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 1 h 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.

<table>
<thead>
<tr>
<th>Size (nm)</th>
<th>Zeta Potential (mV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MNPs</td>
<td>ca. 14</td>
</tr>
<tr>
<td>SMNPs</td>
<td>ca. 40</td>
</tr>
</tbody>
</table>

Table 1: Size and zeta potential MNPs and SMNPs

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.

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.

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