

ENGINEERED BIOBASED PRODUCTS FROM AGRICULTURAL FEEDSTOCK: *High performance nano-encapsulation matrix for sustained delivering of bioactive compounds to agricultural crops*

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Efforts are being made worldwide, including USDA laboratories to investigate new uses for agriculturally-derived and/or biobased materials as well as to improve and transform such materials to create novel functionalities. Research described here is multidisciplinary in nature, which combines the fundamental knowledge of plant growth/development, soil sciences, microbiology, and polymer science and engineering to create a novel, high impact fertilizer of superior functionality with an inherent long-term sustained delivery mechanism. Controlled release encapsulation matrix containing biologically active microorganisms for use as fertilizer in irrigated lands was developed and optimized. Once exposed to water, matrix absorbed water, maintained integrity, and allowed microbial growth within the matrix and concomitant release of active compounds in the vicinity for plants up-take. Encapsulation matrix exposed under wide variety of temperatures, humidity, salt concentrations and UV intensities had little or no impact on matrix functionality or microbial growth. The microbial cells failed to grow back only when matrix was exposed to extreme temperature (175°C, 24h). The goal is for matrix to last at least 2-3 years in the field for successive crops, thus, eliminating the use of chemical fertilizers, pesticides etc., often requiring multiple applications a single crop cycle. Preliminary studies on the selection of polymers, processing techniques and evaluation of matrix performance will be presented. While field trials are being awaited, green-house experiments have already indicated a remarkable success for this approach. The knowledge of biopolymers and material processing was critical in the design and development of product of controlled performance. The use of biopolymers as well as the environmental benefit of this approach will be discussed.

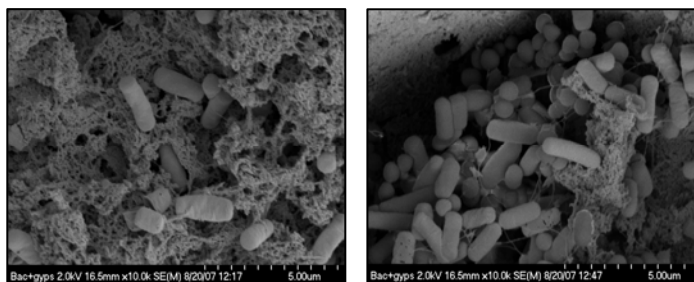


Figure 1: Microbial encapsulation and proliferation within the matrix to produce growth promoting compounds.



Figure 2: Development of root mass in plants treated with conventional fertilizer (left) and encapsulated microbes (right).