INTERNATIONAL RESEARCH FELLOWS ASSOCIATION

Impact Factor – 3.452

ISSN – 2348-7143

INTERNATIONAL RESEARCH FELLOWS ASSOCIATION'S

RESEARCH JOURNEY

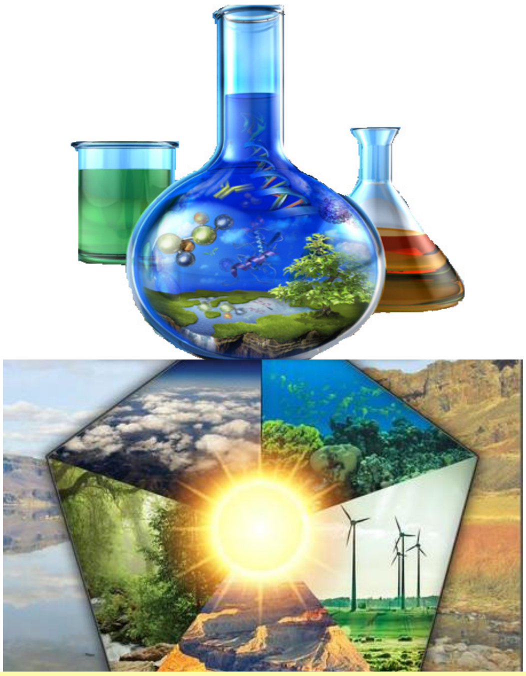
Multidisciplinary International E-research Journal

PEER REFREED & INDEXED JOURNAL

December-2017

SPECIAL ISSUE-XXV

Recent Trends in Chemistry and Environment



Guest Editor :
Dr. R. P. Phalak
Principal,
Dadasaheb Devidas Namdeo Bhole College,
Bhusawal, Dist. Jalgaon [M.S.] India.

Editor in Chief :
Dr. Dhanraj Dhangar
Assist. Professor,
MGV's Arts & Commerce College,
Yeola, Dist. Nashik [M.S.] India.

Executive Editor of the issue: Dr. R. B. Dhake
Dadasaheb D. N. Bhole College, Bhusawal, Dist. Jalgaon.

This Journal is indexed in :

- University Grants Commission (UGC) List No. 40107 & 44117
- Scientific Journal Impact Factor (SJIF)
- Cosmoc Impact Factor (CIF)
- Global Impact Factor (GIF)
- Universal Impact Factor (UIF)
- International Impact Factor Services (IIFS)
- Indian Citation Index (ICI)
- Dictionary of Research Journal Index (DRJI)

For Details Visit To : www.researchjourney.net

SWATIDHAN PUBLICATIONS

ISSN : 2348-7143
December 2017

Green synthesis of silver nanoparticles, their characterization and antimicrobial Study

Hemant Bhangale[1], Dilip Patil[2*]
[1]JDMVP's Arts, Commerce and Science College, Yawal, Maharashtra, India
[2]Nanomaterial Research Laboratory, R.C. Patel ACS College,
Shirpur, 425405, Maharashtra, India
*Corresponding mail: dr.drpatil@gmail.com

Abstract :

The present paper reports the extracellular synthesis of silver nanoparticles using the penicillium species. Formation of nanoparticles was indicated by colour change of the reaction medium from pale yellow to brown and further confirmed using UV-visible spectra showing the absorption peak at 425 nm representing the characteristic surface plasmon resonance peak of the silver nanoparticles. The particle size observed using Zeta sizer measurement was found to be in the range between 15 nm to 30 nm. Fourier Transform Infrared spectroscopy analysis showed the presence of protein molecules alongwith the silver nanoparticles. The synthesized silver nanoparticles were evaluated for the antimicrobial activity against Gram positive bacteria staphylococcus aureus and displayed the zone of inhibition 21.19 nm in diameter.

Key words: silver nanoparticles, extracellular synthesis, UV-visible spectroscopy, FTIR, TEM, antimicrobial activity.

Introduction :

Metal nanoparticles possess unique optical, electrical, electronic and magnetic properties which can be altered by manipulation of size and shape of the nanoparticles[1]. Hence, they found applications in various fields like agriculture, medicine, catalysis[2], sensing, bioimaging etc. The use of silver has been known for a long time for the treatments of burns and chronic wounds. Silver nanoparticles have the potential exhibited for antimicrobial activity against Gram positive and Gram-negative bacteria and hence found enormous applications in the field of pharmaceuticals [3].Realizing the importance of silver nanoparticles in various fields researchers attracted for the synthesis of silver nanoparticles by various physical and chemical methods. But these methods are expensive, bulky and involve the use of toxic chemicals and hence triggering the environmental pollution. Biological methods are then attracted much attention for the synthesis of nanoparticles as these are simple, cost effective and eco-friendly routes and having the potential for large scale production. Use of microorganisms, plant extract has been reported for the preparation of silver nanoparticles. Fungi such as *Fusarium oxysporum[4], Aspergillus Flavus[5,6], Aspergillus Niger[7]*etc. have shown their ability for the extracellular synthesis of silver nanoparticles.

