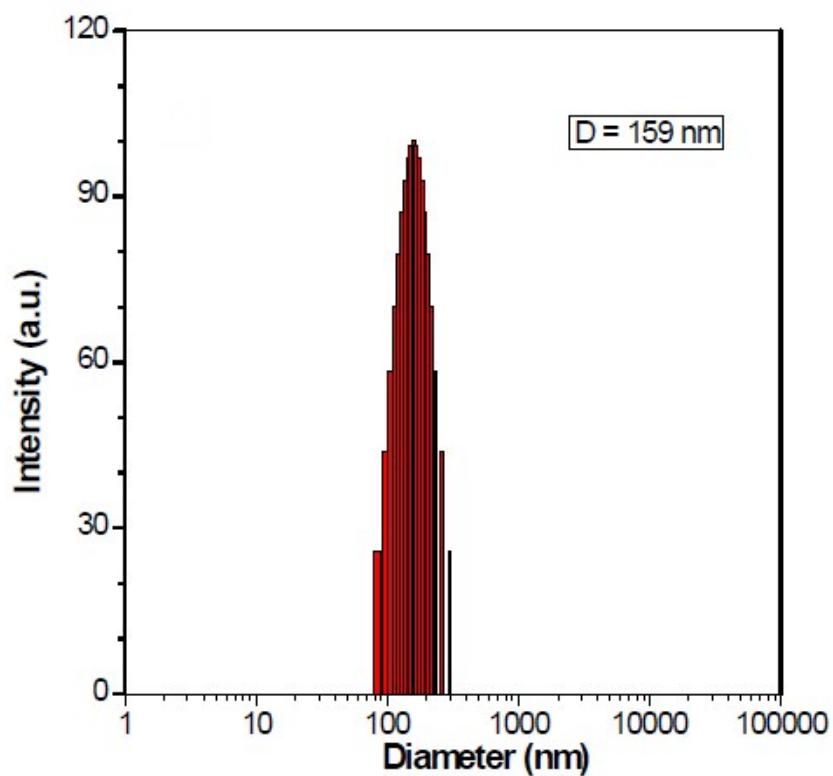


Fig. S5. Particles size of the nano-aggregated of $10 \mu\text{M}$ m-TPE-RNS in CH_3CN -water mixture with 60% water fraction measured by DLS [1].

4. Scanning confocal microscope configuration

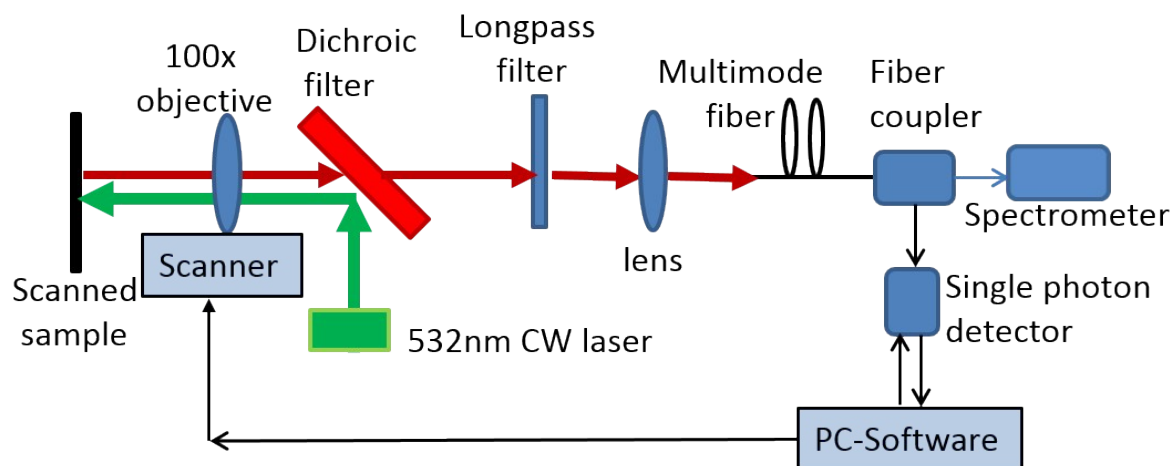


Fig. S6: Scanning confocal microscope configuration for fluorescence intensity imaging of the samples. 100x objective is mounted onto the scanner and its position is shifted to scan the samples.

