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BIOSYNTHESIS OF SILVER NANOPARTICLES USING SACCHAROMYCES SP. STRAIN BDU – XR1

Abstract. *Presented work was dedicated to synthesis of silver nanoparticles by yeast strain Saccharomyces Sp. BDU-XR1 which was isolated from spontaneous yogurt used in Azerbaijan. It was founded that this yeast strain is capable of forming silver nanoparticles. First of all its ability to form silver nanoparticles were detected by to stain reaction medium in a dark color and by to give absorption wavelength of 410 – 420 nm in UV-spectrophotometer. According to the characteristic X-ray EDS spectrum specified that these nanoparticles are silver. In the scanning electron microscope the nanoparticles are observed with a circular shape and its sizes are 8 – 17 nm.*
Keywords: *Yeasts, silver nanoparticles, Saccharomyces sp., scanning electron microscope, EDS analysis*

Introduction. Already more than 10 years, the synthesis of metal nanoparticles is carried out with the use of physical, chemical and biological methods in many developed countries of the world. Chemical and physical methods have various limitations in terms of synthesis procedures which may involve use of drastic experimental conditions coupled with may involve use of toxic byproducts, thus damaging the environment [4, 6, 11, 13].

It is known that an alternative approach is their production by the process of biosynthesis, using different species of fungi which act as nanobiofactores, since they produce and secrete enzymes which help in reduction of metal ions to nanoparticles. They are further easy to culture, maintain and due to considerable biomass favor the large scale production of a wide variety of metal nanoparticles including those of silver, gold, iron, cadmium, selenium and platinum [14-16]. Silver nanoparticles have recently attracted a lot of interest due to their distinctive properties such as large surface areas, unique physical, chemical and biological properties [1-3, 7, 8].

It should be noted that there is little information about the use of yeasts in the synthesis of nanoparticles [9, 10, 12].

It is known that species of *Saccharomyces* are used in baking and for production of beers, wines. It is perhaps the most useful yeast since ancient times. Therefore, the production of silver nanoparticles through these fungi is completely harmless to workers in the technological processes. In previous studies different yeast strains were isolated from natural substrates and their morpho-cultural properties were studied. It was determined that only one of these strains – XR1 is darkened the color of solution [5].

From this point of view the aim of the present work is study the ability of yeast *Saccharomyces sp. BDU-XR1* synthesize silver nanoparticles.

Materials and methods. As an object of research Saccharomyces sp. BDU-XR1 used for the synthesis of silver nanoparticles, which was isolated from spontaneous yogurt, which was used in Khachmaz region. This strain was grown in liquid medium with the following: yeast extract – 10 g, sucrose – 20 g, peptone – 20 g to 1 litre of distilled water. The yeats strain Saccharomyces sp. BDU-XR1 was incubated in thermostat at 30o C for 48 hours and 10 g biomass was obtained. After 48 hrs of cultivation, mycelial biomass was separated from the cultural broth by filtration. The settled biomass was washed thrice with 100 ml distilled water. The 10 g washed biomass was suspended in 100 ml distilled water and 1 ml

(1mM) AgNO3 solution was added. Then obtained mixture was incubated in thermostat at 30o C for 13 days.

At the end of the experiment, biomass was separated by filtration and presences of silver nanoparticles were analyzed at filtrate. The formation of nanoparticles was determined due to the darkening color of reaction medium

and to the characteristic absorption of silver nanoparticles in spectrophotometer

("UV – VİS specord 250 plus").

Then the sample was prepared from cultural broth and was dried. The Particle sizes and morphology of Nano-Ag distributions of these samples were also obtained using scanning electronmicroscope (JEOL 7600F, Japan). Due to the EDS analysis was defined that obtained nanoparticles are silver.

Results and discussion. Through the researchs it was determined that color of wet biomass and reaction medium darkened during the incubation period. The color changing was not observed in control flask, which incubated at the same condition. The darkening of reaction medium is one of the indications the presence of silver nanoparticles. The results are shown in the Fig.1.

Yeast biomass was separated from the dark-colored experimental variant, colloidal solution was analyzed and absorption wavelength of 410 - 420 nm was observed in UV-spectrophotometer (Fig.2). Thus this absorption was fit to the characteristic absorption of silver nanoparticles.

The morphology of prepared samples was studied in scanning electron microscope and it was determined that they have a circular shape, also it was determined that the sizes of silver

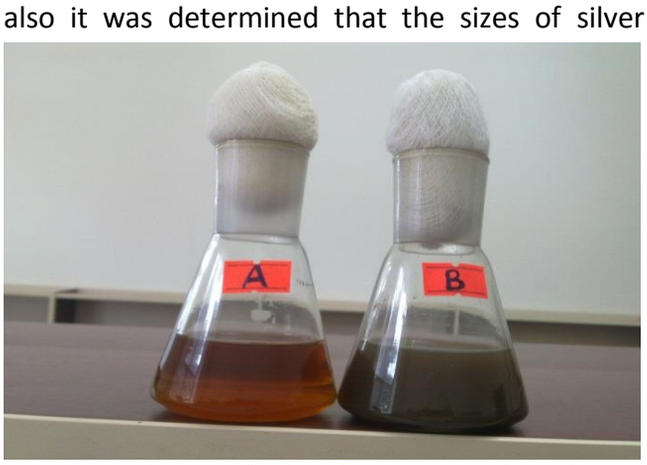

Fig.1. The change of color of reaction medium during formation of silver nanoparticles by strain Saccharomyces sp. BDU-XR1: a - control variant, b - experimental variant

