

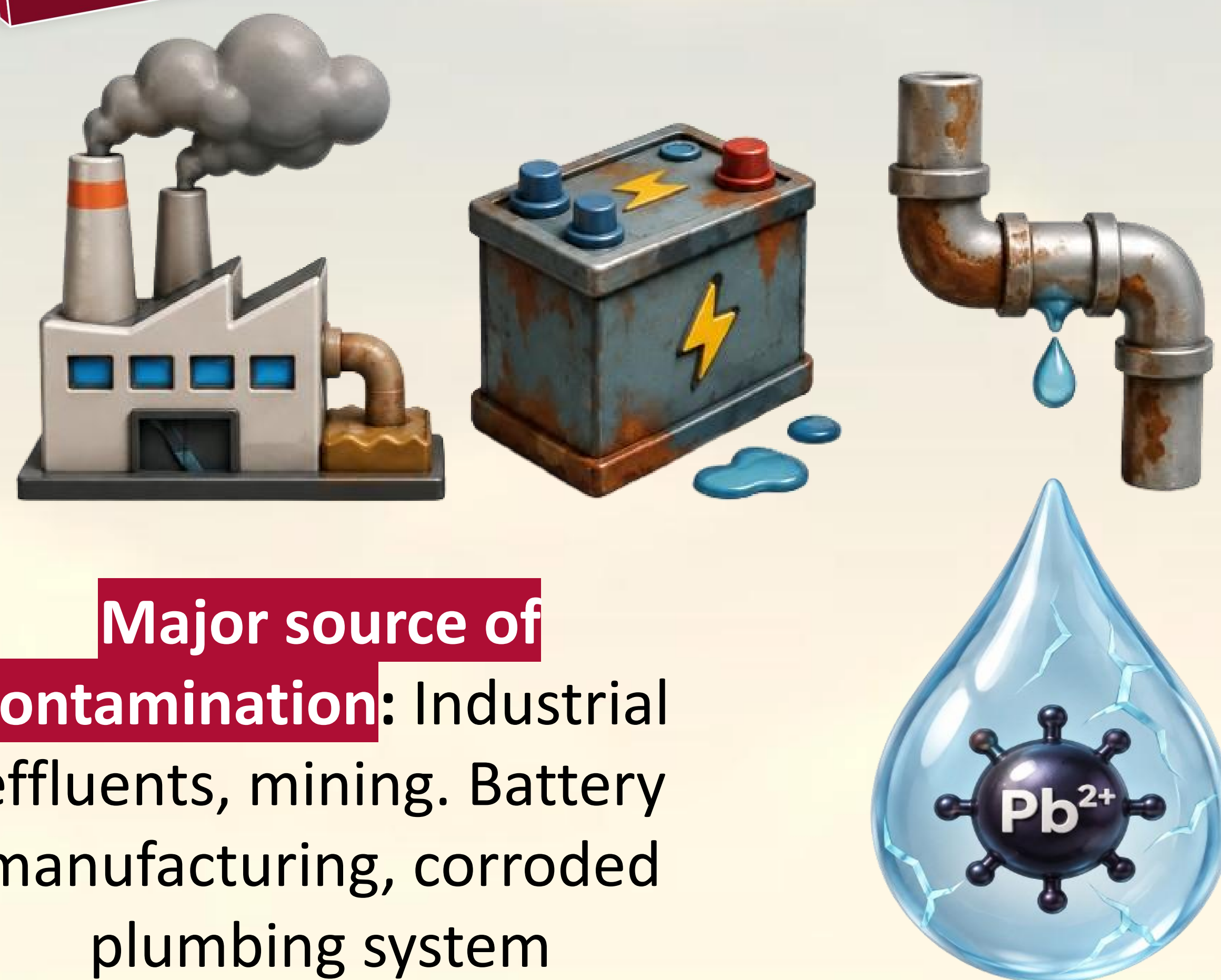
Green Valorization of Cocoa Pod Husk into Carbon Quantum Dots for Water-Safe Fluorescent Detection of Pb²⁺

