Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Archives of Applied Science Research, 2011, 3 (2):377-380

(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-508X
CODEN (USA) AASRC9

Biosynthesis of silver nanoparticle and its antibacterial activity

Nithya.G , N. Hema shepangam* and S. Balaji

Post Graduate and Research Department of Microbiology, Hindusthan College of Arts and Science, Coimbatore, Tamilnadu

---

ABSTRACT

The use of microorganisms in the synthesis of nanoparticles emerges as an ecofriendly and existing approach. In this study biosynthesis of silver nanoparticles using Streptococcus sp, Proteus sp, Pseudomonas sp and its antimicrobial activity against (S.typhi, S.epidermidis, K.pneumoniae,P.aeruginosa, P.vulgaris, E.coli) different pathogen has been reported. The zone of inhibition seems in both gram positive and gram negative bacterial strains.

Keywords: Silver nanopartices, Antibacterial activity, Zone of inhibition.

INTRODUCTION

Nanotechnology is foreseen to significantly influence science, economy and everyday life in the 21st century and also to become one of the driving forces of the next industrial revolution. Different fields of this novel technology comprise the production, characterization and manipulation of nanoscale structures(1). In the last decades, the interest of both science and industry was focused on the production of nanoparticles-solid particles that could be no crystalline, aggregates of crystallites or single crystallites in the range of 1-1000nm.Besides the rather established chemical and physical production procedures[2-19]. Numerous organisms have been found to synthesize nanoparticles. Biological production systems are of special interest due to their effectiveness and flexibility. Microbial cells are highly organized units, regarding morphology and metabolic pathways, capable of synthesizing reproducible particles with well defined size and structure. Furthermore, biogenic nanoparticles often exhibit water soluble and biocompatible properties, which are essential for many applications.

Presently metal accumulating bacteria have shown potential for material science. Biomimetics is the area of research dealing with material science and engineering through biology. Bacteria are involved as workers in the living factory and plethora of novel nanostructured particles with unexpected properties are produced in the living factory which have applications in biomedical sciences, optics, magnetics, mechanics, catalysis and energyscience. These biological materials can be used in their native form directly extracted from the living systems, or they can be processed after extraction and modified to their desired form [2].

Silver nanoparticle act as an antimicrobial and antibiotic agent when incorporated in proteins, nanofibre, first aid bandages plastics, soap and textiles, in cell cleaning fabrics and as a conductive filler.

Thus ,the aim of the study to synthesize silver based bionanoparticles. The present investigations revealed with the isolation and monitoring of silver nanoparticles from the bacteria like *Pseudomonas* sp, *Proteus* sp,*Streptococcus* sp and their antibacterial assessment was performed to produce novel drugs to overcome drug resistance and advance reaction

MATERIALS AND METHODS

Collection of the extract

Pseudomonas sp, *Proteus* sp, *streptococcus* sp are the 3 bacteria included in this study. The culture were obtained from IMTECH Chandigarh .The strain were maintained at 4^0c on nutrient agar slant .The bacterial used for biosynthetic experiment were grown aerobically in a broth .

Culture

The bacterial strain was inoculated in the autoclaved media and sterilized at static condition and allowed to grow for 24 hrs at 37^0C. All the chemicals used were of analytical grade purchased from the Precision Scientific Co.

Synthesis of silver nanoparticles

For the synthesis of silver nanoparticles, 20ml of the bacterial filtrate was brought in contact with1mM of silver nitrate final concentration in 150ml Erlenmeyer flask, and agitated at 25°C in dark condition under normal pH ranges from 7-8. Simultaneously controlled without silver ions was also run along with the experimental flask.

Antibacterial analysis

The antibacterial activity of isolated microbial silver based nanoparticles pellet were tested by standard well cutting method. The test bacterias *streptococcus* sp *Pseudomonas* sp, *Proteus* sp were included in this study to assess the susceptibility pattern of the compounds. 100µl of the diluted components were loaded on marked wells with the help of micropipette and the plate were incubated at 37^0c for 24 hrs for observing inhibition rate .

RESULTS AND DISCUSSION

It was found that aqueous silver ions when exposed to bacterial extract were reduced in solution, there by leading to the formation of silver hydrosol .The bacterial biomass were pale yellow in colour before the addition of silver ions and this changed to dark brownish colour, suggested the formation of silver nanoparticle. The bottle were observed periodically was change in colour from pale yellow to different shade of brown. (Table 1)

Characterization of silver nanoparticle:

Visual inspection:

Appearance of brown colour solution clearly indicated the formation of silver nanoparticle in the reaction mixture.

Antimicrobial activity against bacterial pathogen:

Silver nitrate has long been considered as a powerful and natural antibiotic and antibacterial agent. Silver nanoparticles exhibited antibacterial properties against bacterial pathogens with

close attachment of the nanoparticles themselves with the microbial cells. The antibacterial activity of the synthesized silver particles have been investigated against *Salmonella typhi*, *Streptococcus epidermidis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus vulgaris*, *E.coli*, *Klebsiella pneumonia*. Microbial nanoparticles of *Streptococcus* sp showed very strong inhibitory action against *S.typhi* (40mm zone of inhibition) followed by *S.epidermidis (*38mmzone of inhibition*)*, *S.aureus*(36mm zone of inhibition), *P.aeruginosa*(35mm zone of inhibition), *P.vulgaris* and *E.coli* (34mm zone of inhibition),*K.pnemoniae*(30mm zone of inhibition).

