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**CHARACTERIZATION AND PROSPECTION OF ANTIBACTERIAL
NANOPARTICLES SYNTHESIZED BY “GREEN” SYNTHESIS METHODS USING
SPRUCE NEEDLES EXTRACT**

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Introduction.

The problem of exposure to microorganisms, mainly bacteria, is a serious topic in many fields of activity, in medicine and health care, as well as in the food industry.

Nanomaterials, mainly using metal particles – copper, silver as a functional agent, known for their antibacterial properties, are a promising development for solving this problem [1].

At present, the main source for obtaining polymeric and composite materials is still hydrocarbon raw materials (oil, gas) and other non-renewable resources.

Nowadays, the attention deserves the concept of "green" synthesis that could be considered as synthesis methods that use living, biological, plant medium in the process of synthesis of nanomaterials, which makes these methods more environmentally friendly and economically viable [2]. The use of plant extracts as reducing agent and stabilizer in the synthesis of metal nanoparticles is worth a particular attention.

In this work, the synthesis of silver nanoparticles by green synthesis method using spruce needle extract was carried out and the resulting nanoparticles were characterized to identify the potential for antibacterial applications.

Main part.

In this work, spruce needle extract, known for its rich composition of bioactive groups, to the best of our knowledge was first ever used for the synthesis of silver nanoparticles and characterization of the obtained silver nanoparticles was carried out to identify a potential antimicrobial applicability.

The synthesis was carried out according to standard protocol, with selection of optimum synthesis parameters for higher efficiency [3]. Distilled water, 100ml was used as the solvent to obtain the extract, spruce needles were taken in an amount of 15g. The extraction is carried out under slight heating for 15-20 minutes until the color of the extract becomes characteristic. The synthesis of the nanoparticles itself was also carried out under slight heating (60 degree Celsius), for 60 minutes until the color changes to dark.

The properties of the obtained silver nanoparticles were investigated using standard physicochemical methods. A scanning electron microscopy (SEM) imaging of the nanoparticles was conducted. Resulting image allowed us to determine the shape and size of the obtained nanoparticles. UV-Visible spectroscopy (UV-Vis) was performed to confirm the formation of silver nanoparticles. The obtained values of peak wavelengths are in agreement with the results of previous studies in which silver nanoparticles were investigated [4]. In addition, the antibacterial properties of silver nanoparticles were investigated. The obtained values of the minimum inhibitory concentration (MIC) indicate significant antibacterial activity.

Conclusion.

The synthesis of silver nanoparticles by green synthesis method using spruce needle extract was successfully carried out. The obtained nanoparticles have proper characteristics and evident antibacterial activity and, as a consequence, are promising for use in various fields - health care and food industry.

References:

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