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Introduction



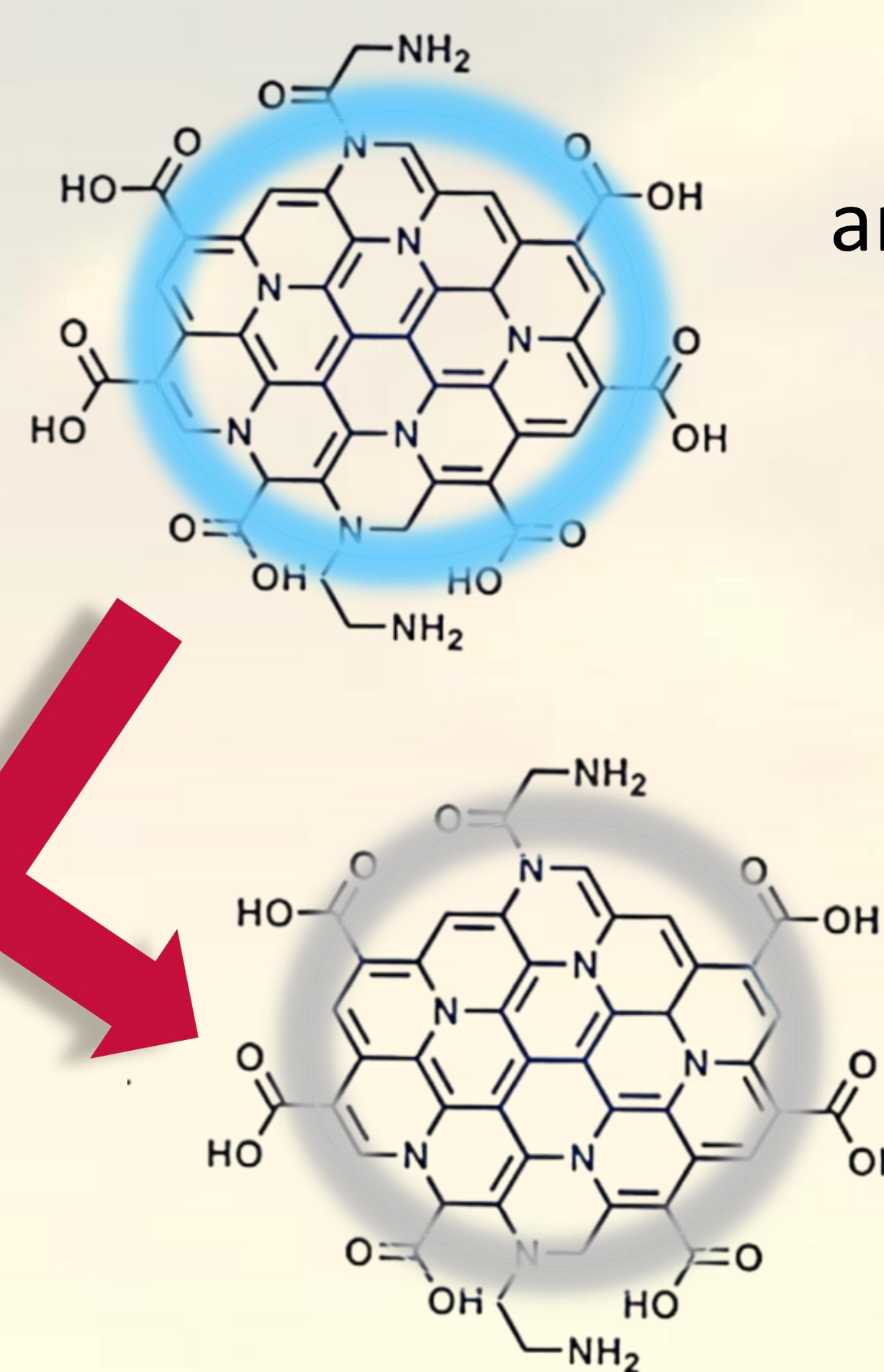
Major source of contamination: Industrial effluents, mining. Battery manufacturing, corroded plumbing system

Lead is highly toxic and non-biodegradable: The WHO guideline value for lead in drinking water is 0.01 ppm



Conventional detection is expensive and complex: Current methods like AAS require costly instrumentation and lack portability for field testing

Methodology



Development of carbon quantum dots with 'turn on' and 'turn off' properties for the detection of Pb²⁺