5. Master curve for PL intensity with Hg^{2+} concentration

The effect of PL intensity with the function of Hg^{2+} concentration is shown in Fig. S7. With fixed AIE concentration at $10 \mu\text{M}$ and interaction time at 30 min, the fluorescence intensity increased with increasing the concentration of Hg^{2+} (1, 5, 10, 20 and $30 \mu\text{M}$), and reached a plateau at $10 \mu\text{M}$ of Hg^{2+} . A linear relationship between fluorescence intensity and Hg^{2+} concentration was observed when the ratio of Hg^{2+} and AIE was less than 1.

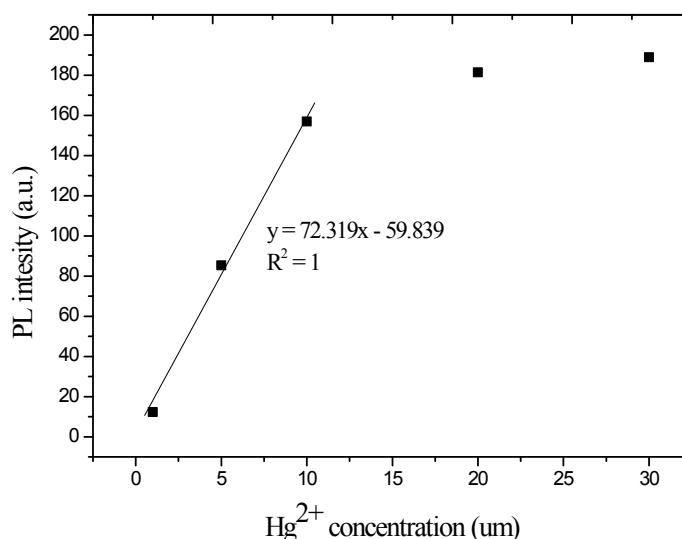


Fig. S7. Photoluminescence (PL) intensity of Hg^{2+} (1, 5, 10, 20, $30 \mu\text{M}$) at the AIE concentration of $10 \mu\text{M}$ at salinity 20 and time elapse time 30 min.

8. Bioaccumulation of Hg^{2+} at different rotifer densities

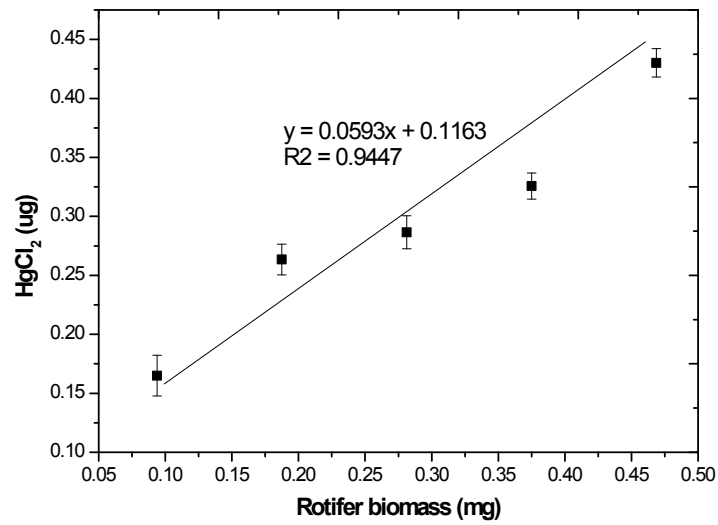


Fig. S8. Bioaccumulation of Hg^{2+} (HgCl_2 , 5 μM) at different rotifer densities (mg/mL) within 20 min. Lines from the linear curve fit with the equations presented.

