BIOSYNTHESIS OF SILVER NANOPARTICLES USING PLANT EXTRACTS : AN UPDATE

Katarina Smilkov[1], Darinka Gjorgieva Ackova[1]

Department of Applied Pharmacy, Division of Pharmacy, Faculty of Medical Sciences, University Goce Delčev, Štip, North Macedonia

katarina.smilkov@ugd.edu.mk; darinka.gorgieva@ugd.edu.mk

Background: In the recent period, different types of nanoparticles (NPs) have been proposed to improve antioxidant, but also antimicrobial properties of various natural compounds. Much attention has been dedicated to synthesis of NPs using biogenic enzymatic processes. The biosynthesis of NPs has been claimed to be superior to chemical synthesis, especially because of the opportunity of producing more environment-friendly and less toxic products.

Among the numerous types of NPs, bioreduction-produced silver NPs from ionic silver-containing solutions are receiving much attention. In this work, we present an update on our investigation on biosynthesis of silver NPs (AgNPs), thus presenting a method of reduction of silver nitrate solution, using a plant decoct from black pepper fruit (*Piper nigrum*, L).

Materials and methods: The biosynthesis of AgNPs was performed using 1 mmol/L $AgNO_3$ solution, by bioreduction provided from the complex composition of pepper fruit extract, obtained by decoction. The reaction was performed in dark, in order to avoid possible photochemical reactions (Fig. 1). The kinetics of formation of the silver NPs was monitored by UV/VIS spectrophotometry (BOECO S-300, Germany) during a period of 6h and this technique was used to determine the optimal incubation time for the bioreduction process. The formation of NPs vs time was monitored at 420nm, since our previous research have shown sharpest peak at this wavelength with the amount of extract used, although some studies report surface plasmon resonance peak at wavelengths from 410-450 nm, depending on the concentration and type of extract used.

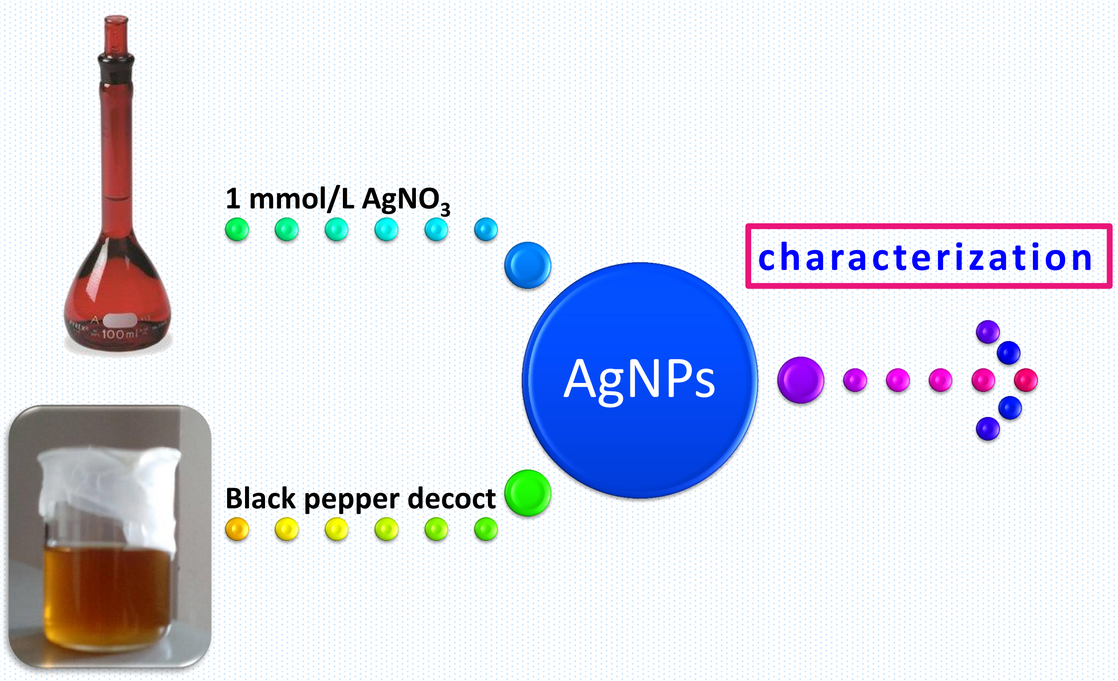

Fig. 1: Diagram of biosynthesis of AgNPs using Black pepper decoct.

