Antimicrobial Properties of Bionanomaterials Obtained from Vegetable Sources †

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Antibiotic resistance of pathogenic microorganisms is a major problem of the 21st century. In this sense, finding alternatives to classical antibiotics is one way this problem can be solved. In this respect, we initiated research which aimed at the testing of bionanomaterials containing Ag⁺ or Au³⁺ ions and some vegetable extracts. The vegetable used for obtaining nanobiomaterials were the following: Ranunculus ficaria (AgNPfr, AuNPfr); Allium ursinum (AgNPau, AuNPau); Hippophae rhamnoides (AgNPfr AuNPfr); Brassica oleracea variety gongyloides, white and purple (AgNPbow, AgNPbop, AuNPbaw AuNPbop); and Cucurbita maxima, Valenciano variety (AgNPcm, AuNPcm). Bionanomaterials were synthesized according to the methodology presented by Sorescu et al [1].

The antibacterial activity was evaluated using the disk-diffusion method [2], with microbial inoculum sown on the surface of Petri dishes. The obtained values were quantified compared to those obtained with the usual antibiotics [3–5]. Microorganisms used in biological tests were isolated in medical clinic from patients (Escherichia coli, Bacillus subtilis) or were purchased from DSMZ collection (Candida rugosa).

The results obtained indicated that the Escherichia coli present sensitivity to some bionanomaterials synthesized with Ag⁺. From this point of view, good results are obtained for bionanomaterials AgNPfr, AgNPcm, and AgNPbop. In the case of the last two bioproducts, the inhibition diameters obtained are comparable with the antibiotic ampicillin.

The best results were observed in the case of the AgNPfr bioproduct, for which we obtained higher inhibition diameters, comparable with antibiotics such as: Ampicillin, Carbencilin, Ticarcillin, Cefazolin, Cefaclor, Nalidixic acid, Gentamicin, and Kanamycin.

In the case of bionanomaterials synthesized with Au³⁺, the obtained results showed that these do not have biological activity on the studied microorganisms, except AuNPfr, where the occurrence of the resistance phenomenon (AuNPfr) is observed. It is important to mention the fact...
that the phenomenon of resistance also appears in the case of nanomaterials with Ag⁺, like AgNPau, Ag NPbow.

In conclusion, nanobiomaterials synthesized with Ag⁺ and plant extracts have biological activity in the case of Gram-negative bacteria, the best results being obtained in the case of the bioproduct synthesized with \textit{Ranunculus ficaria} extract.

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**References**