Several pathogenic bacteria possessed increased resistance to the currently available antibiotics. It was reported that silver nanoparticles showed excellent antimicrobial activities various pathogen hence can be predicted as the alternative to these antibiotics [8].

ISSN : 2348-7143
December 2017

In the present work we have reported the extracellular synthesis of silver nanoparticles using the fungus penicillium species and studied their antimicrobial performance.

Materials and methods

Analytical grade silver nitrate was purchased from Sigma Aldrich. The fungus culture *penicillium species* (NCIM 1313) was obtained from National Chemical Laboratory culture collection centre, Pune.

Synthesis ofsilver nanoparticles :

The fungus culture *penicillium species* was grown aerobically in potato dextrose broth at 30^0C under static condition for seven days. Then biomass was harvestedby filtration through the whatmann no. 1 filter paper. The fresh and clean biomass was resuspended in 100 ml deionized water and incubated at 30^0 at110 rpm. After 72 h of incubation the biomass was separated by filtering with the use of Whatmann no,1 filter paper. The obtained cell filtrate was used for the synthesis of silver nanoparticles.

For the synthesis of silver nanoparticles 25 ml of cell filtrate was mixed with equal amount of 1mM silver nitrate solution in Erlenmeyer flask and kept in shaking incubator running with the speed 110 rpm for 24 h [9]. The flask containing only cell filtrate was also maintained at the same conditions.

Characterization of silver nanoparticles :

The formation of silver nanoparticles was monitored visually by observing the change in colour of the reaction mixture and then by using UV-visible spectroscopy (Shimadzu 2450) scanningin the range between 200 nm to 800 NM. The colloidal solution of silver nanoparticles was also subjected to FTIR analysis for the detection of biomolecules responsible for thesynthesis mechanism.The particles size distribution of synthesized Ag NPs was examined using the Malvern Zeta sizer.The antimicrobial activity of silver nanoparticles was evaluated against Staphylococcus aureus by disc diffusion method. The sample disc P16 impregnated with 100 µl of colloidal solution of silver nanoparticles was placed on nutrient agar plates and incubated at 37^0C for 24 h.

Result and discussion

UV-visible spectroscopic measurements

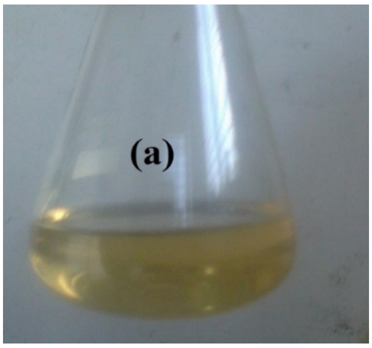


Figure 1(a) Cell filtrate

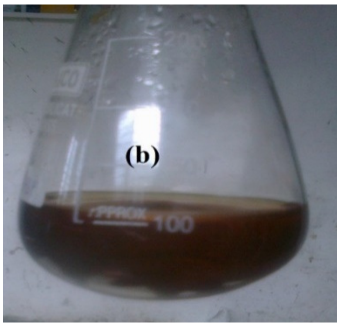


Fig.1(b) Cell filtrate treated with $AgNo_3$

The change in colour of the reaction mixture from pale yellow to dark brown was the primary sign of the formation of the silver nanoparticles . The appearance of the brown colour was due to the surface plasmon resonance phenomenon [10]exhibited by the silver nanoparticles. The colour of the cell filtratewas remained same.

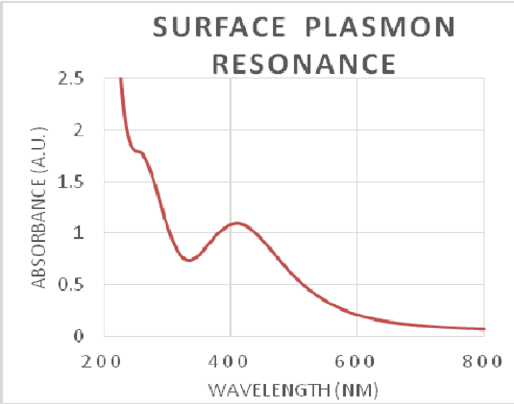


Figure 2 Cell Filtrate treated with silver nitrate

The UV-visible spectra showed the surface plasmon resonance peak at 413nm confirmed the reduction of silver ions into silver nanoparticles [11].

