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Introduction

- Silver nanoparticles (Ag NPs) have unique optical, electrical, and thermal properties which can be incorporated into products that range from photovoltaics to biological and chemical sensors.
- In this study, surface-enhanced Raman spectroscopy (SERS) and UV-vis spectroscopy were used to gather the information.
- Our work will give a fundamental understanding of the interactions between 4-mercaptobenzoic acid (4-MBA) and silver nanoparticles.

Research Objective

- Provide a fundamental understanding of the interaction between Ag NPs and 4-MBA for the development of SERS tag materials.

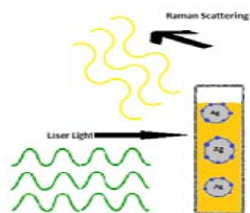
Procedure

Synthesis of Ag NPs

- The preparation of the Ag NPs was done using the seed-mediated Lee-Meisel method.

Study of the SERS and UV-vis

- Mix the Ag NP solution with different concentrations of 4-MBA.
- Vary different experimental parameters, for example concentration of 4-MBA or reaction time.



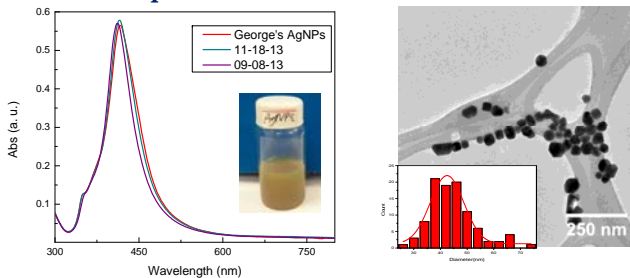
SERS diagram



SERS testing equipment

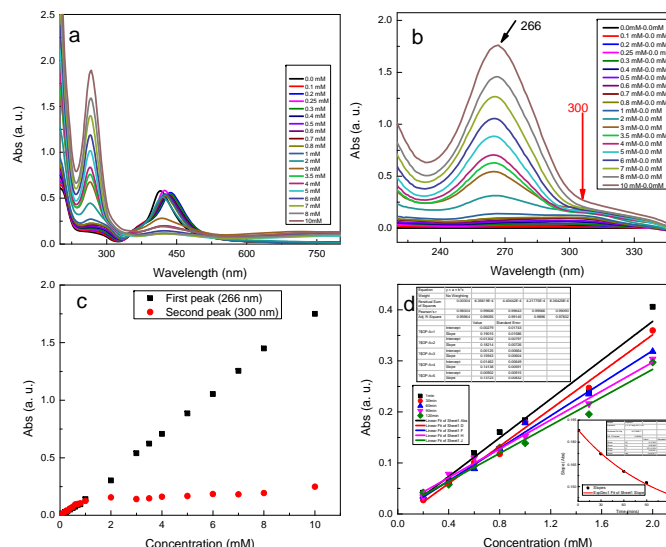
Results and Discussion

Silver Nanoparticles



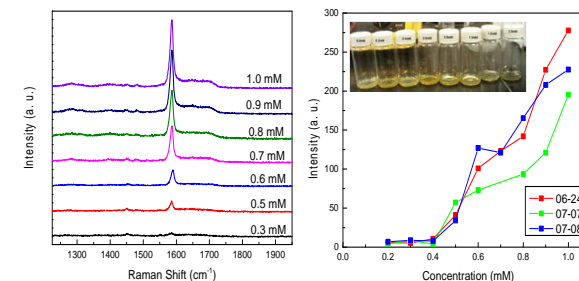
- The plot of UV-vis spectra for Ag NPs shows that all the peaks are around 416 nm. TEM images indicate that the size of the Ag NPs is around 45 ± 15 nm.

UV-vis Spectra



- UV-vis spectra of Ag NPs with various conc. of 4-MBA.
- Zoom in, Background corrected UV-vis Spectra.
- Absorbance of 266 & 300 nm with various 4-MBA conc.
- Changes in the slope (266 nm peak) during the reaction.

SERS for Colloidal Solution



- SERS comparison of Ag NPs with different 4-MBA concentrations. The intensity of the SERS at 1580 cm^{-1} is evaluated with increment of 4-MBA concentration.

Conclusions

- Interaction between 4-MBA and Ag NPs results in several interesting optical behaviors.
- As time progresses, the 266 nm peak slope (abs. vs. conc.) decreases non-linearly.
- The SERS intensities of 4-MBA adsorbed to Ag NPs show a non-linear relationship with the increase of 4-MBA concentration.

References

- Gu, N. *et al. J. Coll. Inter. Sci.* **2013**, *394*, 263-268.
- Kitaev, V. *et al. J. Chem. Edu.* **2010**, *87*, 1098-1101.

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