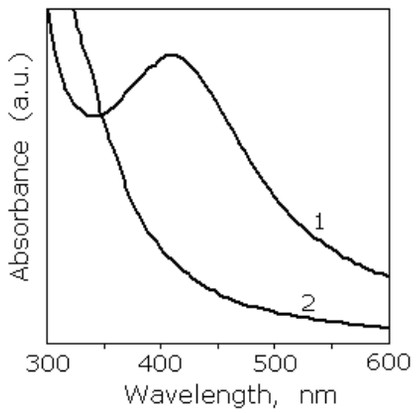

Fig.2. UV-visible spectra of silver nanoparticles synthesized by Saccharomyces sp. BDU-XR1: 1-experimental variant, 2-control variant

nanoparticles are 8-17 nm. As can be seen from picture, the silver nanoparticles create larger-sized clusters (Fig.3).

It was X-ray analysis for to study the element composition of nanoparticles and their specters were shown at Fig4. It was mapping during the EDS analyses and it was determined that formed nanoparticles are silver nanoparticles.

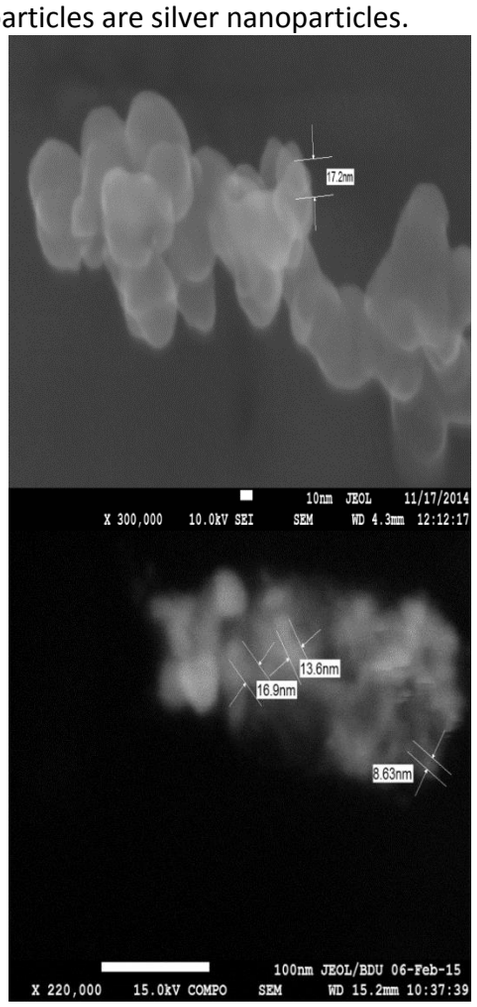

Fig.3. Scanning electron microscopy of silver nanoparticles synthesized by Saccharomyces sp. BDU-XR1.

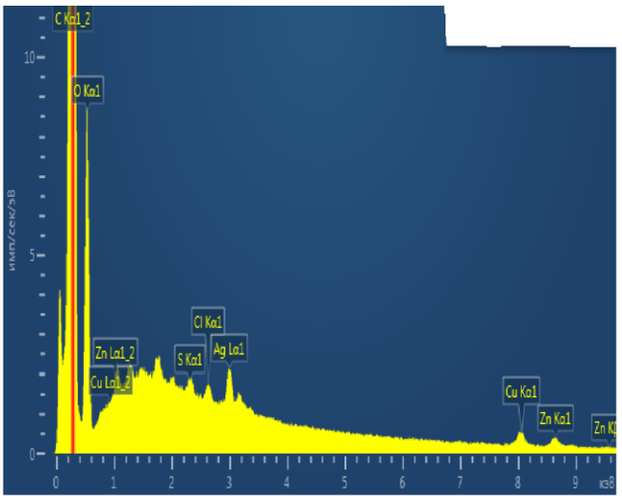

Fig.4. The characteristic EDS spectra of silver nanoparticles synthesized by Saccharomyces sp. BDU-XR1

Conclusion. Thus due to results of research it was determined that the yeast strain ability of *Saccharomyces sp. BDU-XR1* to form silver nanoparticles was detected by staining reaction medium in a dark color and absorption wavelength of 410 - 420 nm in UV – VİS spectrophotometer. According to the characteristic EDS analysis X – ray spectrum specified that these nanoparticles are silver. In the scanning electron microscope the silver nanoparticles are shown with a circular and its sizes are 8 – 17 nm.

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