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Silica-coated polymeric nanoparticles for silicic acid delivery

Novel silica-coated nanoparticles with a stimulus-responsive core that can swell and fracture the surrounding silica shell, leading to the release of silicic acid.

IP Status: Provisional Patent Application Filed

Applications

- Agricultural disease management
- Crop yield enhancement

Key Benefits & Differentiators

- **Dual loading capabilities:** Polymer-core can be loaded with small molecule cargo that is also released upon silica shell fragmentation
- **Complete dissolution of silica nanoparticles:** Unlike conventional silica nanoparticles, this approach generates small, high surface area silica fragments that aid in silicic acid release

Technology Overview

Nanoparticles are emerging as promising alternatives to traditional agrochemicals due to their unique nanoscale properties. Specifically, silicon-based nanoparticles have shown the potential to promote plant growth, combat plant diseases, and serve as carriers for agrochemical compounds. Following foliar-, soil-, or seed-based introduction, silica nanoparticles exposed to water release silicic acid that can be used by the plant, providing an essential source of silicon. However, to maximize plant benefits, a steady release of silicic acid is needed, rather than a single application, highlighting the need for improved delivery mechanisms.

Researchers at the University of Minnesota have developed novel nanoparticles consisting of a polymeric core encased in a silica shell. Polymer-core swelling breaks the shell and generates small, high surface area silica fragments that serve as a continuous supply of silicic acid to plants. Unlike existing nanoparticle delivery strategies, these novel nanoparticles deliver silicic acid from the shell, leaving the core of the nanoparticle available for delivery of additional molecular cargo. The controlled fragmentation and dissolution of the silica shell ensures a continuous supply of silicic acid, offering a more efficient and sustained delivery system.

Phase of Development

TRL: 2-3
Proof of concept. Polymer core swelling has been shown to induce silica shell fragmentation in the presence of acidic media.

Desired Partnerships

This technology is now available for:

Technology ID
2024-018

Category
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Researchers

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