FTIR analysis

FTIR spectroscopy was performed to identify the biomolecules responsible for the synthesis and stabilization of the silver nanoparticles. Fig. depicts the FTIR spectrum of the colloidal silver nanoparticles with the bands observed at 3363 to 3580,2077,1643,1357,657 cm^{-1}. The overall observation suggests the existence of proteins along with the nanoparticles responsible for the reduction and stabilization of the nanoparticles [12].

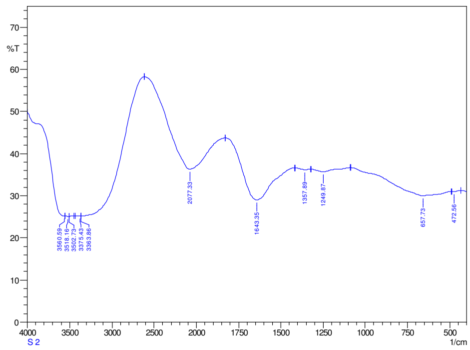


Figure 3 FTIR spectrum showing the presence of proteins in the sample.

Particle size analysis

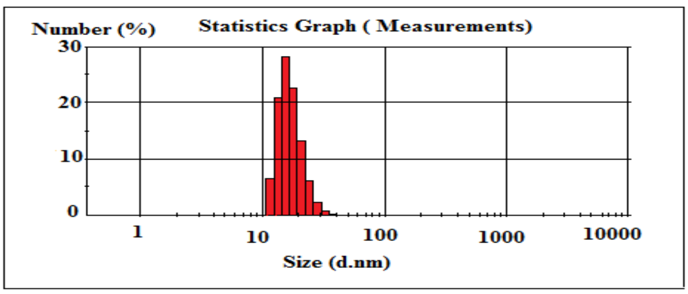


Figure 4 Particle size analysis

Particles size analysis of the synthesized silver nanoparticles is presented in figure5 revealed that most of the particles were found in the range between15 nm to 30 nm.

Antimicrobial Activity

The antibacterial activity of the synthesized silver nanoparticles was shown in fig. 6. The zone of inhibition of diameter 21.19 mm corresponding to the sample disc P16 exhibit the antibacterial performance of silver nanoparticles.

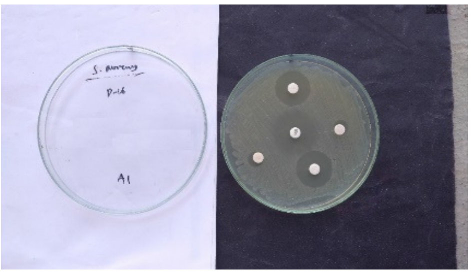


Figure 5 Antimicrobial activity of AgNPs

Conclusion

Penicillium species extract have the ability for extracellular synthesis of silver nanoparticles. The prepared silver nanoparticles were found to be in the size range 15 nm to 30 nm. The remarkable antimicrobial activity exhibited by the nanoparticles have shown their potential for the alternative to present antibiotics in the field of pharmaceutics.

References

1 Z.L. Wang,J.Phys. B.104,1153,(2000)
2 M.Raghasudha,International Journal of Modern Chemistry and Applied Science,3(1),(2016),306-308.
3 P. Galletto, P.F. Brevet, H.H. Girault, R. Antoine, M. Broyer, J. Phys. Chem.B.,103,8706,(1999).
4 Ahamad A., Mukherjee P., Senapati S.,Mandal D.Khan M.I. Kumar R., Colloids Surface B. Biointerfaces 28,313-318,2003.
5 Navin Jain ,Arpit Bhargava, Sonali Majumdar, J.C. Tarafdar and Jitendra Panwar, Nanoscale ,2011,3,635-641.
6 *R.Manimozhi, R. Anitha,bInternational Journal of Pharmaceutics and Drug Analysis,Vol.2,issue 9,2014,734-739*
7 *A.K. Gade,P.Bonde,A.P. Ingale,P.D.Marcato,N.Duran,and M.K.Rai,Journal of Biobased Materials and Bioenergy,vol.2,2008,1-5.*
8 Dattu Singh, Vandana Rathod Shivaraj Nimganagouda,Jyothi Hiremath, Ashishkumar Singh and Jasmine Mathew, Bioinorganic Chemistry and Applications, Volume 2014.
9 HemathNaveen K.S., Gaurav Kumar, Karthik L, Bhaskara Rao K.V.,Archives of Applied Science Research,2010,2(6),161-167.
10 Ingale A., Rai M., Pierrat S., Sonnichsen C., Current Nanoscience,4,141 -144,2008.
11 Pitark Jm, Silkin VM, Chulkov EV, Echenique PM, J Optic Pure Applied Optic 2005,7,73-84.
12 Nikhil S. Shaligram, Mahesh Bule, Rahul Bhambure, Rekha S. Singahal, Sudhir Kumar Singh, George Szakacs, Ashok Pandey,Process Biochemistry 44(2009),939-944.