

J. R. Stefanović<sup>1</sup>, D. D. Ilić<sup>2</sup>, D. M. Jakovljević<sup>1</sup>, G. Đ. Gojčić-Cvijović<sup>1</sup>, M. M. Vrvčić<sup>2</sup>

<sup>1</sup> IChTM - Department of Chemistry, University of Belgrade, Njegoševa 12, P.O. Box 473, 11000 Belgrade, Serbia  
(jovana\_stefanovic@chem.bg.ac.rs)

<sup>2</sup> Faculty of Chemistry, University of Belgrade, Studentski trg 12-16, P.O. Box 51,  
11158 Belgrade, Serbia

Pullulan is one of the extracellular polysaccharides produced by the "black yeast" *Aureobasidium pullulans* that is widely spread in different ecological sites, including forest, soil and peat [1]. Pullulan is a linear  $\alpha$ -D-glucan which structure consists of a series of maltotriose units connected by  $\alpha$ -D-(1-6) glycosidic bonds. However, some of the maltotriose units are replaced by higher oligosaccharide units, most frequently with maltotetraose units [2]. In the earlier work we reported structure of the pullulan produced by *Aureobasidium pullulans*, strain CH-1 [3].

Silver nanoparticles have been synthesized using pullulan and its polyaldehydes that served to cross-link the individual polymeric chains of this polysaccharide and 100 mM  $\text{AgNO}_3$ . Obtained solutions of polymers were used as both the reducing and stabilizing agents.

Reactions were carried out in two different conditions: in the microwave and in the autoclave. Nanoparticles thus prepared are found to be stable in aqueous solution over a period of one month at room temperature, without any aggregation of the particles (Figure 1). UV-Vis spectra of the investigated solutions showed a characteristic absorption peak at 424 nm (Figure 2).

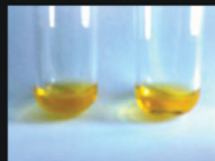


Figure 1: Solutions of silver nanoparticles, one day after experiment (left) and one month later (right)

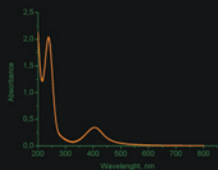


Figure 2: UV-Vis spectrum of the silver nanoparticles

The morphology of the samples was analyzed using scanning electron microscopy (SEM), which showed polydispersity of the particle size (Figures 3, 4).

Antimicrobial activity testing was carried out at agar plates with different concentrations of the investigated solutions, against various strains of bacteria and fungi. Results showed that the microbial growth was gradually reduced as the concentration of the silver increased. Figure 5 represents some experiments against *Micrococcus lysodeikticus* ATCC 4698.

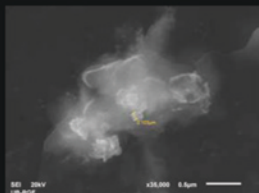


Figure 3: Scanning electron microscopy of obtained silver nanoparticles

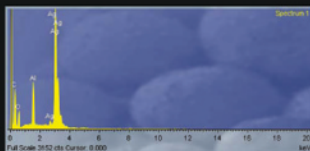


Figure 4: Energy-dispersive spectroscopy spectrum of silver nanoparticles prepared from 100 mM  $\text{AgNO}_3$  solution



Figure 5: Antimicrobial test against *Micrococcus lysodeikticus*

Application of pullulan and its derivatives in nanochemistry extends the use of this polysaccharide, which is already widely present in various fields, such as medicine, biotechnology, food, pharmaceutical, cosmetic and many other industries [4].

#### REFERENCES:

- [1] M. Đ. Radulović, O. G. Cvetković, S. D. Nikolić, D. S. Đorđević, D. M. Jakovljević, M. M. Vrvčić, *Biores. Technol.* **99** (2008) 6673-6677
- [2] D. D. McIntyre and H. J. Vogel, *Starch*, **45** (1993) 406-410
- [3] D. M. Jakovljević, M. M. Vrvčić, M. Đ. Radulović, M. S. Hranisavljević - Jakovljević, *J. Serb. Chem. Soc.* **66** (2001) 377-383
- [4] R. S. Singh, G. K. Saini, J. F. Kennedy, *Trends Biomater. Artif. Organs*, **20** (2007)

ACKNOWLEDGEMENT: This work was supported by the Ministry of Science and Technological Development, Republic of Serbia, Project No. III 43004.