PREPARATION OF SILVER NANOPARTICLES FROM YEAST USING SABOURAUD DEXTROSE BROTH AND MEASUREMENT OF ANTIBACTERIAL EFFECT

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Abstract

The method of preparing AgNPS in this paper is a simple and different from other methods. Where we used Saccharomyces cerevisiae and Sabouraud Dextrose broth (SDB) medium and mix it with AgNO₃ solution, the interaction between these solutions has produced AgNPS as a result of oxidative reduction in solution the size of crystal appears (15nm) in XRD and peak absorption (470nm), SEM images showed that AgNPS were different shapes (clusters, semispherical), AgNPS was used as an antibacterial on two types of pathogenic bacteria (Staphylococcus epidermidis and Eschrichia coli), the effectiveness was well.

Key words: Nanoparticles, AgNPS, Morphology.

Introduction

The meaning of the word “Nano” is called to any parameter when it is represented as a measure of 10-9 times of SI units. NPs and their applications have been undetected and unknown in recent years. The term nanotechnology was associated with the name of the Japanese scientist (Taniguchi, 1974).

Nano science is slowly stepping up in various fields until a group of scientists began to report on how heavy metals are being processed by Microorganisms.

This remediated of metal crystal is imperceptible. After evidence of nanoparticles is available, the applications of these NPs have expanded. For example, AgNPs are used as antibacterial agents in many facilities and infrastructure in China. It is also used as an antibacterial in surgical procedures to reduce infection during the procedure and also as antifungal (Mullen et al., 1989) (Kalishwaralal et al., 2009) (Gurunathan et al., 2009).

Silver - Nps: AgNps obtained from silver nitrate have replaced silver oxide for antibacterial use silver was used war (Sheikpranbabu et al., 2009) (Chu et al., 1988) (Deitch et al., 2009) (Margraff et al., 1977) (Silver, 2003) (Atiyeh et al., 2007) (Law et al., 2008), where used as an ointment to heal wounds. AgNPs better than Ago NPs in therapeutic uses, Since AgONPs are effective for short periods. The applications of AgNPS have increased to enter Various fields such as Medicine, food production health care, due to their distinct chemical and physical properties (Mechanical, thermal, optical, electrical etc.) (Gurunathan et al., 2015) (Li et al., 2010) (Mukherjee et al., 2001) and biological advantages like antibacterial anticancer cell (Chernousova et al., 2013). These physical, chemical and biological properties result from surface to volume ratio. (Gurunathan et al., 2009) (Li et al., 2001) physical and chemical methods for the properties preparation AgNps are good but they contain negative sides such as a high cost and toxicity and require many tools. (Gurunathan et al., 2015) (Sharma et al., 2009).

The characteristic of the biological method for the preparation of AgNPs is limited toxicity, more productivity, simplicity and excellent solubility. (Gurunathan et al., 2015) Safety aspect of NPs.

The properties of many materials change when they are reduced to nano scale the surface area of the particles increased, resulting in increased interactions with environment Nanomaterial’s are of limited toxicity (Gwinn et al., 2006) and therefore have the advantage in an
medicine, biochemistry and nanotechnology (Bruchez et al., 1998) (Cao et al., 2004) (Cao Y.C., 2002) (Akerman et al., 2009).

**Materials and Methods**

The silver nanoparticles were prepared by biologic way from yeast (Saccharomyces cerevisiae) (Sowbarnika et al., 2018) (Kaushik et al., 2015), a new method for the preparation of nanoparticles, where the yeast was grown in Sabouraud Dextrose Broth (SDB).

By adding (0.1 gm) form dry (Saccharomyces cerevisiae) to SDB where growth yeast colonies after putting the flask in shaker incubation at (30°C, 110 rpm) for two days, then made centrifuge for the growth of (Saccharomyces cerevisiae + SDB). We take (50 ml) from supernatant, dissolved (0.5 gm) from AgNO₃ in (50ml) Deionized water, the concentration will be (0.6 M), when we add yeast (Drop wise) the concentration will be (0.3 M), after that stirring for solution by stirrer device during 30 minutes and incubated flask in shaker incubation with the (110 rpm at 30°C) for 24h, the color of solution is changing from light yellow to dark brown then red then black over time as shown in fig. 1.

Take the precipitate of solution after centrifuged (5000 rpm, 10 minutes) and washed it for several times by ethanol and then we take the extract dry up with under vacuum oven (200°C, 3 hrs, -0.06 MPa) and thus will get AgNPs (dry powder).

**Results and Discussion**

XRD analysis: AgNPS Crystals did not appear in XRD with one phase but appeared in different phases, there are four peaks for silver 2θ= 38.32°, 44.47°, 64.62°, 77.55° and strongest peaks at 2θ = 38.32°, 77.55° with max intensity I/I₁ = 100, 51 (in order) and Fall with half max (FWHM) = 0.56, 0.47 (in order) as shown in fig. 2.

Miller/indices in order

- 2θ= 38.32° → (111)  
- 2θ = 44.47° → (200)

**UV-Vis spectroscopy**

AgNPS solution was examined after 48h in UV-Vis device for the purpose of measuring absorption and the peak absorption was at wavelength (470)nm which corresponds to the wavelength for AgNPS, peak of the absorption at (470)nm indicate to AgNPS in solution as illustrated in fig. 3.

**Fig. 1:** Changing colors during time.  
**Fig. 2:** X-ray diffraction of biosynthesized AgNps.  
2θ = 64.62° → (200)  
2θ = 77.55° → (311)  
**Fig. 3:** Uv spectra of biosynthesis AgNps after 48 hrs.
notice the following bands as shown in fig. 4.

- Band at 668.81 cm\(^{-1}\) (low band) Corresponding to Cl stretching.
- Band at 1634 cm\(^{-1}\) (Mid band) Corresponding to N-H banding frequency.
- Band at 2007 cm\(^{-1}\) corresponding to C-N stretching of any R-N=C=S

**SEM**

Interactions during the biosynthesis process. Leads to the production of NPS that take different morphology and structures and identify the morphology are done during FESM.

The morphology of NPs in the images were multiple shapes, (rock, Clusters, Semi spherical, semi cubic).

It was pH between (5, 6) acid, perhaps it is the reason for these morphologies grain size of SEM Images greater than crystal size at XRD, the reason: (XRD) depends on size or measure particles without taking the number of defects in the crystal.

**Anti bacterial activity of yeast extract synthesized AgNPS**

We measured the inhibitory effect of different concentration of AgNps against Staphylococcus epidermidis and Escherichia coli. As shown in table 1.

**References**

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Bacterial type</th>
<th>Inhibition zone</th>
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