Encapsulating a germination adjuvant in lignin nanoparticles to reactivate quiescent seeds

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Recently, environmental concerns have led to a more sustainable approach for nanoparticles design such as renewable starting materials, less toxic solvents, and biodegradable compounds. These procedures are important especially when nanoparticles move from the laboratory scale to large-scale manufacturing. This is particularly true for agricultural use, the latest frontier of nanoscience applications. In this field, several biopolymers have received particular attention as appealing compounds for nanocarrier preparation; one of these is lignin, an inexpensive product originating from renewable materials. Lignin also represents the main byproduct of wood pulp and paper manufacturing industry.

In the present work, we propose to use lignin for nanocapsule production to deliver gibberellic acid (GA3), a phytohormone able to induce germination, to quiescent seeds. We prepared nanocapsules using Kraft lignin, which is obtained in the separation of cellulose during the pulping process. GA3 was dissolved in acetone/ olive oil 50% v/v and the obtained emulsion was added to lignin solution (2% w/v) obtained at pH = 12. High-power sonication was then applied to obtain stable and monodisperse formulations. The loaded nanocapsules contained GA3 at three different concentrations (0.5mg/mL, 1mg/mL, 1.5mg/mL). The nanoparticles were extensively characterized by Dynamic Light Scattering (DLS), Scanning Electron Microscopy (SEM) and Small Angle Neutron Scattering (SANS). They were preliminarily tested on seeds from two species: *Eruca Sativa* and *Solanum lycopersicum* var. *cerasiforme* in order to investigate their potential phytotoxicity. Application to seeds with low germination capability is in progress.