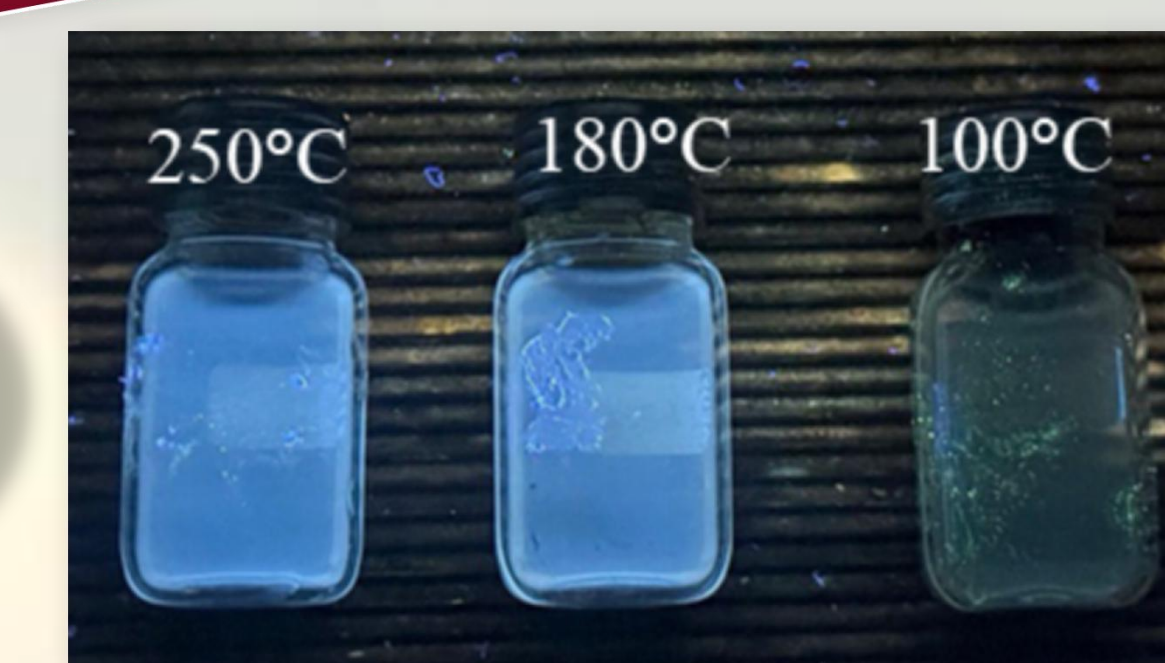
Investigation of the Limit of Detection (LOD) and Kinetic Study

Evaluate fluorescence sensing performance using different initial concentrations of Pb²⁺ ions (0-50 ppm)

Synthesis and characterization of carbon quantum dots (CQD) via hydrothermal method at different temp.

