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# Investigation of carbon dots for toxic metal chelation therapy employing red blood cell membranes as a biomimetic model

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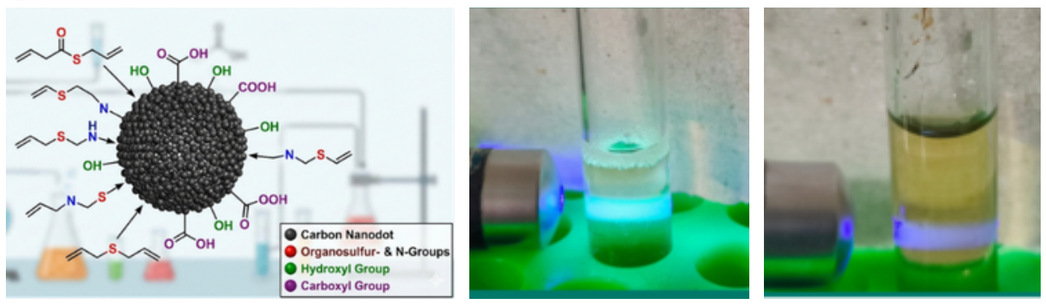
## INTRODUCTION & AIM

- **Garlic-derived carbon dots (GDCDs)** represent a promising biomaterial class in theranostic and heavy-metal detoxification applications owing to their excellent optical properties, near-absent immune toxicity, and intrinsic biocompatibility, but **suffer from a lack of structural targeting** specificity and non-uniform binding motifs.
- **Surface and compositional modification of carbon dots** can effectively solve this problem, retaining most of their advantageous photoluminescent and core properties.
- In this study, **sulfur-functionalized** core structures were fabricated using a facile hydrothermal method, and the interface was bio-functionalized via multi-dentate carboxyl and sulfhydryl tracking networks to evaluate their protective, anti-hemolytic efficacy against acute mercury-induced cytotoxicity in red blood cell models.

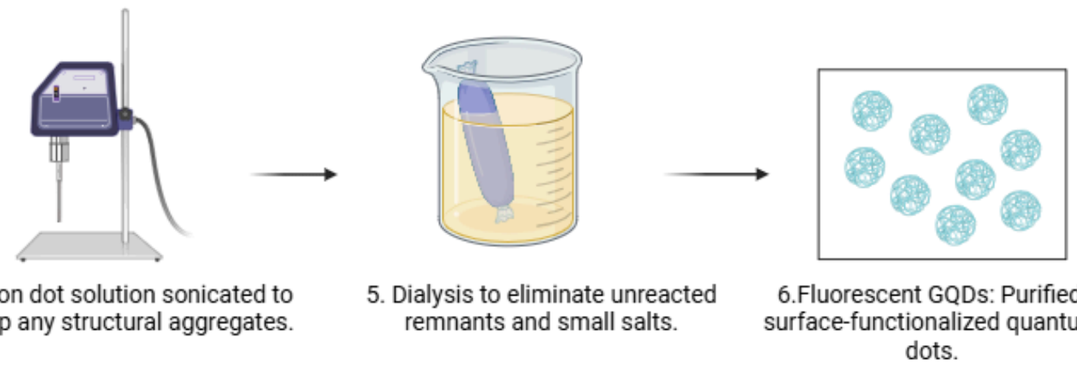



## METHOD

1.Fresh garlic cloves (1g) pulverized to fine paste.

2. Paste extract centrifuged at 5,000 rpm to isolate crude.

3. Liquid extract heated at 200°C for 20 min until brown.



4. Carbon dot solution sonicated to break up any structural aggregates.

5. Dialysis to eliminate unreacted remnants and small salts.

6.Fluorescent GQDs: Purified, surface-functionalized quantum dots.

**Figure 1. Schematic workflow for the green hydrothermal synthesis of garlic-derived carbon dots (GDCDs) via microwave-assisted carbonization, acoustic dispersal, and membrane dialysis refinement.**

