CHEMISTRY DEPARTMENT SEMINAR

Exposure of Bean Plants to Coated and Uncoated Zinc Oxide Nanomaterials under Different Soil Conditions: Effects on Plant Growth and Seed Quality

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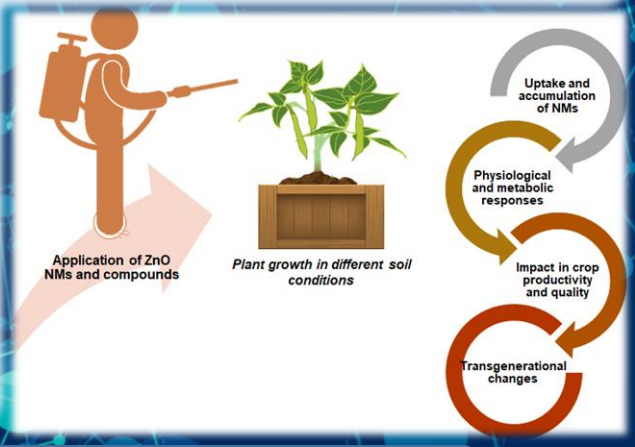
Currently, the production of ZnO nanomaterials is about 33,400 tons/year. These nanomaterials are mainly incorporated into cosmetics and personal care products, due to their absorbing and reflecting properties, antimicrobial, and deodorant characteristics. The high production and the variety of uses suggest that the ZnO nanomaterials are released into the environment interacting with plants, which are the primary producers. Bean (*Phaseolus vulgaris* L.), a staple food in several countries worldwide, could be intentionally or unintentionally exposed to ZnO nanomaterials with unknown consequences. In this study, red kidney bean plants were exposed to uncoated (Z-COTE) and surface coated (Z-COTE HP1) commercial ZnO nanomaterials. In addition, microsized ZnO and ionic $ZnCl_2$ were used as bulk and ionic counterparts. The working hypothesis of this study was that the surface coating of Z-COTE HP1 would have a different impact in the plant physiology and nutrition compared to the uncoated Z-COTE. Plants were cultivated for the full life cycle in two different soils varying in organic matter content. At harvest, changes in agronomical parameters, element composition of plant tissues, and the yield and nutritional composition of mature seeds were determined. In addition, the transgenerational effects of the ZnO nanomaterials were evaluated in a second generation of non-exposed seeds. Results have shown that coated Z-COTE HP1 increased root length and the concentration of more nutritional elements in plant tissues, when compared to uncoated Z-COTE. However, none of the nanomaterials affected the composition of immature pods. Mature seeds harvested from Z-COTE exposed plants had the most sugar in organic matter-enriched soil, whereas Z-COTE HP1, at all concentrations, increased Cu in seeds in natural soil. In general, a dissimilar impact in the seeds was found in soils of different composition. In the transgenerational study, both nanomaterials decreased nickel in seeds in the first and second generation, suggesting nanomaterial-driven epigenetic changes. The hypothesis of a different effect by Z-COTE and Z-COTE HP1 was confirmed in several parameters in the plants, such as root growth and mineral accumulation (including Zn) in the tissues. Whereas in the seed quality, the coated material had more effects than Z-COTE. Overall, the exposure to ZnO nanomaterials showed little to no toxic effects in bean plants, even after significant Zn accumulation.



October 11th @ 12 pm – Jones Annex 101