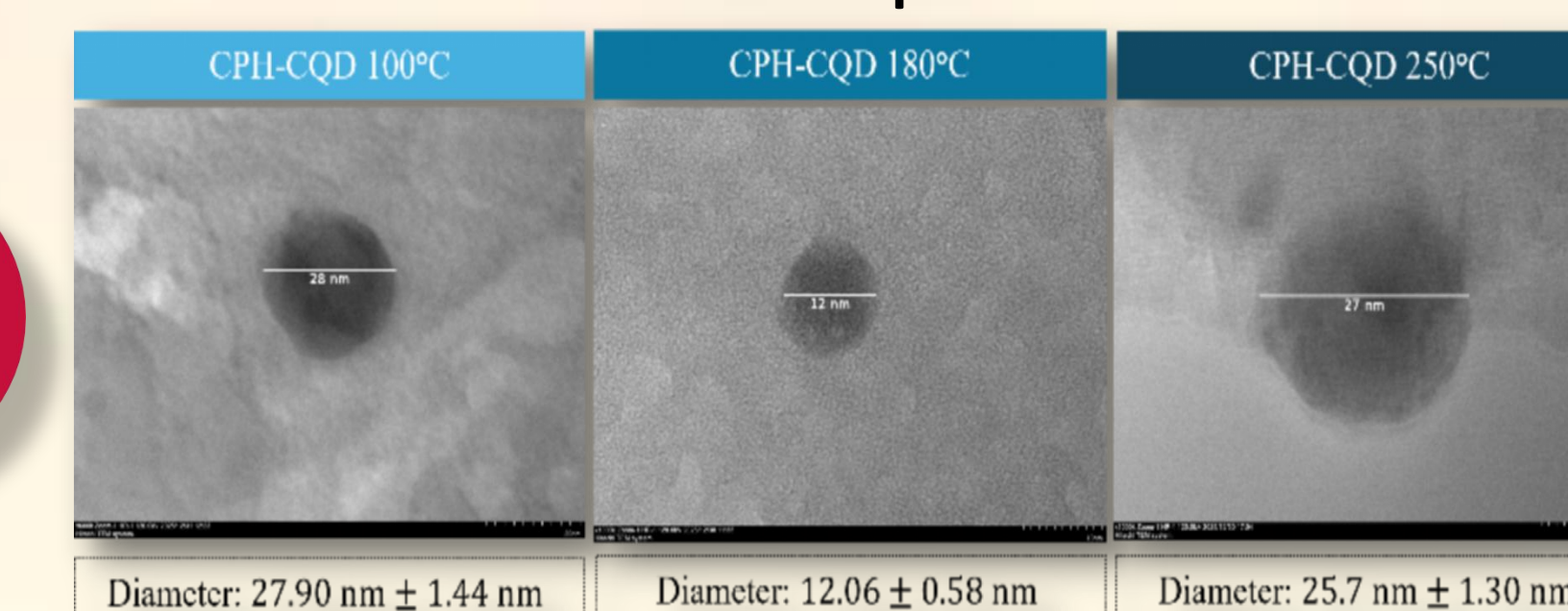
Results

1



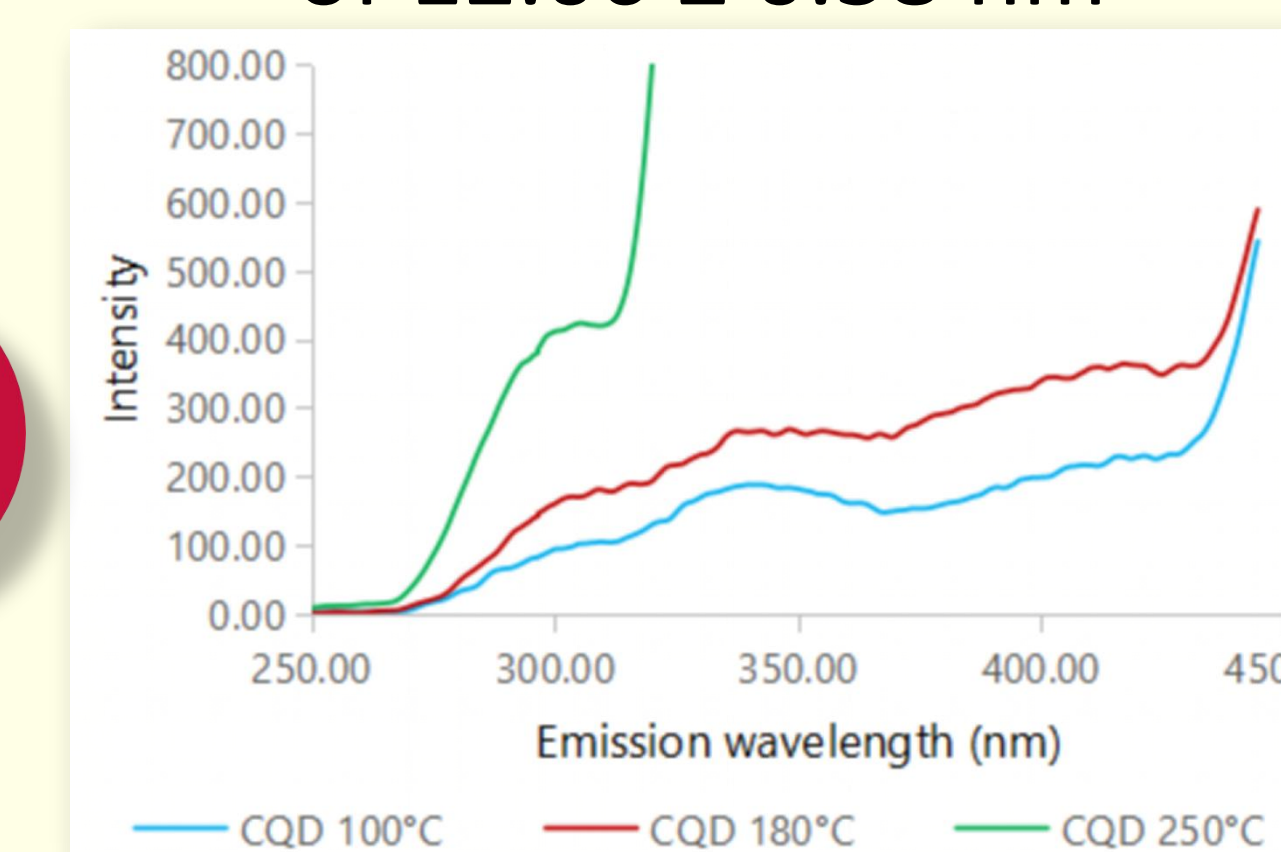
❖ From UV light, CQD180 & CQD250 emitted bright blue fluorescence, attributed to the $\pi \rightarrow \pi^*$ electronic transition. CQD 100 does not fluoresce due to incomplete carbonization