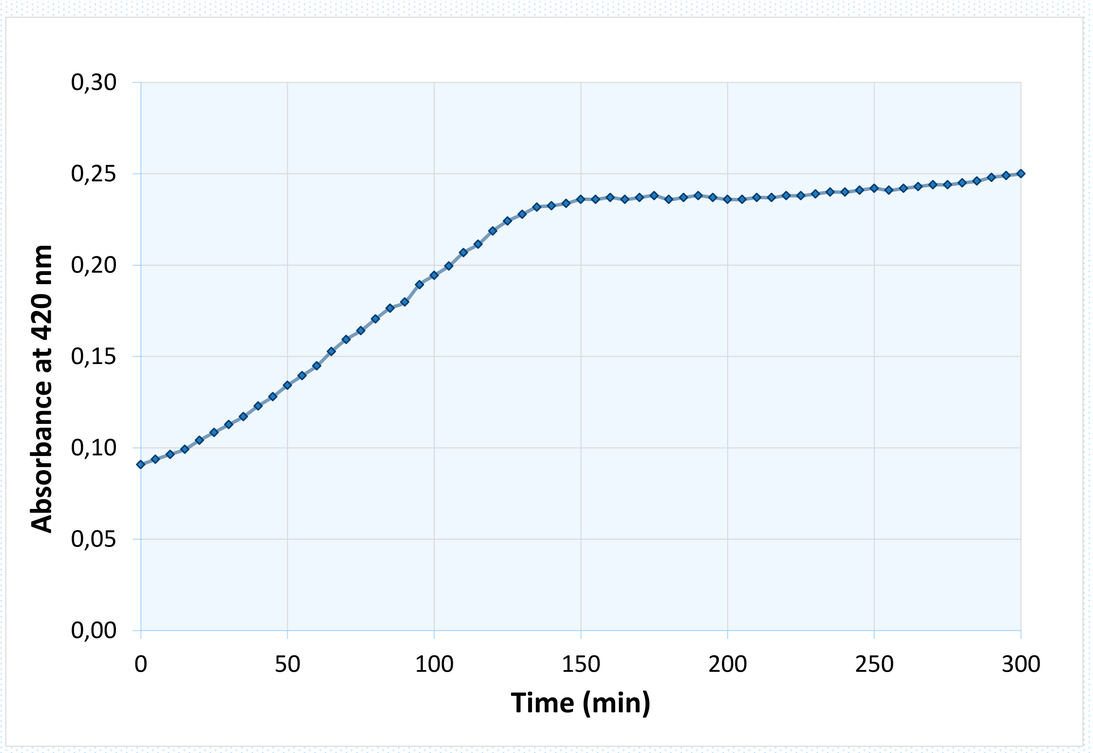

Fig. 2: Monitoring AgNP formation at 420 nm.

Results: Our results show that the optimal formation of the AgNPs occurs during the first 2 hours from the start of the reaction, thus we used 2h reaction time in our further experiments of AgNP synthesis using this method. During the monitored time, the absorbance of the reaction mixture increases gradually (Fig.2), and is expected to increase more, due to the further reduction of silver, which may result in NP with altered shape, aggregates and conglomerates. Because of this, we believe that 2h reaction time is optimal in order to obtain spherical AgNPs wih this method.

CONCLUSION

In this presentation, we presented an update on the method development for synthesis of silver NPs using plant extracts. Other methods of characterization are ongoing, such as microscopy imaging, FTIR analysis and size analysis that will provide more detailed characterization of these NPs. The next step planned is to assess their antioxidant properties and their antimicrobial activity. Considering the controversies that follow AgNPs and nanoparticles in general, toxicological studies are also planned, as one step further, in order to also assess the possible risk of administration of these entities in therapeutical purposes.