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Azadaliyeva S.F.
Odlar Yurdu University, Baku, Azerbaijan khuda1949 @mail.ru

THE INFLUENCE OF INITIAL ACIDITY (pH) ON THE PRODUCTION OF SILVER NANOPARTICLES BY SACCHAROMYCES ELLIPSOIDEUS BDU – XR1

Abstract. *The aim at the presented article was to investigate the influence of initial acidity (pH) on the production of silver nanoparticles by Saccharomyces ellipsoideus BDU - XR1 abtained from culture collection of Microbiology Department of Baku State University. The reaction mixture contained 10 q wet biomass of yeast and 10^{-3} mol AgNO3 solutin was separately incubated in the acidity of pH 4,0; pH 5.0; pH 6,0; pH 7.0 and pH 8.0 at 30^0C for 7 days. Spectrophotometric analyses of the samples showed that the incubated samples at pH 6.0, 7.0 and 8.0 have a absorption (peak), in the 408 to 412 nm wavelengths characteristic for silver nanoparticles. So the synthesis of silver nanoparticles by this strain occurs in the range of pH 6.0 – 8.0 and the optimum initial acidity was pH 7.0. Synthesis of silver nanoparticles was not observed when pH was 4.0 and 5.0.*

Key words: *yeast, Saccharomyces ellipsoideus BDU – XR1, initial acidity, silver nanoparticles, UV spectrum.*

Introduction. Synthesis of nanoparticles is one of the fastest developing areas of nanotechnology. Unlike large-size materials, these particles have specific biological properties that are characterized by physical, chemical, magnetic, thermal, optical, and quantum sizes. Nanoparticles are widely used in medical diagnostics and treatment, as carriers of pharmaceuticals, cosmetics, dyestuffs, food products, packaging products, transportation of products, oil production, agriculture and, finally the environment. In the most developed countries of the world, large-scale synthesis of metal nanoparticles is carried out using physical, chemical and biological methods [4, 8, 10].

Recently, special attention is paid to the use of biological methods for the production of nanoparticles. Based on the biological synthesis process of nanoparticles, three basic steps are to use medium-sized solvents for synthesis, select ecologically harmless agents and select non-toxic materials for stabilizing nanoparticles. Many synthetic methods depend on organic solvents, which also result in the hydrophobicity of the used agents. So biological methods (using microorganisms and plants) for the synthesis of nanoparticles have some advantage compared with physicomchemical methods. gives an opportunity to increase the biomass and size of the formed nanoparticles. Particular attention is paid to the application of yeast and mould fungi and bacteria in this process [6, 9, 11].

It was possible to synthesize metal nanoparticles, such as silver, gold, zinc, selenium, titanium and platinum, using the yeast [1, 2, 8, 13]. Silver nanoparticles attract more attention due to their large surface area, unique physico - chemical and biological properties. As a result of large-scale researches carried by scientists, it was possible to obtain various metal nanoparticles from yeast of *Saccharomyces* [5, 7, 12].

In our previous studies, the property of *Saccharomyces ellipsoideus* BSU – XR1 to form silver nanoparticles have been determined. The influence of incubation time , temperature and biomass quantity on the formation of silver nanoparticles have been revealed [3].

Objectiv: The main aim at the presented work was to investigate the influence of initial acidity (pH) on the formation of silver nanoparticles by *Saccharomyces ellipsoideus* BDU – XR1.

Materials and Methods. As a research object, was used *Saccharomyces ellipsoideus* BDU - XR1obtained from the culture collection of Microbiology Department of Baku State University.

