

# Biodegradable Enzyme-Responsive Microgels for Sustained Insecticide and Phosphorus Release

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## ABSTRACT

The present disclosure relates to the field of agricultural formulations and discloses a method to fabricate biodegradable, enzyme- responsive microgels (DC-CeIP MGs) for the sustained agricultural delivery. The method includes dissolving cellulose in a sodium hydroxide (NaOH) solution and crosslinking it with sodium tripolyphosphate (STP) to obtain phosphate-crosslinked cellulose microgels (CeIP MGs). The CeIP MGs are functionalized with 3,4- ihydroxyhydrocinnamic acid (DC) via a coupling reaction to form functionalized microgels (DC-CeIP MGs) and. encapsulating imidacloprid (Im) into DC-CeIP MGs by dispersion in water followed by lyophilization, thereby forming a stable powder of Im@DC-CeIP MGs. The obtained Im@DC-CeIP MGs enable enzymetriggered release of imidacloprid and phosphorus, enhancing foliar adhesion, and promoting plant growth.

## KEY APPLICATION AREAS

- 1.Agricultural Inputs & Crop Protection.
2. Controlled-Release Agrochemical Delivery.
3. Sustainable & Precision Agriculture.
4. Smart Fertilizer and Pesticide Formulations.
5. Biodegradable Agricultural Nanomaterials.

## POTENTIAL USE

- 1.Sustained release of imidacloprid insecticide for effective pest control.
- 2.Controlled phosphorus delivery to improve nutrient availability and plant growth.
- 3.Foliar spray formulations with enhanced leaf adhesion and rain-wash resistance.
- 4.Reduction of pesticide leaching and UV degradation, minimizing reapplication frequency.
- 5.Precision delivery of agrochemicals through enzyme-triggered release in soil.
- 6.Crop productivity enhancement while reducing environmental impact.