The 2023 23rd IEEE International Conference on Nanotechnology

IEEE-NANO 2023 CONFERENCE PROCEEDINGS

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July 2-5, 2023 | Jeju, Korea

TuIT10 Biyang

Nanomaterials 6 (Oral Session)

Chair: Makasheva, Kremena — LAPLACE, CNRS, University of Toulouse

16:20-16:32 — TuIT10.1

A New Approach to the Formation of Carbon Nanostructures and Conducting Polymers Composites, pp. 850-850.

Winkler, Krzysztof — University of Biallystok

Wysocka-Zolopa, Monika — University of Biallystok

Gradzka, Emilia — University of Biallystok

Goclon, Jakub — University of Biallystok

16:32-16:44 — TuIT10.2

Copper-Iron Based Bimetallic MOF Decorated Natural Diatoms for Controlled Release of Thiabendazole, pp. 851-852.

Hegde, Vinayak — Agricultural Automation Research Centre, Chonnam National University

P. Bhat, Mahesh — Agricultural Automation Research Centre, Chonnam National University

Lee, Jae Ho — Agricultural Automation Research Centre, Chonnam National University

Lee, Kyeong-Hwan — Agricultural Automation Research Centre, Chonnam National University

16:44-16:56 — TuIT10.3

Sub-Mm3 Dimensional Scaling of Additively Fabricated Microsupercapacitors for Embedded Energy Applications, pp. 853-853.

Hodaei, Amin — EPFL

Subramanian, Vivek — Ecole Polytechnique Federale De Lausanne

16:56-17:08 — TuIT10.4

Electrical and Magnetic Properties of (Cr, Mn)2AlC Films, pp. 854-854.

boucher, richard — TU Dresden

leyens, christoph — TU Dresden

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Copper-Iron Based Bimetallic MOF Decorated Natural Diatoms for Controlled Release of Thiabendazole

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Abstract

The most essential aspect of the current world is to meet the demand and offer nutritious food to the enormously expanding population. However, crop disease and plant illness are significant problems that hinder plant development and lowers agricultural productivity. Thus, it is crucial to prevent/treat plant diseases and productively increase crop yield. The implementation of nanotechnology in the administration of active ingredients (AIs) offers an opportunity to improve the efficacy, environmental impact, and cost-effectiveness of AIs while also encouraging innovation and competition in the agricultural sector [1]. Such nanomaterials can be engineered to achieve a controlled and steady release of fungicides over a time period. Further, it is possible to enhance the stability and shelf-life of fungicides, allowing them to remain effective for a longer period. In this context, the current study investigated the release of thiabendazole employing lauric acid modified a hybrid composite nanomaterial comprised of natural low-cost diatoms and a copper-iron-based bimetallic MOF. Herein, the hybrid nanocomposite was developed by growing the bimetallic MOF over the surface of diatoms via the hydrothermal method followed by vacuum-assisted lauric acid capping. Lauric acid is temperature sensitive material, which readily degrades above 44 °C [2]. This feature leads to achieving the temperature-responsive AI release ability of nanocomposite. Such temperature-responsive formulations are beneficial in controlled environment agricultural systems where it could be possible to release the AIs by tuning the ambient temperature. In addition, the study demonstrates the in vitro release at different pH, temperature, and in vivo release studies using plants. Diatoms, being natural silica-based particles, possess a substantial number of active sites as well as specific characteristics such as porosity and surface area [3]. Bimetallic frameworks, on the other hand, feature greater stability, a synergistic effect, and a large surface area [4]. Thus, the combination of diatoms and bimetallic MOFs may provide the comprehensive physical-chemical characteristics required for thiabendazole administration. The developed formulation has shown a high fungicide loading capacity of 35%. The material has shown an interesting in vitro release profile of 65.45, 53.44, and 47.16% for pH 5, 7, and 9 respectively. The hybrid nanomaterial has also shown significant properties in preventing *Botrytis cinerea* fungus infections in plants. Further, nanoparticle uptake studies in plants are also systematically investigated to understand their translocation and distribution within the plant microenvironment.

ACKNOWLEDGMENTS

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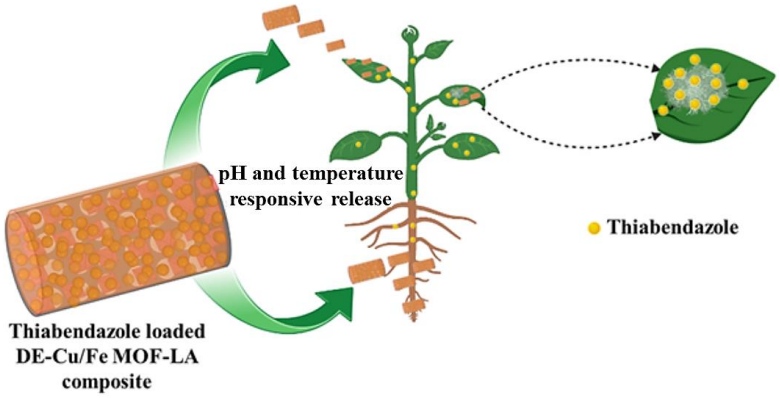

Figure 1. Schematic representation of thiabendazole release from bimetallic hybrid MOF nanocomposite for prevention of fungal disease in plant.