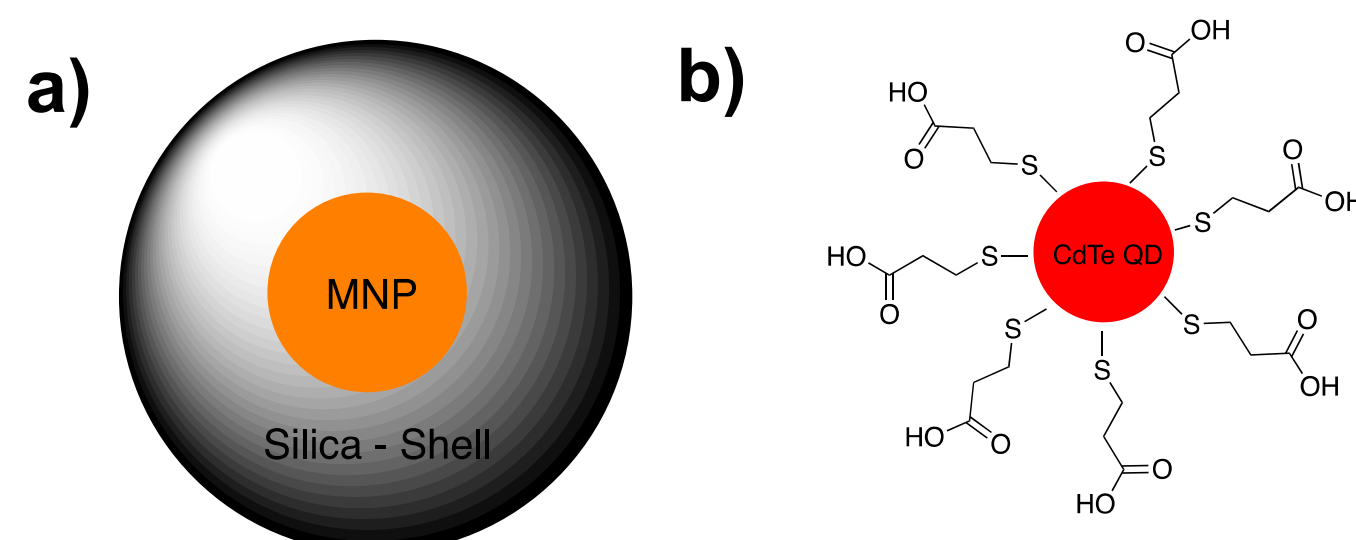


Synthesis of Silica Coated Magnetic Nanoparticles & Quantum Dots for Bioconjugation of Lectins

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Introduction

Silica Coated Magnetic Nanoparticles (SMNPs) are of great interest to the scientific community because their magnetic properties allow them to be great candidates for targeted drug delivery and point-of-care diagnosis and detection. **Quantum Dots (QDs)** are size tunable, highly fluorescent, photostable and highly specific. These properties again ensure that they are widely used for fluorescent biosensing and in vitro targeting for proteins and carbohydrates.



Scheme 1: a) SMNPs core-shell nanoparticles and b) CdTe QDs

Materials & Methods

Synthesis of SMNPs - a mixture of 2 mmol iron(III) acetylacetonate, 10 mmol hexadecanediol, 6 mmol oleic acid, 6 mmol oleylamine, 20 mL benzyl ether was refluxed for 2 h at 200 °C and then refluxed for 1h at 280 °C. The product was purified by centrifuging 3 times with ethanol (EtOH), hexanes, and EtOH respectively before being redispersed in hexane. A 0.5 mg MNPs were redispersed in 1 mL cyclohexane, 60 uL of 3-aminopropylsilane (APS) in cyclohexane (17.5 uL + 983 uL) and stirred 0.5 h. 0.225 g IGEPAL-Co-520 in 5 mL cyclohexane, 50 uL 25% NH₄OH, 30 uL tetraethyl orthosilicate (TEOS) were added sequentially and stirred for 0.5 h, 1 h and 8-10 h respectively. All materials were purchased from Sigma Aldrich.

Synthesis of CdTe QDs - 1 mmol Cd(CH₃COO)₂·2H₂O was dissolved in 50 mL distilled de-ionized water and 90 uL thioglycolic acid (TGA) was added. The pH was adjusted to the 10.5 - 11.0 range with NaOH and stirred for 5 min. 0.2 mmol K₂TeO₃ was dissolved in 50 mL DI water and was added along with 0.4 g NaBH₄ and stirred for 5 min. The mixture was then refluxed at 100 °C and the reaction time was varied to obtain the desired emission spectra. All materials were purchased from Sigma Aldrich.

