Synthesis and Characterization of Drug Carrier Silica Nanoparticles for the Development of Sustainable Agricultural Technologies

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In recent years, addressing agricultural challenges has necessitated the development of alternatives featuring systemic and targeted chemical release for plants. Integrating nanotechnological advancements into agrochemicals emerges as a promising avenue to contribute to sustainable agricultural systems and mitigate the impact of climate change. Nanoparticles (NPs) offer potential applications in agriculture, driven by their physiochemical properties, notably the large surface area/volume ratio, facilitating a highly reactive interface between the particles and their local environment. Silicon, abundant in the Earth, possesses numerous positive effects on plants, rendering it a crucial element in agriculture [1]. Silicon nanoparticles promote enhanced plant growth, aligning with the principles of safe and environmentally friendly agricultural practices. The porous nature of silicon nanoparticles further positions them as excellent nanocarriers for various agrochemicals, further supporting agricultural objectives [2].

This study focuses on the synthesis of mesoporous silica utilizing silicon-based Tetraethyl orthosilicate (TEOS). Crystal structure analysis through X-ray diffraction (XRD), Fourier Transform Infrared Spectrophotometer (FT-IR) for structural and chemical bonding insights, and Field Emission Scanning Electron Microscopy (FESEM) for surface morphology and particle size analysis were conducted. Additionally, energy dispersive X-ray analysis (EDX) characterized the elemental composition of the compounds. The synthesized mesoporous silica is anticipated to contribute to sustainable agricultural technologies as a promising agrochemical carrier based on the comprehensive characterization and analysis performed.

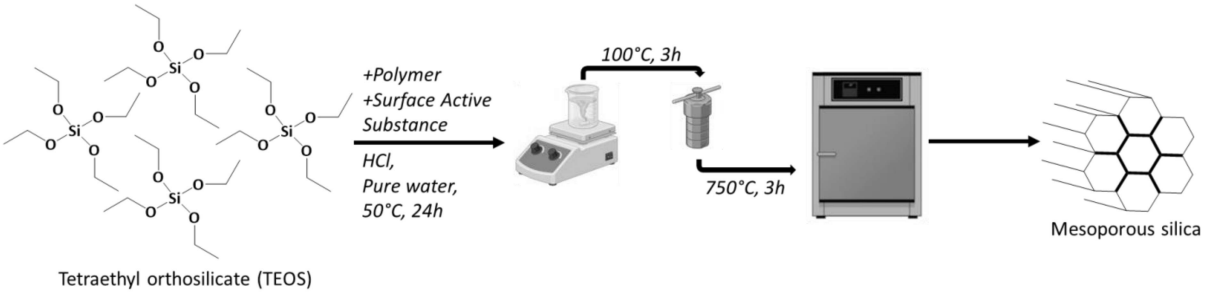

Figure 1. The representative illustration of the MS synthesis process.

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References:

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