2



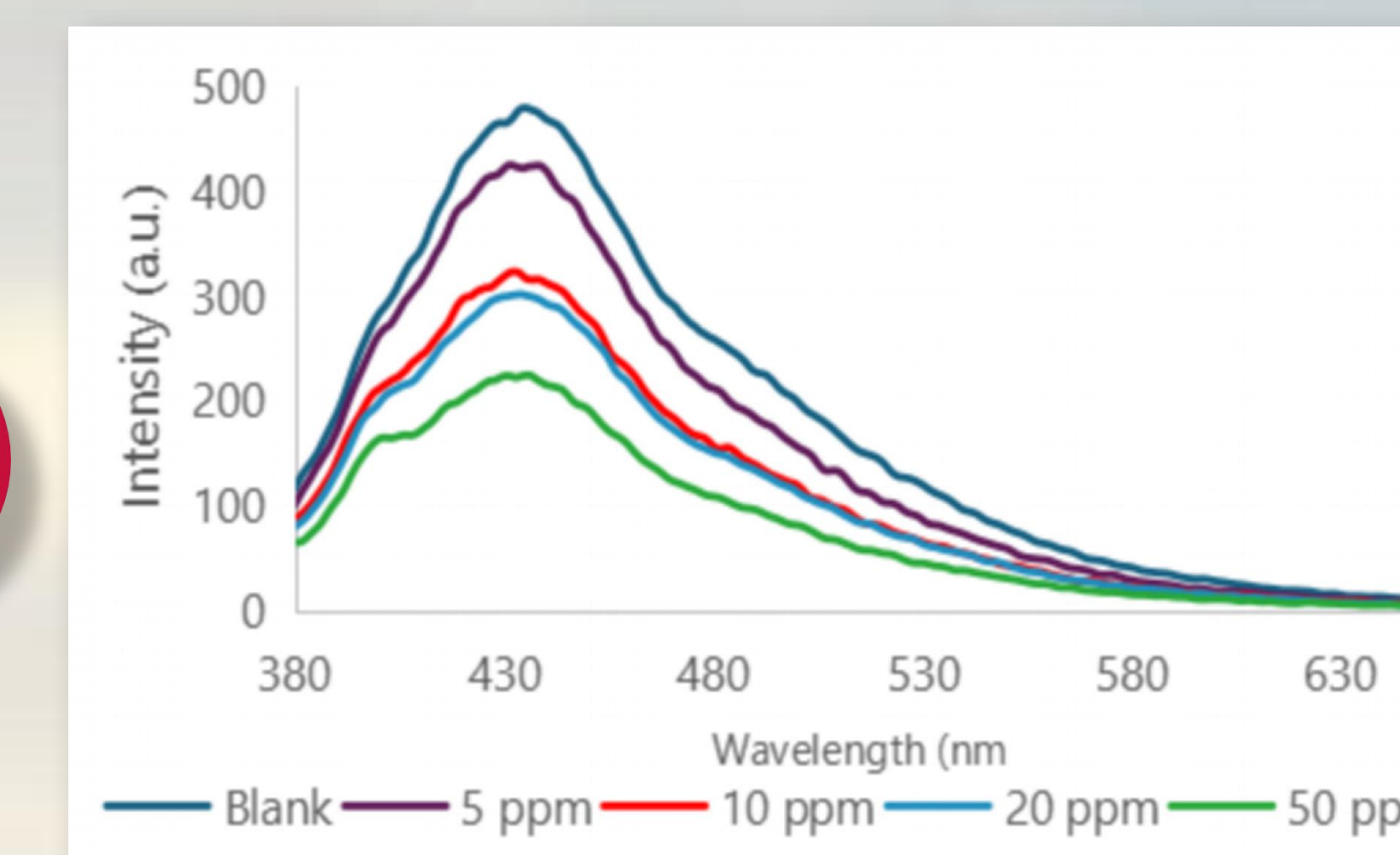
❖ From HRTEM, CQD180 exhibited the optimal morphology, characterized by discrete, quasi-spherical nanoparticles with a mean diameter of 12.06 ± 0.58 nm