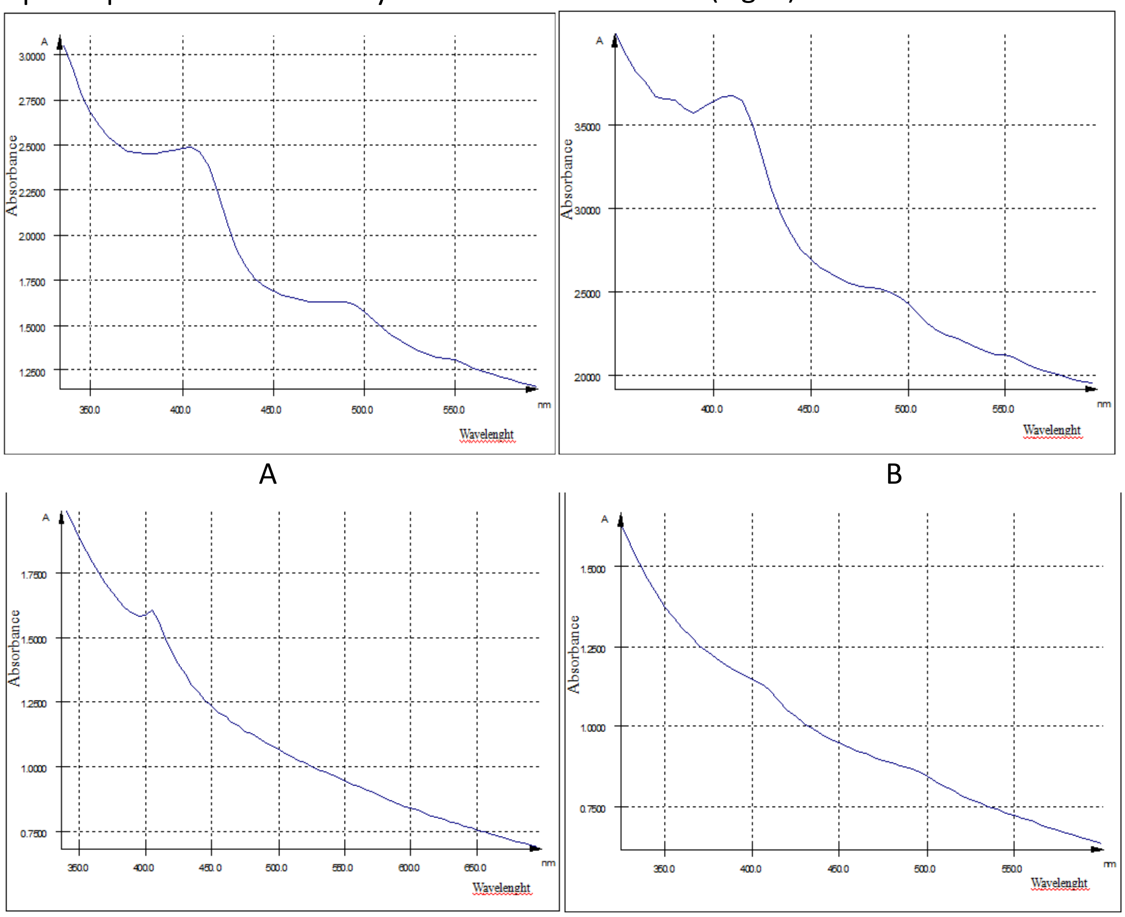
Saccharomyces ellipsoideus BDU – XR1 was cultivated in nutrient medium having the following content: yeast extract – 10 g, sucrose – 20 g, pepton - 20 g, distilled water – 1 liter. The culture was cultivated for 48 hours at 30°C in thermostat. The obtained yeast biomass was separated by filtration from yeast culture and washed 3 times with 100 ml sterile distilled water. Adding 10 gram wet biomass into 90 ml sterile distilled water was prepared the suspension, then added 10 ml 10^{-3} molar AgNO3 solution and was incubated in dark medium for 7 days at a temperature of 30^0C in the acidity of pH 4.0; 5.0; 6,0 and 7,0.

The formation of silver nanoparticles was primarily observed by the change of the reaction mixture color from light yellow to dark brown. Under the same conditions, no color change was observed in the incubated control tube (no $AgNO_3$ solution added).

Then the biomass was separated by filtration and spectrophotometric analysis of these samples was performed on the spectrophotometry "UV - Vis SPECORD 250 plus" (Germany).

Results. The formation of silver nanoparticles by *Saccharomyces ellipsoideus* BDU – XR1 initial acidity were studied depending on the (pH 4.0, pH 5.0, pH 6.0, pH 7.0, pH 8.0). It was determined that when silver nanoparticles assembled in the medium it darkened the reaction mixture. This phenomenon is considered to be the primary indication of the existence of silver nanoparticles. From the 3rd day of the incubation, noticeable variation in the reaction mixture has begun (Fig.1). Then spectrophotometric analyses were carried out taking samples from these reaction mixtures. The absorption spectra were observed in the 408-412 nm wavelengths on the UV-VIS spectrophotometry of samples taken from the reaction mixtures pH 6.0; 7.0 and 8.0. Based on spectrophotometric analyses of the samples taken from the variants of the poor color change pH 4.0 and 5.0 the absorption has not been observed (Fig. 2).

Fig.1. The color darkening of the reaction mixture - of Saccharomyces ellipsoideus BDU - XR1. A – control; B – experiment



A B

C D

Fig.2. The UV – spectrum of silver nanoparticles depending on various ambient acidity of the Saccharomyces ellipsoideus BDU – XR1. pH 6,0 (A); pH 7,0 (B); pH 8,0 (C); pH 5,0 (D);

Discussion. The presenee of the above dates shows that the synthesis of silver nanoparticles by *Saccharomyces ellipsoideus BDU – XR1* occurs in the range of acidity pH 6.0 – 8.0 and optimum pH is 7.0. At the same time maximum absorbanee of UV-VIS spectra was 412nm. These datas the same with results in *Saccharomyces boulardii* [14]. However, UV-VIS spectra absorbanee of silver nanoparticles, produced by othe strains of *Saccharomyces were* different. Silve nanoparticles produeed by

Saccharomyces cerevisiae shown absorbanee in 430 nm [15] by *Sacch. Cerevisiae – in 450* nm [16] by commercial bakers yeast - in 413 – 455 nm [17]. These differences perhaps related with formation of clusters of silver nanoparticles.

