Available online at www.scholarsresearchlibrary.com

Scholars Research Library

J. Nat. Prod. Plant Resour., 2013, 3 (2):23-30
(http://scholarsresearchlibrary.com/archive.html)

ISSN : 2231 – 3184
CODEN (USA): JNPPB7

Synthesis of plant mediated silver nanoparticles and antimicrobial activity in *Cucumis sativa*

S. Divya Priya[1], S. Sharmila[1] and T. Nusrath[2]

[1]P.G and Research Department of Biochemistry, N.G.P Arts and Science College, Coimbatore, India
[2]Dr. N. G. P. Arts and Science College, Coimbatore, India

ABSTRACT

The aim of this study was the synthesis of silver nanoparticles in the aqueous leaf extracts of Cucumis sativa and investigate its antibacterial activity.Nanoparticles are being used in many commercial applications.It was found that aqueous silver ions can be reduced by aqueous extracts of plant parts to generate extremely stable silver nanoparticles in water. The results recorded from UV- spectrum, scanning electron microscopy are support the biosynthesis and characterization of silver nanoparticles.

Keywords: silver nanoparticles, Antibacterial activity, SEM analysis

---

INTRODUCTON

Nanotechnology is emerging as rapidly growing field with application in science and technology for the purpose of manufacturing new materials at the nanoscale level [1].The field of Nanotechnology is one of the most active areas of research in modern material science .The word “nano” is used to indicate one billionth of meter. The term Nanotechnology was coined by Taniguchi, a researcher at the University of Tokyo, Japan .Nanoparticles exhibit completely new or improved properties based on specific characteristics such as size, distribution and morphology [2]. Nanotechnology has many branches. There are Molecular Nanotechnology, Environmental nanotechnology and wet nanotechnology etc. In the field of nanotechnology many tools and machines are used.Nanotechnology is a growing field day by day making an impact in all spheres of human life [3].

Today, nanometalparticles, especially silver, have drawn the attention of scientists because of their extensive application in the development of new technologies in the areas of electronics, material sciences and medicine at the nanoscale [4]. Silver nanoparticles have many applications; for example, they might be used as spectrally selective coatings for solar energy absorption and intercalation material for electrical batteries, as optical receptors, as catalysts in chemical reactions, for biolabelling, and as antimicrobials [5].Historically, silver has been found in applications ranging from traditional medicines to culinary items. It has been reported that silver nanoparticles (SNPs) are non-toxic to humans and most effective against bacteria, virus and other eukaryotic micro-organism at low concentrations and without any side effects [6].

MATERIALS AND METHODS

Collection of plant sample
The leaves of *Cucumis sativa* were collected from local areas of Kerala and has authenticated from TNAU, Cbe.

Preparation of the extract
10g of plant powder was weighed and it is mixed with 100ml of water. The extraction was carried out in a shaker for 24 hours. The solution was filtered through what's Mann no.1 filter paper. The filtered samples were collected in a conical flask. The obtained extract was used for the synthesis of silver nanoparticles.

Preparation of silver nitrate solution
1mM silver nitrate solution was prepared by the concentration of 0.0169gm in 100 ml double distilled water and stored.

Metal-plant extract interaction
90 ml of the silver nitrate solution was taken in conical flask.To this add 10 ml of the leaf extract. The colour change of the silver nitrate solution was found from colorless to dark brown. Incubate the conical flask at room light for 72 hours.

Concentration of phyto nanoparticles
After 72 hour incubation, the color change was observed.

This indicates that the silver nanoparticles were synthesized from leaves with the help of aqueous solution. Then this solution was taken in centrifuge tube and it was centrifuged at 10,000 rpm for 20 min.The pellets were taken after centrifugation and mixed with petroleum ether for rapid drying, dried pellets were collected in a micro centrifuge tube with ethanol and pellets were used for testing SEM and antimicrobial activity.

Sem analysis
Scanning electron microscope (SEM) analysis was done using Hitachi S-4500 SEM machine. Thin films of the sample were prepared on a carbon coated copper grid by just dropping a very small amount of sample on the grid, extra solution was removed using a blotting paper and then the film on the SEM grid were allowed to dry by putting it under a mercury lamp for 5 minutes.