3



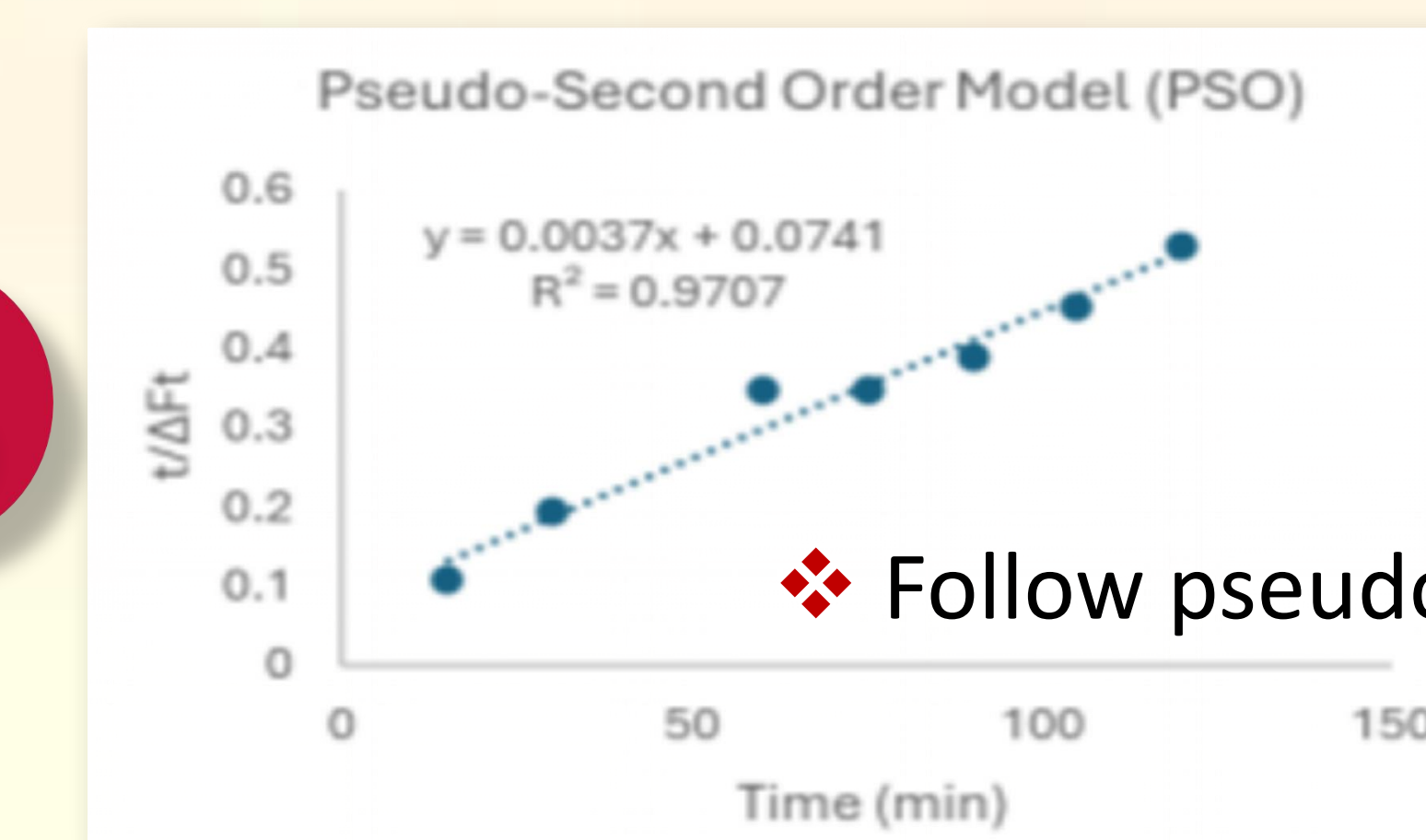
❖ The fluorescence intensity of the CQD250 shows a sharp spike intensity: elastic scattering interference occurred due to CQD aggregation. CQD180 was selected for further study.

4



❖ An increase in lead ion leads to a decrease in fluorescence intensity at the maximum peak wavelength of 435 nm
❖ From Stern Volmer Plot, $R^2=0.928$ with a quenching constant of 0.0213 ppm^{-1} was achieved indicating a static quenching mechanism with LOD calculated to be 1.80 ppm

5



❖ Follow pseudo-second order

Conclusion

❖ Successful development of CQD-based fluorescent sensor for Pb²⁺ detection in water
❖ Supports SDG 6 – Clean Water and Sanitation
❖ Future improvement: Enhance LOD through heteroatom doping of CQDs