

## Green Synthesis of Silver Nanoparticles Mediated by Plant by-Product Extracts

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**Abstract :** Green synthesis of nanoparticles (NPs) represents a promising, accessible, eco-friendly, and safe process with significant applications in biotechnology, pharmaceutical sciences, and farming. The aim of our study was to obtain silver nanoparticles, using plant wastes extracts resulted in the essential oils extraction process: *Thymus vulgaris* L., *Origanum vulgare* L., *Lavandula angustifolia* L., and in hemp processing for seed and fibre, *Cannabis sativa*. Firstly, we obtained aqueous extracts of thyme, oregano, lavender, and hemp (two monoicous and one dioicous varieties), all harvested in western part of Romania. Then, we determined the chemical composition of the extracts by liquid-chromatography coupled with diode array and mass spectrometer detectors. The compounds identified in the extracts were in agreement with earlier published data, and the determination of the antioxidant activity of the obtained extracts by DPPH (2,2-diphenyl-1-picrylhydrazyl) and ABTS (2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid)) assays confirmed their antioxidant activity due to their total polyphenolic content evaluated by Folin-Ciocalteu assay. Then, the silver nanoparticles (AgNPs) were successfully biosynthesised, as was demonstrated by UV-VIS, FT-IR spectroscopies, and SEM, by reacting  $\text{AgNO}_3$  solution and plant extracts. AgNPs were spherical in shape, with less than 30 nm in diameter, and had a good bactericidal activity against Gram-positive (*Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas fluorescens*).

**Keywords :** plant wastes extracts, chemical composition, high performance liquid chromatography mass spectrometer, HPLC-MS, scanning electron microscopy, SEM, silver nanoparticles

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