Novel Synthesis and Characterization of Manganese Nanoparticles: A Third Year Study

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Nanoparticles are of significance because of their small size and unique characteristics. Few studies have been conducted on the synthesis of manganese nanoparticles. This project was among the first to synthesize manganese nanoparticles, and this was done using a microfluidic device with manganese acetate as an ion source and sodium dithionite as a source of oxide. Three different capping ligands were used for the nanoparticles: oleic acid, FusionRed protein, and Texas Red labeled BSA. The nanoparticles capped with oleic acid were titrated with hydrochloric acid and energy dispersive x-ray spectroscopy was used to determine if the nanoparticles were made of a manganese salt or of manganese metal. The data suggest that the nanoparticles were made of manganese oxide. In addition, the nanoparticles capped with all three ligands were characterized using fluorescence spectroscopy and scanning electron microscopy. The data show that the nanoparticle synthesis was successful. The nanoparticles capped with oleic acid were approximately 70 nanometers across and spherical in shape, while the nanoparticles capped with Texas Red labeled BSA formed nanosheets that were about 2-3 micrometers long and 80-90 nanometers in width. By changing the capping ligand, the size and the shape of the nanoparticle also changed. Potential uses of the manganese nanoparticles were also investigated. Experimentation was completed to see if the manganese nanoparticles could be used as a delivery mechanism for the fluorescent proteins to travel through the plant cell membrane without being denatured. If the proteins can make it into the plant cell without denaturing, manganese nanoparticles could also potentially be used as a delivery mechanism for proteins involved in gene editing technologies.

Awards Won:
Third Award of $1,000