## RESULTS & DISCUSSION

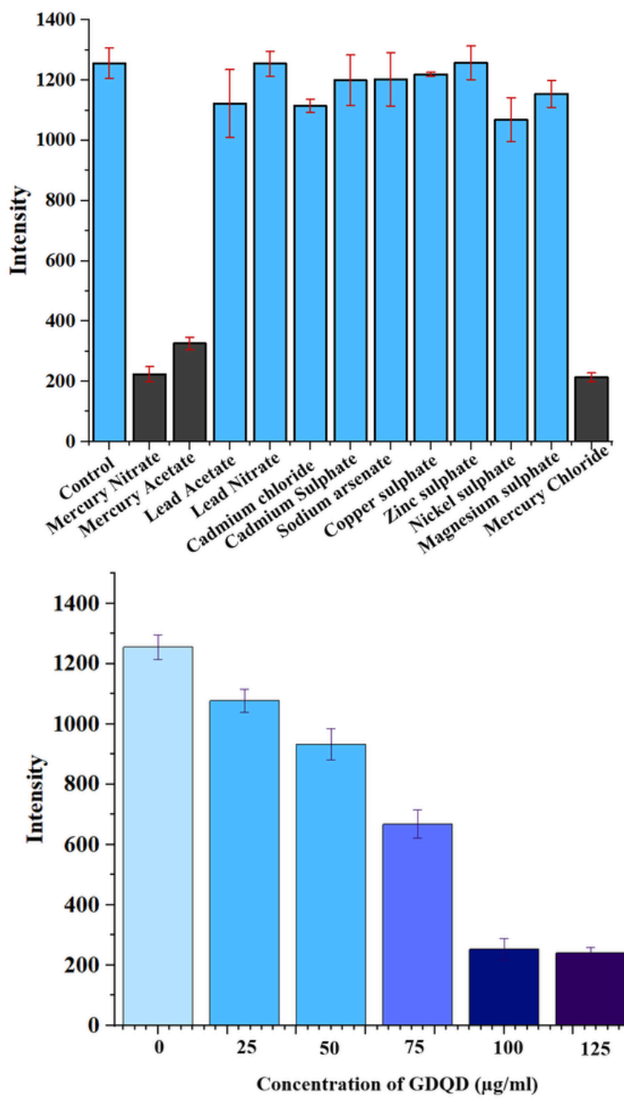






**Figure 2: A) Fluorescence intensity of GDCD incubated with different metal ions B) Fluorescence intensity of 100 µg/ml of mercury chloride incubated with different concentrations of GDCD**