Table1Periodical colour change from pale yellow to dark brown with 1mM Silver nitrate.

Time	Organisms		
	Streptococcus sp	*Pseudomonas* sp	*Proteus* sp
0 minutes	-	-	-
10minutes	-	-	-
30minutes	+	+	+
1hours	+	+	+
2hours	++	++	++
4hours	++	++	++
8hours	++	++	++
16hours	++	++	++
24hours	+++	+++	+++

- No colour change ; + colour change ; +pale yellow ; ++Tinge brown ; +++Brown colour

Table 2: Zone of inhibition of nanoparticle against bacterial strains tested.

Bacterial culture	*Streptococcus* sp (in mm)	*Proteus* sp (in mm)	*Pseudomonas* sp (in mm)
S.typhi	40mm	30mm	30mm
S.epidermidis	38mm	28mm	32mm
S.aureus	36mm	24mm	34mm
P.aeruginosa	35mm	23mm	32mm
P.vulgaris	34mm	23mm	30mm
E.coli	34mm	22mm	34mm
K.pneumoniae	30mm	20mm	20mm

CONCLUSION

The study included the synthesis of silver nanoparticles from the bacteria namely *Streptococcus* sp, *Proteus* sp and *Pseudomonas* sp and their antimicrobial activity. From the study it was concluded that the aqueous silver ions exposed to the microbes were reduced in the structure level and the nanoparticles were synthesized. Presence of nanoparticles were confirmed by color change of media from pale yellow to brown colour. The antimicrobial efficiency of *Streptococcus* sp was more than *Proteus* and *Pseudomonas* against *S.typhi* .Hence it has wide application in medical field.

REFERENCES

[1] K.J.Klabunde, *Nanoscale materials in chemistry*, J.Wiley &sons, Inc, Newyork **2001**.
[2] J.C.Hulteen, D.A.Treichel, M.T.Smith, M.L.Duval, T.R.Jensen, R.P.Van Duyne, *J.Phys.Chem.* B**1999**,103(19), 3854.
[3] M.McCord,*J.Vac.Sci.Technol.BMicroelectron.NanometerStruct.process.Meas.Phenom.***1997**,15(6),2125.
[4] J.Silverman,J.Vac.Sci.Technol.B*Microelectron.NanometerStruct.Process.Meas.Phenom.***1997**, 15(6), 2117.

[5] J.Melngailis, A.A.Mondelli, I.L.Berry, R.Mohondro, J.Vaccum *Sci*. *Technol*. B 1998, 16(3), 927.
[6] T.Kodas, M.Hampden-Smith, in Aerosol *processing of materials* (Eds: T.Kodas, I.Hampden-smith), Wiley-VCH, Newyork 1999.
[7] B.J.Kooi, G.Palasantzas, J.T.M.De Hosson, *Appl. phys. Lett*. 2006, 89, 161914.DOI: 10.1063/1.2358860.
[8] S.I.Dolgaev, A.V.Simakin, V.V.Voronov, G.A.Shafeev, F.Bozon-Verduraz, *Appl.Surf.Sci*. **2002,** 186(1-4),546.
[9] Z.Dai, S.Sun, Z.Wang, *Nano Lett*. **2001**,1(8),443.
[10] C.C.Koch, *Nanostructured Mater*.**1997**,9(1-8),13.
[11] W.H.Jiang, M.Atzmon, *Acta Mater*. **2003**, 51(14),4095.
[12] V.Liveri,in *controlled synthesis of Nanoparticles in Micro heterogeneous Systems* (Ed:D.J.Ockwood), Springer, Boston **2006**.
[13] S.H. Wu, D. H. Chen, *J Colloid interface* Sci. **2004**, 273(1), 165
[14] B.M Rabatic, M. U. Pralle, G. N. Tew, S. I. Stupp, *Chem. Mater. Sci*. **2003**, 15(6), 1249.
[15] K. M. Mayya, N. Jain, A. Gole, D. Langevin, M. Sastry, *J.colloid Interface Sci*.**2004**, 270(1), 133.
[16] A. Swami, A. Kumar, R. Pasricha, A. B. Mandale, M. Sastry, , *J.colloid Interface Sci*.**2004**, 271(2), 381.
[17] R.T. Lv, C.B. Cao, Y.J. Guo, H. S. Zhu, *J Mater Sci*.2004, 39(5), 1575
[18] Z. P. Liu, Z. K. Hu, J. B. Liang, S. Li, Y. Yang, S. Peng, Y. T. Qian, *Langmuir* **2004**, 20(1),214.
[19] R.B. Zhang, L. Gao, Q. H. Zhang, *Chemosphere* **2004**, 54(3),405