Antimicrobial activity of silver nanoparticles
The Antibacterial activity of isolated plant silver nitrate based nanoparticles pellets were tested by paper disc method.The bacteria were collected from Department of Microbiology lab, Dr. N.G.P. Arts and Science College, Coimbatore. The test organisms used for assay are*Staphylococcus aureus, Proteusvulgaris,E.coli, Pseudomonas areoginosa, Klebsiella pneumonia*. The antibacterial activity of the synthesized silver nanoparticle was evaluated by measuring the zone of inhibition

Preparation of media
2.8g of nutrient agar was weighed correctly and dissolved in 100ml of sterile distilled water. pH was adjusted to 7.2 and was autoclaved at 121^0C for 15 minutes. 20ml of molten agar was poured in to the sterile petric plate and allowed to solidify.

Fig: 1 *Cucumis sativa*

Fig: 2

Fig:3

Colour change of leaf extract containing silver before and after synthesis of silver nanoparticles

RESULTS AND DISCUSSION

Medicinal plants play a key role in human health care. About 80% of the world population, mainly in developing countries relies on the use of traditional medicine which is predominantly based on plant material. They have lesser side effects and are effective in certain disorders are based on experience in the use of plant products against common diseases.

Plants have played in significant role in maintaining human health and improving the quality of human life for thousands of years and have served humans well as valuable components of medicines, seasonings, beverages, cosmetics and dyes [7].

Among noble-metal nanoparticles silver nanoparticles have received considerable attention due to their attractive phytochemical properties [8].The production of nanoparticles can be devised only by certain indications. On such indication is an increase in ph rate. This is considered to be an important requirement for the complete formulation data of the nanoparticles [9].

Microorganisms play an important role in toxic remediation through reduction of metal ions nano crystalline silver particles has found tremendous applications in the field of high sensitivity bimolecular detection and diagnosis. However there still need for economic, commercially viable as well as environmentally clean synthesis route to synthesize silver nanoparticles.

Metal- Plant Interactions:

a) Colour change The plant extract was mixed with prepared silver nitrate and incubated. During incubation at room temperature the metal ions present in the solution were interacted with plant compounds and converted to pale yellow to dark brown color on exposure to sunlight. The intensity of the color increased with time. The time duration for color change varies with plant. The color change indicates the formation of silver nanoparticles. The change in color is primary due to the excitation of surface Plasmon vibrations in silver nanoparticles, as showed following figures

Table -1 Periodical colour change from pale yellow to dark brown of the *Cucumis sativa* with silver nitrate solution

Time	Sample	Control
0 min	-	-
1 hour	+	-
2 hour	++	-
4 hour	+++	-
8 hour	++++	-
16 hour	+++++	-
24 hour	++++++	-
28 hour	+++++++	-

+Pale yellow, +++Light brown, +++++Reddish brown, +++++++Dark brown

b) pH Change

Growth of the nanoparticles takes place in the alkaline pH. The alkaline pH is required for the complete formulation and structural data of the nanoparticles. The increased pH indicated the formation of nanoparticles.

Table 2 The periodic change in P^H during plant nanoparticles formation

Time	P^H
0 Minute	7.2
1st hour	7.4
2nd hour	7.7
4th hour	7.8
8th hour	7.9
16th hour	8.0
24thhour	8.3
28th hour	8.5
72th hour	8.9

The biosynthesized silver nanostructure by employing *Cucumis sativa* leaf extract was further demonstrated and confirmed by the characteristic peaks and the structural view under the scanning electron microscope.

