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Foliar and Root Exposure to AgNPs: Evaluating Risks to Plant Health, Soil Microbiota and Consumer Safety

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The application of metal nanoparticles in industry and agriculture increases their environmental release, raising concerns about their potential for trophic transfer. In a 28-day experiment, Mentha spicata L. exposure to nano-silver (AgNPs) at concentrations of 1-100 mg/L via root irrigation resulted in a significant silver accumulation in the soil (up to 1447 mg/kg at 100 mg/L), which correlated with inhibited microbial activity. In contrast, foliar exposure to AgNPs at 100 mg/L caused a substantial increase of silver content in the leaves (140.3 mg/kg), alongside a 9-fold increase in the root system and an 18-fold increase in the soil compared to the control.

Both treatments stimulated the plant's physiological response, enhancing the production of carotenoids, chlorophyll, and antioxidant activity. The extraction efficiency of silver into herbal infusion was highly variable (1–98%), depending on the exposure pathway and the concentration of the applied AgNPs. A health risk assessment based on tea consumption indicates that silver concentrations exceeding 0.348 mg/L in the infusion may pose a potential adverse effect to human health.

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