

Faculty Member Contact Information

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Contact Info	
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Department	Chemistry

2 Unfunded URCA Assistant(s)

Are you willing to work with students from outside of your discipline? If yes, which other disciplines?

- Yes

How many hours per week will your student(s) be required to work in this position?
(Minimum is 6 hours per week; typical is 9)

- 9 hours

Will it be possible for your student(s) to earn course credit?

- Yes, in CHEM 296/396/496 for 1-2 credit hours.

Location of research/creative activities:

- Department of Chemistry, Science West, Room 3270

Brief description of the nature of the research/creative activity?

- Use of Supramolecular Host-Guest Association with Modified Silver Nanoparticles for Chemosensing Applications:
- Silver nanoparticles (AgNPs) have emerged over the last century as powerful tools for toxic ion sensing due to their high surface-to-volume ratio and surface plasmon resonance properties. However, the ability of silver nanoparticles to successfully screen various metal ions depends on the methods used during synthesis. In this study, we employed the supramolecular assembly of β -Cyclodextrin (β -CD) and 1,2,3- triazole (ADT) to synthesize and stabilize AgNPs. Experiments using AgNP/ β -CD and AgNP/ADT inclusion complexes were performed independently to test whether varying β -CD and ADT concentrations in the synthetic methodology would affect the size distribution, absorbance, and stability of the prepared nanoparticles. The objective of this study is to

demonstrate that modifying and enhancing synthetic processes yield nanoparticles with elevated absorbance λ_{max} values, low polydispersity index, and enhanced stability for toxic ion screening. The use of β -CD and ADT as capping agents has exhibited potential in synthesizing shape and size-controlled nanoparticles, along with potential in chemosensing applications. To test the hypothesis, AgNPs were synthesized through the reduction of silver nitrate by sodium borohydride and subsequently encapsulated by β -CD and ADT. AgNP inclusion complexes were optimized by various concentrations of β -CD and ADT through optical characterization using Dynamic Light Scattering and UV-Vis Spectroscopy for metal ion sensing.

Brief description of student responsibilities?

- 1. During their time, the researcher will review the relevant literature to plan out the methodology for preparing the microemulsion.
- 2. They will be working towards generating pilot data on this research by:
 - (a) synthesizing silver nanoparticles and functionalizing them for stable nanoparticle formation.
 - (b) characterizing the nanometals using UV-Vis spectroscopy and the dynamic light scattering technique, and understanding the fluorescence properties of the molecules under study in a supramolecular environment
 - (c) Assessing the inclusion complex formed between silver nanoparticles and supramolecules using UV-Vis and fluorescence spectroscopy for the binding mechanism.

URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals. What exactly should your student(s) have learned by the end of this experience?

- The researcher working on this project will receive training in both qualitative and quantitative research methodology. They will be able to:
 - a) gather literature, explore, and cite any previous work,
 - b) prepare appropriate concentrations of supramolecule solutions of different categories based on their diameter and functional groups,
 - c) determine the size and stability of the nanoparticles formed through the encapsulation of organic molecules in a colloidal environment
 - d) gain expertise in different spectroscopic techniques such as absorption, steady-state fluorescence, and fluorescence anisotropy,
 - d) disseminate research output through conference presentations and publish articles in highly impactful peer-reviewed journals.
 - e) The pilot data generated will help in developing a proposal for external funding agencies.

Requirements of Students

If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:

- I will work inclusively with students to set their timings. Given the safety of the students in a chemistry lab, the recommendation is to adjust the times on weekdays (M-F) between 8 am and 5 pm.

If the location of the research/creative activities involves off campus work, must students provide their own transportation?

- A part of the research project will include testing outside the facility in the building. The students must be able to provide their own transportation in such circumstances.

Must students have taken any prerequisite classes? Please list classes and preferred grades:

- Completed CHEM 241 A/B and 245.

Other requirements or notes to applicants:

- Taking either the CHEM 245 or the Analytical Chemistry classes during the URCA application process.