The reduction of silver ions present in the extract of silver complex during the reaction within ingredients present in the *Cucumis sativa* extract absorbed by revealed the presence of silver nanoparticles by SEM analysis and it showed the particle size as well as the cubic structure of nanoparticles

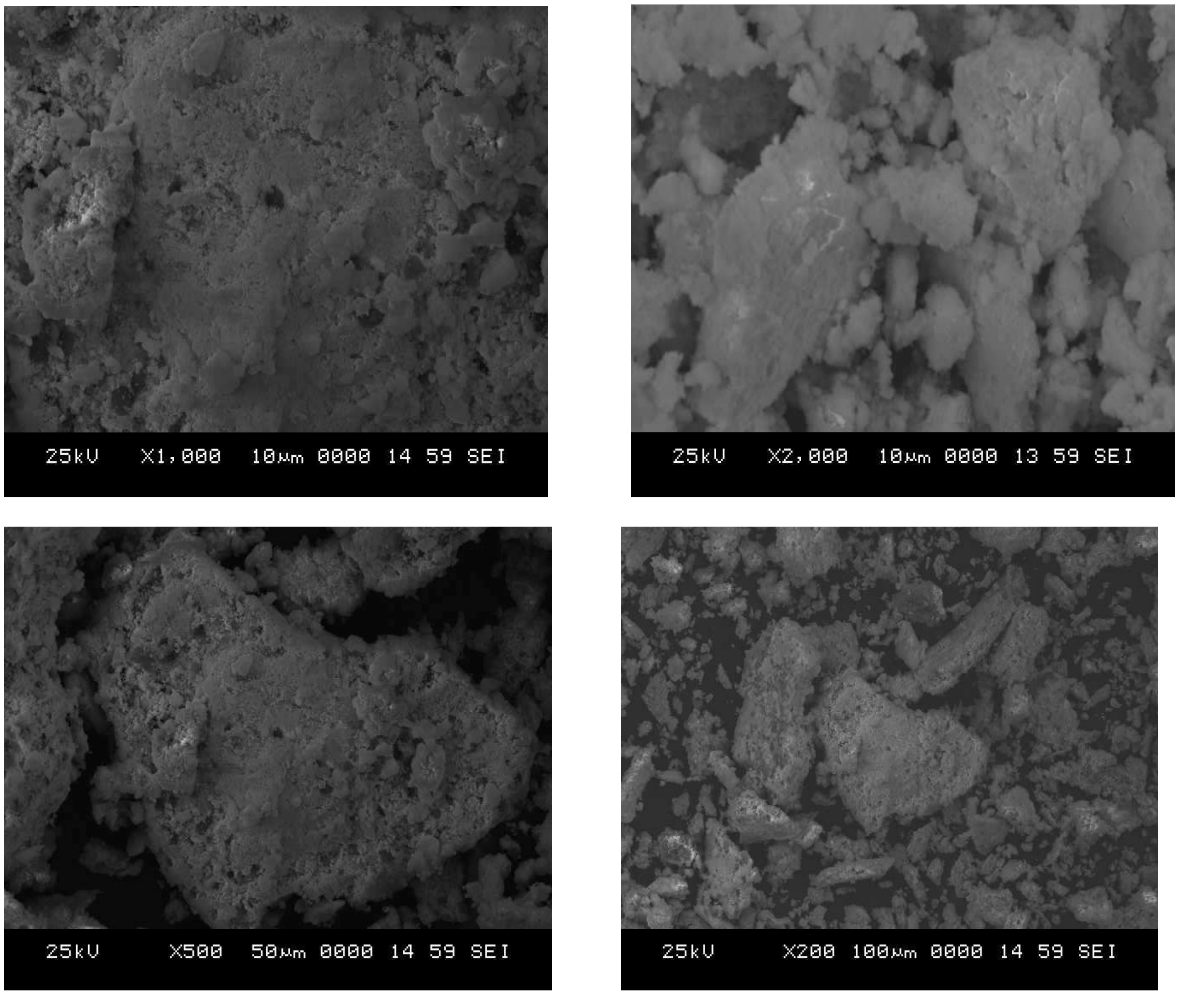


Fig: 3 SEM micrograph of silver nanoparticles

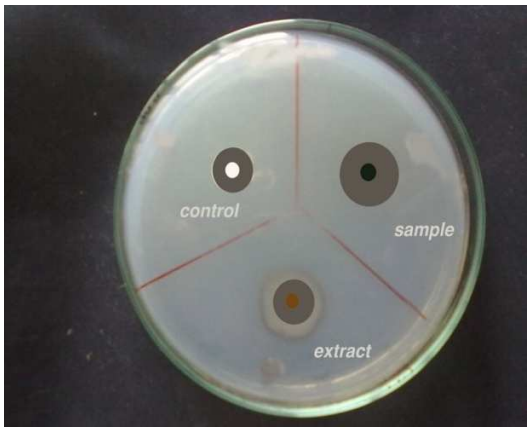
Concentration of phytonanoparticles

The brown color of the plant extract obtained was centrifuged and pellet obtained was used to check its antibacterial activity.

