Manganese Nanoparticle Synthesis Using Various Capping Agents and the Effects of Nanoparticles on Raphanus Sativus: A Second Year Study

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Nanoparticles are becoming more commonly used for delivery of gene editing technologies in plants. A common nanoparticle used for delivery are silver nanoparticles (AgNPs), which have shown to increase oxidative stress in plants. In my project from the previous year, manganese nanoparticles (MnNPs) were developed using a microfluidic device and were shown to decrease oxidative stress in crops. Therefore, MnNPs may be more efficient when it comes to delivery. This hypothesis was investigated by applying MnNPs capped with oleic acid and AgNPs to Raphanus sativus plants and comparing the effects the nanoparticles had on stress tolerance. The plants treated with MnNPs had a significantly higher growth rate than the plants treated with AgNPs. This provides supporting evidence for the hypothesis that MnNPs increase stress tolerance in plants and AgNPs decrease stress tolerance in plants. In addition, an attempt was made to bind Texas red labeled bovine serum albumin protein (BSA) to MnNPs by replacing the capping agent with the protein. The MnNPs capped with the BSA as well as the MnNPs capped with oleic acid were estimated to be concentrated at about 120 million nanoparticles per milliliter. However, the nanoparticles capped with oleic acid appear to be larger in size than the nanoparticles capped with Texas-red labeled BSA on the fluorescence spectra. The nanoparticles capped with oleic acid were found to be stable for about one year. Because MnNPs are stable over extended periods of time and proteins are able to be bonded to the MnNPs, they could potentially be viable for delivery of gene editing technologies.