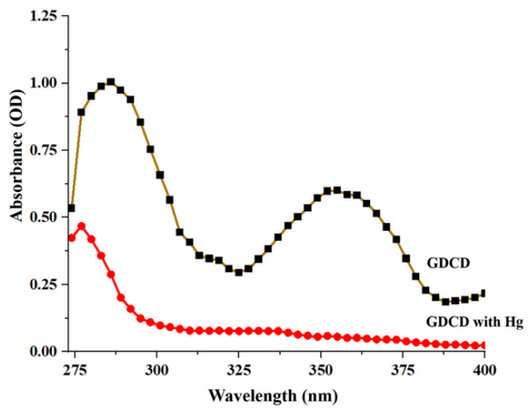



**Figure 3: UV-visible absorption spectrum of GDCD and mercury chelated**

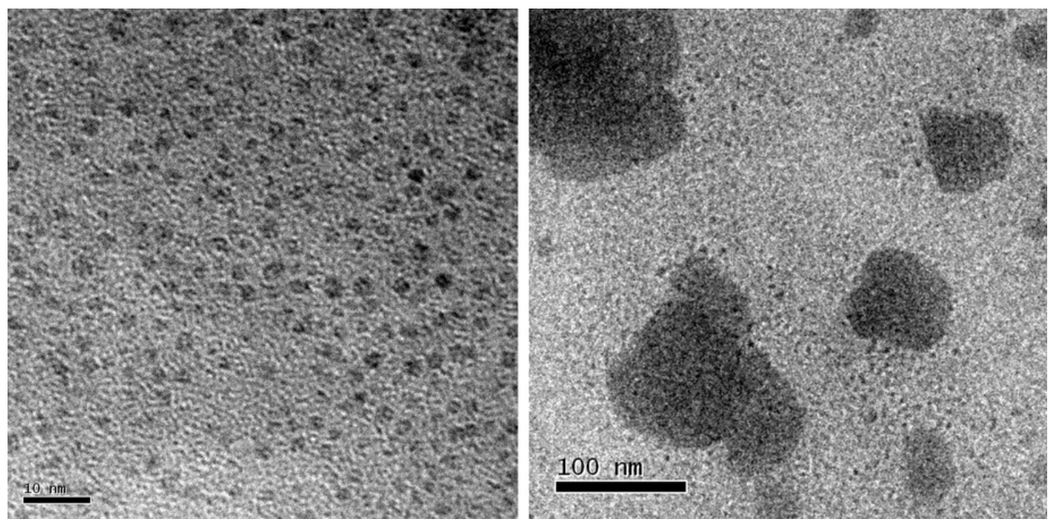



**Figure 4: Transmission electron microscopy of GDCD and mercury chelated GDCD**

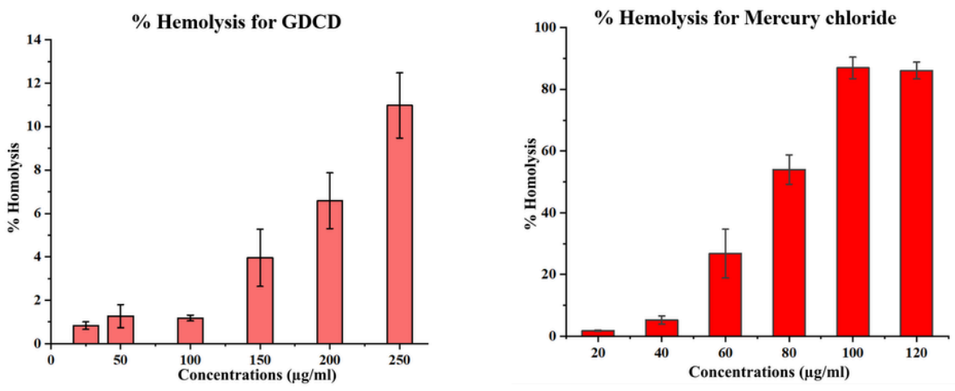



**Figure 5: Hemolysis assay for A) GDCD B) Mercury chloride C) Mercury chloride incubated with GDCD at various ratios**

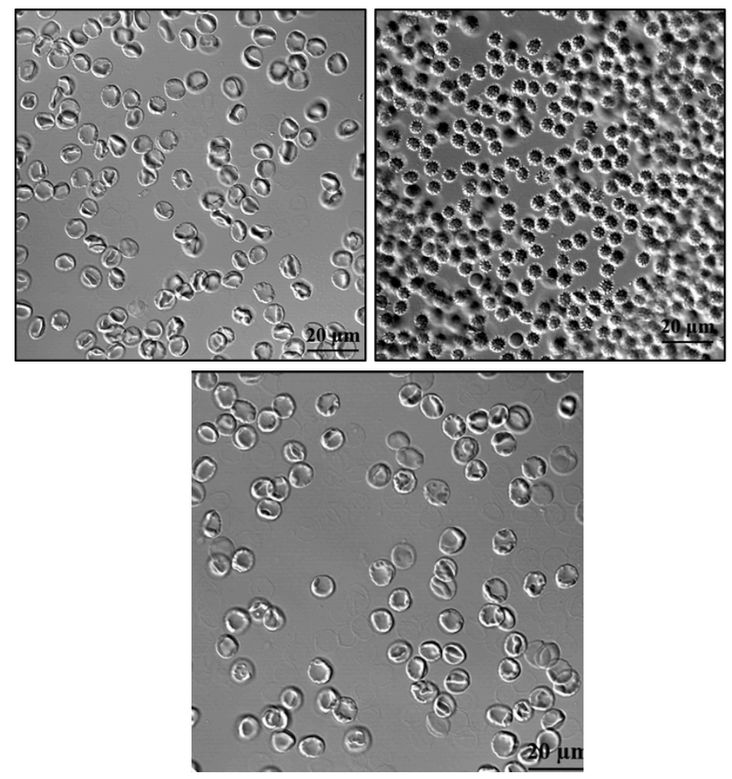



**Figure 6: Microscopy image of A) Control RBC, B) Mercury chloride incubated with RBCs, C) Mercury chloride and GDCD incubated with RBCs**

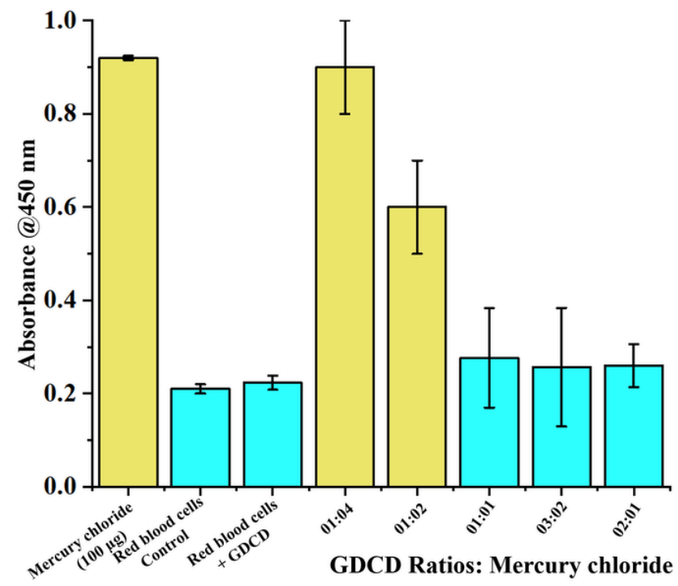



**Figure 7: A) Lactate dehydrogenase Assay for RBC incubated with mercury chloride alone, GDCD alone and various ratios of mercury chloride to GDCD**

## CONCLUSIONS

This study highlights the potential of GDCD as an efficient, low-cost and **biocompatible nanomaterial** for metal ion chelation. Their application may extend to wastewater treatment, the management of metal-induced pathological conditions.

## REFERENCES

[1] J. Briffa, E. Sinagra, R. Blundell, Heavy metal pollution in the environment and their toxicological effects on humans, Heliyon 6(9) (2020).

[2] M. Balali-Mood, K. Naseri, Z. Tahergorabi, M.R. Khazdair, M. Sadeghi, Toxic Mechanisms of Five Heavy Metals: Mercury, Lead, Chromium, Cadmium, and Arsenic, Frontiers in pharmacology 12 (2021) 643972.