9. Bioaccumulation of Hg^{2+} at different rotifer densities

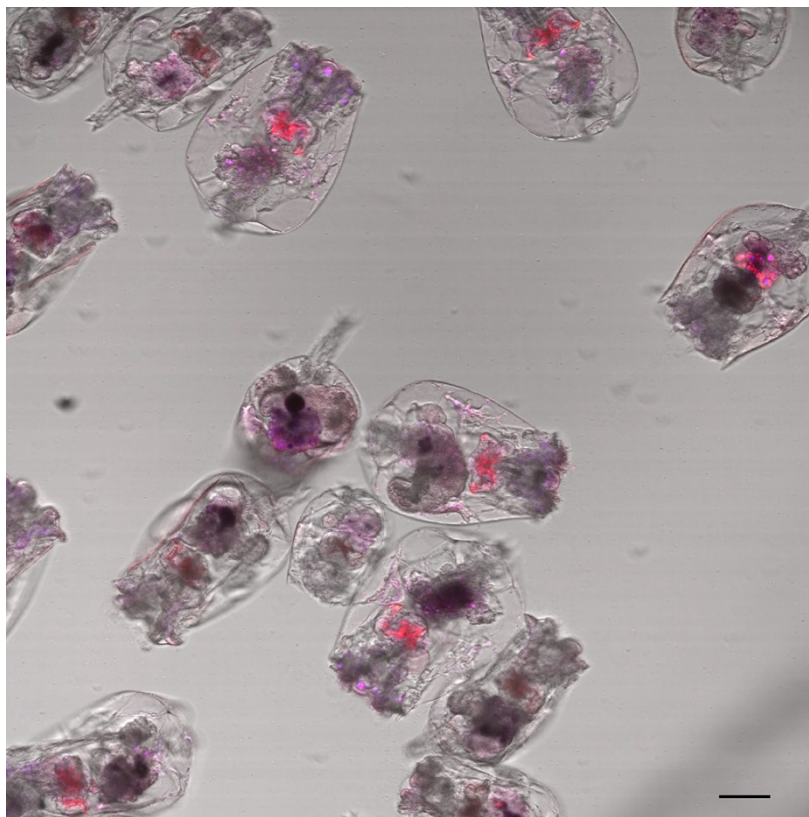
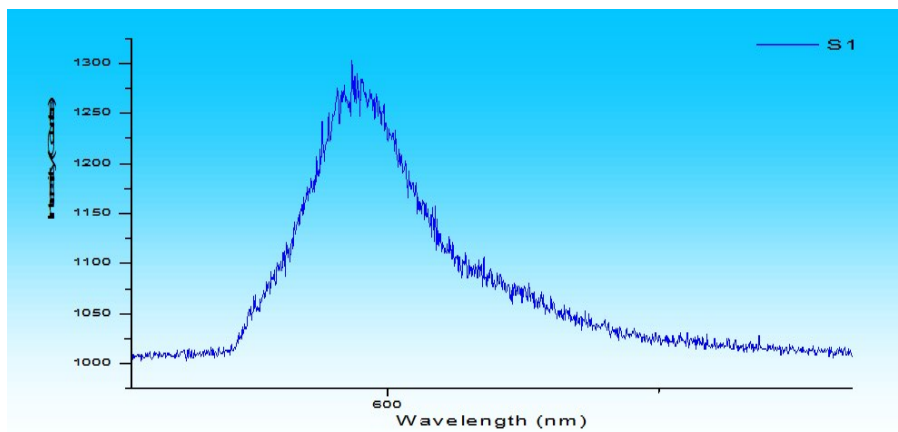


Fig. S9: Fluorescent image of Hg^{2+} in rotifers using AIEgens with small magnification. Bar = 50 μm .

10. Detail FL spectrum obtained from the spectral analysis system

(a)



(b)

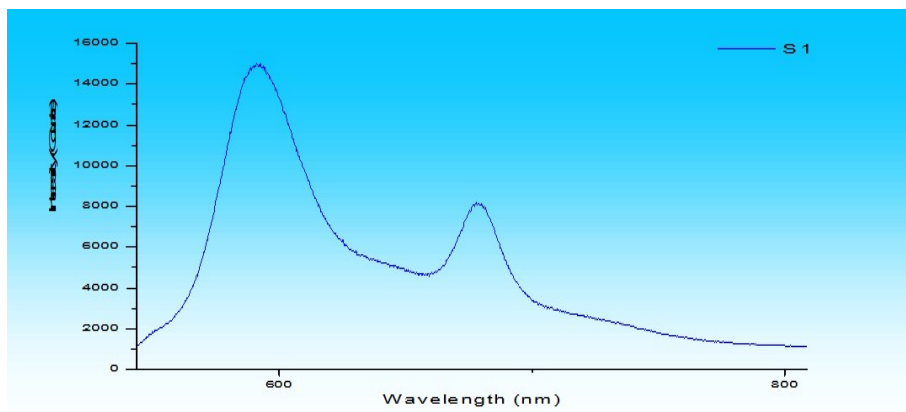


Fig. S10. The PL spectra of points corresponding to (a) Fig 8 (c) and (b) Fig 8 (d) in the main text.

References

- [1] Y. Chen, W. Zhang, Y. Cai, R. T. K. Kwok, Y. Hu, J. W. Y. Lam, X. Gu, Z. He, Z. Zhao, X. Zheng, B. Chen, C. Gui and B. Z. Tang, *Chem. Sci.*, 2017, 8, 2047-2055.