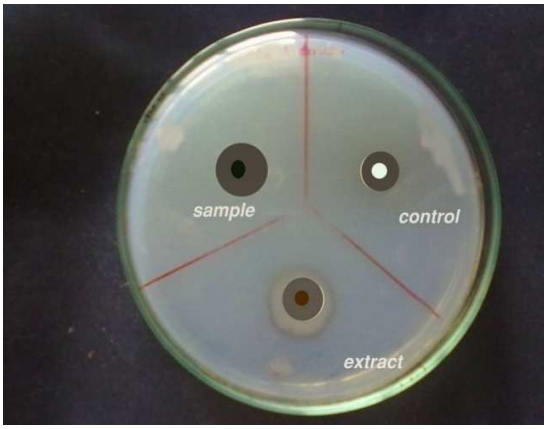
Antibacterial effect of silver nanoparticles

The nanoparticles synthesized by green route were found toxic against four bacterial species at a concentration of 50µl Ag nanoparticles. The effect of silver nanoparticles in antibacterial activity against Pseudomonas & Staphylococcus, as it is showed maximum zone of inhibition against the antibiotic tetracycline as it showed in follows;

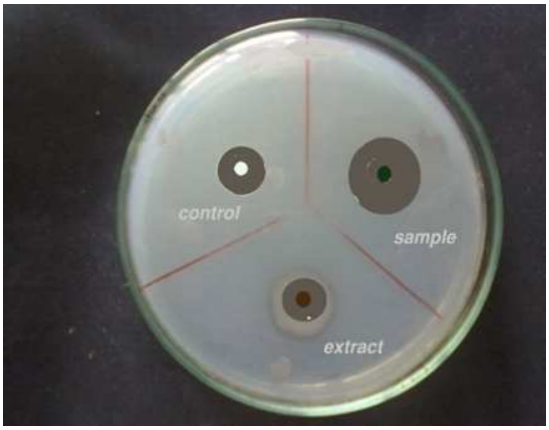
Images of antibacterial activities of silver nanoparticles



