STABILITY AND BIOACCUMULATION PATTERN OF CdSe NANOPARTICLES

Sabri Agachan¹, Erin Russell², Zikri Arslan¹, Ibrahim Farah³, Weiyong Yu⁴, Anthony J. Bednar⁵

¹Department of Chemistry, Jackson State University, Jackson, Mississippi 39217 USA
²Department of Biology, Mississippi College, Clinton, MS 39058 USA
³Department of Biology, Jackson State University, Mississippi 39217 USA
⁴Department of Biochemistry, Worcester Polytechnic Institute, Worcester, MA 01609
⁵US Army Engineer Research and Development Center (ERDC), Waterways Experiment Station, Vicksburg, Mississippi 39180, USA

Abstract. Quantum dots (QDs) exhibit bright and long-lasting fluorescence upon excitation by a light source. The color of emission (fluorescence) can simply be tuned by changing the size of the particles. With these interesting features, QDs appear to be potential materials in optical probing in the near future for medicinal diagnostics, imaging, and technology. While most applications today concentrate on device fabrication with high-quality QDs to respond to the medical and technological demand, little is known about their effects on biological systems and environment. In this study, we have examined the chemical and photostability of CdSe QDs of 3.8 nm in size. Aqueous solutions of CdSe were exposed to UV light (365 nm) for 5 h. Another solution of CdSe QDs was subjected to ultrasounds using titanium ultrasonic probe for 10 min. The bioaccumulation pattern was studied on animal models by injecting the QDs solutions to rats intraperitonally. No significant degradation was observed from sonication, while UV light led to decomposition of the particles to some extent. Analysis of animal organs, including, the brain, lungs, heart, kidney and liver, showed that injected dot primarily accumulated in the liver and kidney. Levels of cadmium in the organs were always greater than that of selenium, which suggests that QDs underwent metabolic degradation to ionic Cd²⁺ and Se²⁻.

Keywords: Nanoparticle, toxicity, accumulation, cadmium selenide