Results

The synthesis of SMNPs and QDs were monitored by Dynamic Light Scattering analysis, which measures the hydrodynamic diameter (nm) and zeta potential (mV) of the synthesized nanoparticles (see Table 1). Figure 1 – demonstrates change in emission with the progress of time

	Size (nm)	Zeta Potential (mV)
MNPs	ca. 14	-3.0
SMNPs	ca. 40	-23.0

Table 1: Size and zeta potential MNPs and SMNPs

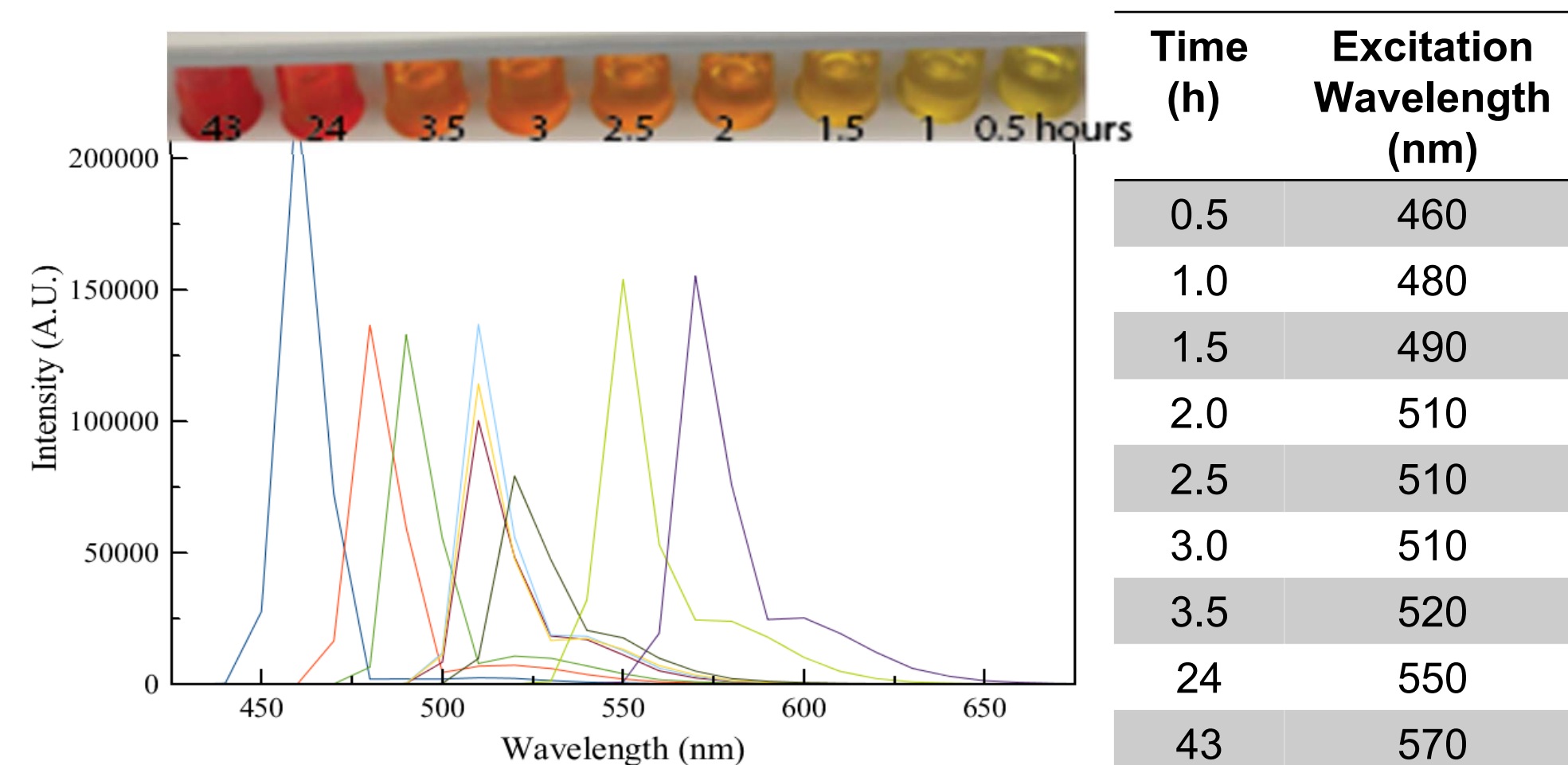


Figure 1: Emission Spectra of QDs (insert respective color of the QDs), table (left) – time Vs. excitation wavelength (nm)

Conclusion

The core-shell SMNPs retained sufficient magnetic properties after silica coating. SMNPs were conjugated with lectin - Concanavalin A was used for the successful detection of *Mycobacterium smegmatis*. CdTe QDs of varying sizes and emission wavelengths were also synthesized.

Future Work

We plan on incorporating both SMNPs and the TGA Capped CdTe QDs simultaneously so bacteria can be detected with the use of a magnet and a pen laser.

Acknowledgements

I would like to thank the UAH Office of the Provost, UAH Office of the Vice President for Research and Economic Development and the Alabama Space Grant Consortium. I would also like to thank Unnati Patel and Kavini Rathnayake for their help with both setting up and running the experiments.