UDC: **620.3:546.56:633.822**

INFLUENCE OF THE TECHNIQUE OF COPPER NANOPARTICLES ADMINISTRATION ON *MENTHA SPICATA*

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Various stages of production, use and disposal of nanomaterials leads to their release into the environment with wastewater and emissions into atmosphere. Therefore, all components of ecosystems, including human health, can be affected. Spearmint (*Mentha spicata*), which is valuable raw plant materials, was chosen as the object of research. The main goal of this work was investigation of the effect of the treatment technique and the concentration of copper nanoparticle (CuNPs) solutions on the their accumulation and transfer in spearmint segments.

Two groups of spearmint plants were exposed to copper nanoparticles in a concentration range of 1-100 mg/L during a 28-day experiment. Foliar spraying was applied for the first group of plants. The second group was irrigated with solutions of CuNPs with the same concentrations. Copper content in plant segments and soil samples was determined by the ICP-OES method. Transmission electron microscopy was used to determine the size and shape of the nanoparticles.

Mint plants have demonstrated the ability to translocate of copper nanoparticles (15-70 nm) from the aerial parts to roots in the foliar spraying exposure. Copper influx into the roots was maximum at the lowest concentration of CuNPs solutions (1 mg/L). At the roots exposure copper mainly accumulated in soils (exceeded the control 22–130 times) and spearmint roots. Accumulation was negligible in leaves and stems when CuNPs solutions in the range 1-50 mg/L was used for irrigation. The copper content in the leaves was maximum when CuNPs 100 mg/L was used, while the copper content in the stems remained practically unchanged.

The results of this study indicate the availability of 15-70 nm in diameter copper nanoparticles for plants, both in the case of foliage spraying and at watering exposure. Differences in the accumulation of copper in roots, stems, and spearmint leaves were revealed depending on the concentration of the CuNPs in solutions and the exposure technique.

Keywords: *copper nanoparticles, uptake, spearmint.*