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Abstract

Green Synthesis of Bimetallic Nanostructures Using Vine Shoot Extracts—Characterization and Antimicrobial Effects †

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Abstract: In order to obtain high quality grapes, necessary for the wine industry, table grapes or other by-products, different management techniques are applied to the vine crops. The pruning is a common practice that generates massive amounts of waste, especially shoots and canes that may affect the environment and also the human health. On the other hand, various scientific studies confirm the presence of phytochemicals (antioxidants) in grapevine waste being used as a natural added-value in food, pharmaceutical and cosmetic industries due to their benefits. The nanoparticle phytosynthesis is a safe, non-toxic and environment friendly approach in which the phytochemicals from vine waste extracts act as reducing agents.

Keywords: vine waste management; green synthesis; nanoparticles; phytochemicals; antimicrobial activity

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1. Introduction

Romania has a rich viticulture history, being one of the largest wine-growing countries in the world and the fifth country in Europe in terms of the number of vineyards, with about 150,000 hectares of vineyards used for wine production [1]. However, the practice of viticulture presents the disadvantage of accumulating large amounts of vineyard wastes. Thus, after pruning the vines in October and March, considerable quantities of vine shoots and canes are produced [2]. Furthermore, these residues represent a valuable source of bioactive compounds, which may have different medical, cosmetic and food applications [3]. The present work evaluates classical and modern extraction methods of phytochemicals from local vine shoot wastes in order to obtain phytosynthesized bimetallic nanoparticles (Ag and Au) with antimicrobial and antioxidant effects.

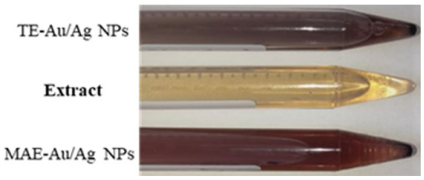
2. Materials and Methods

To extract the phytochemicals from vine shoot wastes, two solid–liquid extraction pathways were approached: classical extraction (using an oven) and microwave-assisted extraction with MILESTONE ETHOS EASY (microwave digestion system). The ratio between solid material and solvent was 1:10 (*w*/*v*). The total phenolic content of extracts was determined using Folin–Ciocâlteu method, while the antioxidant capacities of extracts and

phytosynthesized bimetallic nanoparticles were determined using a DPPH assay. The formation of nanoparticles was monitored by UV–VIS spectrometry in the wavelength range of 300–700 nm. Transmission Electron Microscopy (TEM) was used to visualize the size and shape of bimetallic nanostructures. The antimicrobial activity of both extracts and bimetallic nanoparticles was determined on Gram-positive, Gram-negative and fungi strains.

3. Results

The obtained results suggested the formation of Au/Ag nanoparticles in both extraction methods.



4. Conclusions

The microwave extraction method improves the ability of recovering phenolic compounds from viticultural wastes in order to obtain Ag/Au bimetallic nanostructures with significant antioxidant and antimicrobial activity.

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References

1. Soceanu, A.; Dobrinas, S.; Sirbu, A.; Manea, N.; Popescu, V. Economic aspects of waste recovery in the wine industry. A multidisciplinary approach. *Sci. Total Environ.* **2021**, *759*, 143543. [CrossRef] [PubMed]
2. Rätsep, R.; Karp, K.; Maante-Kuljus, M.; Aluvee, A.; Kaldmäe, H.; Bhat, R. Recovery of Polyphenols from Vineyard Pruning Wastes—Shoots and Cane of Hybrid Grapevine (*Vitis* sp.) Cultivars. *Antioxidants* **2021**, *10*, 1059. [CrossRef] [PubMed]
3. Fierascu, R.C.; Sieniawska, E.; Ortan, A.; Fierascu, I.; Xiao, J. Fruits By-Products—A Source of Valuable Active Principles. A Short Review. *Front. Bioeng. Biotechnol.* **2020**, *8*, 319. [CrossRef] [PubMed]