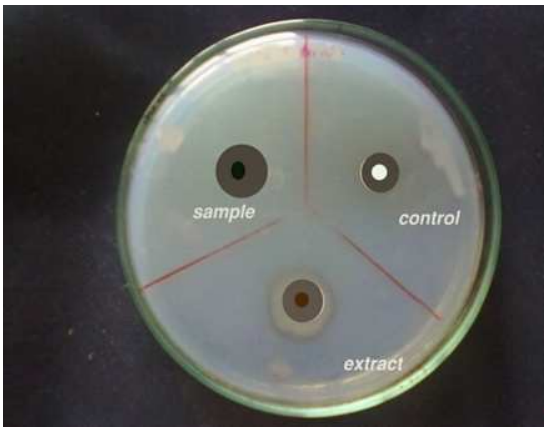
Staphylococcus aureus



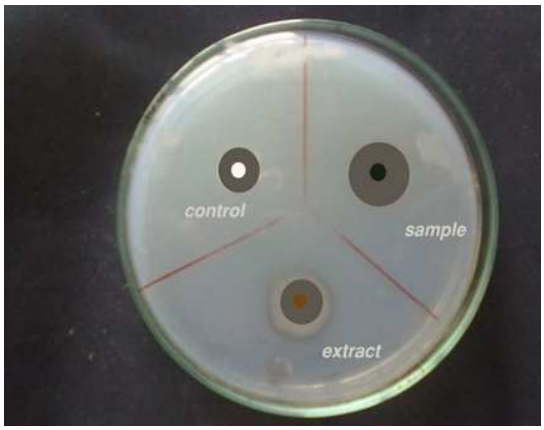
Proteus vulgaris



Escherichia coli



Pseudomonas aeroginosa



Klebsiella pneumoni

Antimicrobial activity of *Cucumis sativa* against selected pathogens

SI.No	Test organism	Standard (Tetracycline)	Plant extract (*Cucumis sativa* 50µg)	Nanoparticles synthesized
1	*Proteus vulgaris*	-	5	7
2	*Staphylococcus aureus*	3	7	10
3	*Escherichia coli*	-	2	4
4	*Pseudomonas aerogenosa*	2	8	12
5	*Klebsiella pneumonia*	-	6	9

The antibacterial activity of silvernanoparticleswas tested. The best activity was obtained against *Psedomonas aeurogensa* and the least activity was showed against *Escherichia coli.*

CONCLUSION

The study included the synthesis of silver nanoparticles from the leaves of plant *Cucumis sativa*and its antibacterial activity. In conclusion, the bio reduction of aqueous Ag^+ ions by the leaves extracts of *Cucumis sativa has* been demonstrated. The reduction of metal ions through the leaves extracts leading to the formation of silver nanoparticles of fairly well defined dimensions.

The reduced nanoparticles were surrounded by a faint thin layer of protein and metabolites such as terpenoids having functional groups of amines, alcohols, ketones, and carboxylic acids. From a technological point of view

these obtained silver nanoparticles have potential applications in the biomedical field and this simple procedure has several advantages such as coast effectiveness, compatibility for medical and pharmaceutical applications as well as large scale commercial production.

The rapid biological synthesis of silver nanoparticles using leaf broth of *Cucumis sativa* provides an environmental friendly, simple and efficient route for synthesis of benign nanoparticles. The bioreduced silver nanoparticles where characterized using UV Visible and SEM techniques. In present study we found that leaf can be also a good source for synthesis of silver nanoparticles and ithas more antibacterial activity against variouspathogenic organisms. Thus it can be concluded that*Cucumis sativa*posses more activity against pathogenic microorganisms and further studies would reveal its other activities.

REFERENCES

[1] Albercht V K, Shaporev A S, Sharikov F Y, Baranchikov A Y, *Superlattices andMicrostructures*,(**2009**), 42 (6), 421–424.
[2] Murphy, Gyu k, Chunrui W, Won P, ZnO nanorods: Synthesis, Characterization and application (**2005**), *Semiconductor science technology*, 20: 1363-1369.
[3] Validyanathanh, Den R, Victoria M K, Hardy A, Van W and Mullens J , Aqueous solution-based synthesis of nanostructured metal oxides, Handbook of Nanoceramics and Their Based Nanodevices, American Scientific Publishers,(**2007**) 17: 285-290.
[4] Magudapathy P, Gangopadhyay P, Panigrahi B K, Nair KGM, Dhara, S, *Physica B* (**2001**), 299(1-2):142-146.
[5] Panacek A, Kvitek L, Prucek R, Kolar M, Vecerova R, Pizurova N, . *J Phys ChemB* (**2006**); 110(33):16248-16253.
[6] Jeong S.H, Yeo S.Y, Yi S.C,. *J. Mat. Sci*, (**2005**) 40, 5407-5411
[7] Inder, Sulochana C.H, *Fitoterapia*, (**2010**), 3, 253-269.J. *Physics. Cambridge* **2007**, 111, 3901.
[8] Jose;Jain D; Upadhyay M.KVerma H.N, *Digest .J. Nanometer. Biostruct, (***2010**), 5, 483-489.
[9] Prabhu N; Divya T.R; Yamuna G,*Digest .J .Nanometer, Biostruct*, (**2010**), 5, 185-189.