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Abstract

Development of Safe Nanoagrochemicals—The Nanoporous Route †

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1. Introduction

Nanoagrochemicals have the advantages of enhanced bioavailability of active ingredients and targeted delivery. In the meantime, nanoparticles proposed as agrochemicals raise environmental concerns. The utilization of siliceous natural nanomaterials (SNNMs) is a solution for preparing agrochemicals' nanoformulations with a low environmental impact. SNNMs such as natural zeolites of diatomaceous earth are *biorationale*, i.e., are generally recognized as safe (GRAS) due to their long utilization without significant side effects and are without endocrine-disrupting, neurotoxic, or immunotoxic effects [1]. We developed nanoformulated foliar fertilizers, wherein we used SNNMs as nanoporous carriers. The presentation aims to present the evidence related to the nanoporous nature of such nanoformulations and the results obtained after applying the nanoformulated foliar fertilizer on the performance of stone fruit trees.

2. Materials and Methods

The SNNMs were activated by heat (natural zeolites) and acid treatment (diatomaceous earth). The activated SNNMs were characterized by FT–IR, SEM, TEM, determination of the active surfaces, and the cation exchange capacity (CEC). The activated SNNMs were used to manufacture NanoFert Z (with zeolites) and NanoFert D (with diatomaceous earth). The nanoformulated foliar fertilizers were applied in 2020 and 2021 to treat stone fruits from the Research Station for Fruit Growing Constanța.

3. Results

The nanoporous structure of activated SNMMs was demonstrated by the physicochemical characterization. Figure 1 presents the transmission electron microscopic images of activated SNNMs, wherein nanopores could be observed. Application of SNNMs together with foliar fertilizer reduced the leaves' temperature up to 4 °C, with improved photosynthetic performance. The yield of apricot and peach trees was increased by 12.82–16.36%. The quality of fruits produced by the treated stone fruit trees was enhanced, with a higher accumulation of polyphenols.

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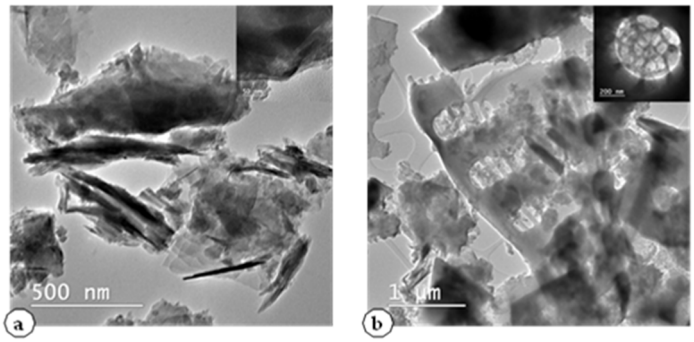

Figure 1. Transmission electron microscopy images of activated SNNMs, (**a**) Rupea natural zeolites, (**b**) Pătârlagele diatomaceous earth. From ref. [2]. Copyright: © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

4. Conclusions

SNNMs act as bioactive carriers, slowly releasing nutrients from foliar fertilizers and improving fruit tree photosynthesis due to the particle film formation.

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