Conclution. Thus, the influence of the acidity on the formation of silver nanoparticles by *Saccharomyces ellipsoideus* BDU – XR1 were investigated. İt has been discovered that the synthesis of silver nanoparticles occurs at pH 6.0 – 8.0. The optimum initial acidity (pH) was pH 7.0. Synthesis of silver nanoparticles was not observed when the pH was 4.0 and 5.0.

References:

1. *Sadowski Z. Biosynthesis and application of silver and gold Nanoparticles. Wroclaw University of Technology, 2010;11: 257 – 266*
2. *Atef H, Mogda K, Mahmoud H. Biosynthesis of silver nanoparticles (Ag-Nps) (a model of metals) by Candida albicans and its antifungal activity on some fungal pathogens. New York sci. jour., 2013; 6: 27 – 33*
3. *Sheik Muhideen Badhusha M., Abdul Kader Mohideen M.M. Biosynthesis of silver nanoparticles using Saccharomyces cerevisiae with different pH and study of antimicrobial activity against bacterial pathogens. Chemical science transactions, 2016; 5(4): 906 – 911*
4. *Ganbarov KhG, Jafarov MM, Hajiyeva FT, Bozkurt HC, Ramazanov MA, Eyvazova GI, Aghamaliyev ZA, Akhmedov IS. Mycogenic formation of silver nanoparticles by the Azerbaijanese environmental isolate Candida macedoniensis BSU – Mİ44. İnternational Journal of Research Studies in Biosciences, 2016; 4 (5):1 – 5*
5. *Ganbarov KhG, Ahmadov IS, Ramazanov MA, Musayev EM, Eyvazova GS, Aghamaliyev ZA. The concentration effect of the formation of silver nanoparticles by the mold fungus Aspergillus niger BSU – A4. Jour. Biotechnol.2014; 28: 185 – 188*
6. *Monteiro DR, Silva SC, Negri M. Effect of silver nanoparticles against Candida albicans and Candida glabrata biofilms. Lett.Appl. Microbiol. 2012; 54: 383 – 391*
7. *Bozkurt HJ, Jafarov MM, Ganbarov KhG. Production and implementation of metal nanoparticles by yeast fungi. News of Baku University, The series of natural sciences. 2017; (2): 34 – 42*
8. *Jafarov MM, Bozkurt HC. and et.al. Formation of silver nanoparticles in the cultural fluid by Candida guillermondii BSU – 217 yeast fungi stamp. Transaction of the İnstitute of Microbiology of Azerbayjan National Academy of sciences, 2017; 15(1): 214 – 219*
9. *Roberto V, Miguel A, Ernestina C. Ultrastructural analysis of Candida albicans when exposed to silver nanoparticles.Journal Plos One,2014;9:1- 10*
10. *Fatima H. Sahib, Nawfal H. Aldujaili and Mohammad M. Alrufae. Biosynthesis of silver nanoparticles using Saccharomyces boulardii and study their biological activities. European journal of pharmaceutical and medical research, 2017; 4(9): 65 – 74*
11. *Hassan Korbekandi, Soudabeh Mohseni, Rasoul Mardani Jouneghani., Meraj Pourhossein and Siavash Iravani. Biosynthesis of silver nanoparticles using Saccharomyces cerevisiae. Artificial cells, nanomedicine and biotechnology, 2016; 44: 235 – 239*
12. *Niknejad F, Nabili M, Daie Ghazvini R, Moazeni M. Green synthesis of silver nanoparticles: Advantage of the yeast Saccharomyces cerevisiae model. Curr med Mycol, 2015; 1(3): 17 – 24*
13. *Azadaliyeva SF, Jafarov MM, Aghamaliyev ZA, Eyvazova Gİ, Ganbarov KhG. The influence of incubation period on the formation of silver nanoparticles by Saccharomyces ellipsoideus BSU – XR1 yeast fungi stamp. Transaction of the İnstitute of Microbiology of Azerbayjan National Academy of sciences, 2018; 16 (1): 42 – 47*
14. *Abhishek Kaler, Sanyog Jain, and Uttam Chand Banerjee. Green and rapid synthesis of anticancerous slver nanoparticules by Saccharomyces boulardii and insight into mechanism of nanoparticle synthesis. Hindawi Publishing CorporationbioMed Rescarch Internnational. 2013; 8; 1 – 8*
15. *Fengjiao He, Zhaohul Li, Feng Gao and Zhi Yang. Extracellular biosynthesis of Ag nanoparticles by commercial bakers Yeast. Advanced materials resedrch. 2013; 785 – 786: 370 – 373*
16. *Kaushik Roy, C. K. Sarkar. C.K. Ghosh. Photocatalytic activity of biogenic silver nanoparticles synthesized using yeast (Saccharomyces cerevisiae) extract. Appl Nanosci. 2014; 197 – 203*
17. *Muthupandian Saravanan, Tsehaye Amelash, Letemichael Negash, Araya Gebreyesus, Arokiyaraj Selvaraj, Vinoth Rayar and Karthik Dheekonda. Extracellular biosynthesis and biomedical application of silver nanoparticles synthesized from bakers yeast. İnternational Jeurnal of Research in Pharmaceutical and Biomedical Sciences. 2013; 4(3): 822 – 828.*