Synthesis of Cd-Se Quantum Dots with a Phosphine Ligand

Cameron Rabalais, Cody Perritt, Nicholette Stewart, Brandi Pippins, Sam Stage, Dr. Heath Barnett
School of Sciences – Chemistry
University of Louisiana at Monroe, Monroe, LA 71209

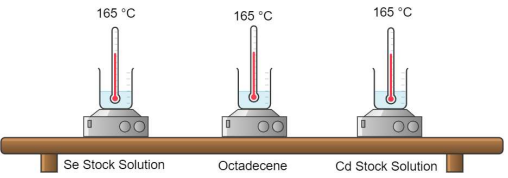
Introduction

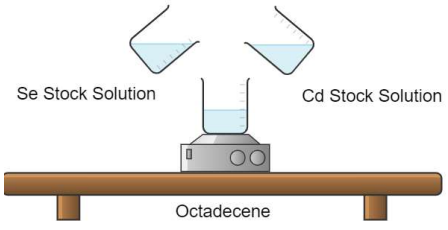
The UV-Vis spectrometry is a spectroscopic technique involving the use of light in the visible, near ultra-violet and near infrared regions to cause electronic transitions in the target material. Quantum dots can be regarded as semiconductors whose excitons (electron hole pairs) experience quantum confinement in all three spatial dimensions. As a result, they have properties that are between those of bulk semiconductors and those of discrete molecules. Cadmium selenium (CdSe) quantum dots in particular have exhibited considerably different optical and electrical properties from its bulk material. Due to the specificity of the optical emissions generated by CdSe, they have potential to form monitors and other display devices that permit a much higher precision in the spectrum of colors. As well as, being used as biological tags in living organisms

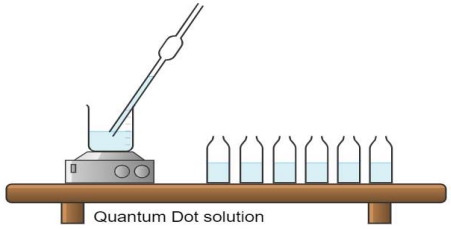
Synthesis

Selenium stock solution: The stock solution is made from 99 mg of Se and 5.5 mL of trioctylphosphine. The mixture is heated and stirred until dissolved.

Cadmium stock solution: The stock solution is made from 53 mg of cadmium acetate dihydrate (CdAc2·2H2-O), 0.6 mL of oleic acid, and 5.5 mL of octadecene. The mixture is heated and stirred until dissolved, and a slight yellow tint develops.







Quantum Dots

UV-vis data on Quantum Dots

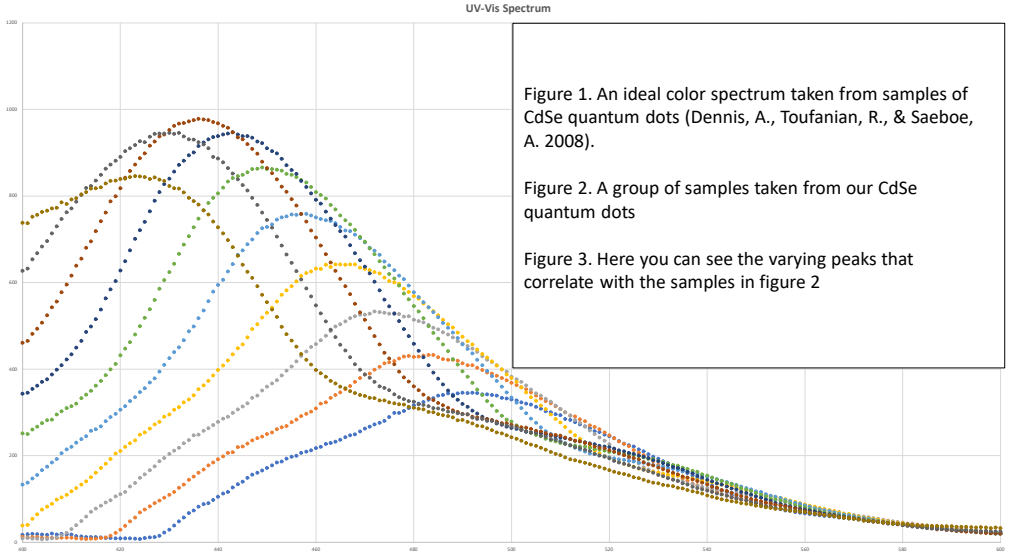


Figure 1. An ideal color spectrum taken from samples of CdSe quantum dots (Dennis, A., Toufanian, R., & Saeboe, A. 2008).

Figure 2. A group of samples taken from our CdSe quantum dots

Figure 3. Here you can see the varying peaks that correlate with the samples in figure 2

Conclusions

Quantum dots are a rapidly growing interest in modern science due to the myriad of things they can be used for. As of now and in the future, quantum dots will progress both leisure and life as they tackle issues from nice TVs to cancer treatment.

Future Directions / Ligands

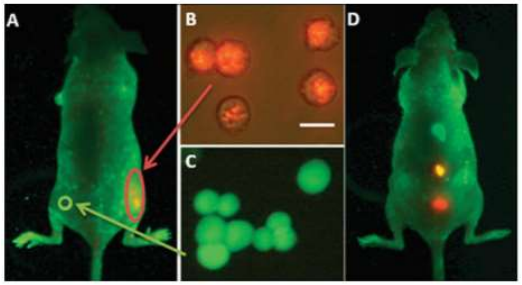


Figure 3 *In vivo* imaging of a rat (Zrazhevskiy, P., Sena, M., & Gao, X. 2010, August 09).

(A) This shows an *In vivo* image of a rat with both quantum dot and organic dye tags.
(B) This portion of the rat shows the QD tags on tumor cells. It is clear to see how distinct they are from the rest of the image.
(C) The organic dye tags shown here are undistinguishable from the autofluorescence of the imaging.
(D) QDs placed under the skin of a living creature can show

References

Zrazhevskiy, P., Sena, M., & Gao, X. (2010, August 09). Designing multifunctional quantum dots for bioimaging, detection, and drug delivery. Retrieved March 29, 2021, from https://pubs.rsc.org/en/content/articlepdf/2010/cs/b915139g

Dennis, A., Toufanian, R., & Saeboe, A. (2008). The Dennis Lab. Retrieved March 29, 2021, from http://sites.bu.edu/dennislab/