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Review Article

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Green Synthesis of Silver Nanoparticle from Different Plants– A Review

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ABSTRACT

Nanotechnology is advance impetus due to its capacity to transform metals into nano particles. Among the metal nano particles, silver nano particles play a vital role in antimicrobial activity, a very important application known from ancient times. A systemic characterization of synthesized silver nano particles was performed using UV, SEM, TEM, XRD and EDX. In this communication, we report a review on the green method for synthesis of nano particles.

Key words: *Nanotechnology, Nanoparticle, Metal nanoparticle, Green chemistry, silver nanoparticle, antimicrobial activity.*

INTRODUCTION

Nanotechnology is rapidly growing filed throughout the world and expected to grow due to wide a number of applications being conducted. Nanotechnology and nano biotechnology are the two emerging filed to improve the product being manufacture and marketed[1]. Nanotechnology is defined as manipulation of matter on atomic and molecular scales. Nanotechnology is classified into two forms, Wet and Dry nanotechnology. Wet nanotechnology deals with living biosynthesis Dry nanotechnology deals with man-made objects[2]. Nano biotechnology is a field that has emerged as an interaction between the two advanced areas such as biotechnology and nanotechnology for developing new bio synthetic devices and eco friendly technology for the synthesis of nano materials in nano scale[3]. Nano particle are the fundamental building blocks of nanotechnology. Particles with size up to 100nm are usually referred as nano particles. Nano particles have greater applications. The greater attention towards the nano particles is that it is not only due to various application and also by its way of synthesis in different filed[4]. Nanoparticles synthesis can be achieved through various approaches including solution reduction, chemical, photochemical, reverse micelles thermal decomposition, radiation assisted, electrochemical, microwave assisted method and recently via biological routes [5-9]. Historically the most effectively studied nanoparticles are mostly derived from noble metals in particular gold, platinum, copper, zinc, titanium, selenium, magnesium, silver and alginate[10]. Metal nano particle have tremendous application in the field of medicine, defense, drug synthesis, catalysis, diagnostics, electronics, biological probes, chemical and bio chemical sensing optics. To date among the above metal nanoparticles, silver nano particle plays an important role in nanotechnology[11].

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Silver nanoparticle, a noble metal nano particle focus it to have a wide ranging application in area of catalysis, antimicrobial, chemical sensing, photochemistry, optoelectronics, electrical conducting and bio material production [12]. Silver nanoparticles can be synthesized by using various approaches including chemical, physical and biological method. In recent time biosynthetic method has received more attention than chemical and physical methods. Among this bio material used biological synthesis includes usage of plant (or) microbes (bacteria, fungi, algae). Synthesis of nanoparticles using plant mediated synthesis as more importance than using microbes due to adverse microbial culture maintenance, time consume and cost effective. For synthesis of nanoparticle, plant extracts utilization as gained tremendous influence in large scale bio synthesis of nanotechnology. The green chemistry synthesis has exhibited a clean, non toxic, non hazardous, cost effective, environmental friendly and therapeutics of extensive use to humans since chemical methods are extremely expensive and consumed toxic chemical which may inform potent environmental and biological risk factors[13]. There are so many reports related to the synthesis of bioactive silver nano particles using several plants extract has been alreadydocumented in various approaches is given in the following table.

Table 1:

S.No	Name of the medicinal Species	Part's	Extract	N.P	Particle size (nm)	Particle shape	Methods	Name of the Microorganism	Zone diameter (mm)
1.	*Acacia nilotia*[14]	Leaf	Aqueous	Ag	30-150	-	Well diffusion	*Pseudomanas*	26
								Escherchia coli	20
								Basillus sp	23
								Proteus sp	13
2.	*Annona reticulate*[15]	Leaf	Aqueous	Ag	20-30	Spherica l	Agar well diffusion	*Escherchia coli*	22
								Staphylococcus aureus	20
3.	*Arbutus unedo*[16]	Leaf	Aqueous	Ag	9-15	Spherica l	Well diffusion	*Escherchia coli*	7
								Pseudomonas putida	5
								Klebesiella pnumoniae	5
								Bacillus subtilis	3
								Staphylococcus Aureus	8
4.	*Argyeria nervosa*[17]	Seed	Aqueous	Ag	20-50	Spherica l	Agar Well diffusion	*Escherchia coli*	16
								Staphylococcus aureus	14
								Bacillus subtilis	17
								Pichla pastoris	12
								Aspergillus niger	17
5.	*Arnebia nobilis*[18]	Root	Aqueous	Ag	40-70	Spherica l	Well diffusion	*Echcherichia coli*	16 to 20
								Staphlococcus aureus	15 to 19
6.	*Artocarpus heterophyllu s Lam*[19]	Seed	Powder	Ag	3-25 to10.78	Irregular	Agar diffusion	*Basillus cereus*	9
								Bacillus subtilis	12
								Staphyloccocus aureus	15
								Pseudomonas aeruginosa	6
7.	*Banana*[20]	Peel	Aqueous	Ag	23.7	Spherica l	Well diffusion	*Bacillus subtilis*	29
								Staphyloccocus arueus	36
								Pseudomons aeruginosa(ATC C)	40
								Pseudomonas aeruginosa	38
								Escherchia coli	39

8.	*Ceratonia siliqua*[21]	Leaf	Aqueous	Ag	5-40	Spherical	Disc diffusion	*Escherichia coli*	8to12
9.	*Citrus sinesis*[22]	Peel	Aqueous	Ag	80	Square and rectangle	Disc diffusion	*Staphyllus epidermidis*	12
								Bacillus cereus	10
								F.acuminatum	6
10.	*Coriander sativum*[23]	Leaf	Aqueous	Ag	8	Spherical	-	*Sta phyloccocus aureus*	28
								Klbesiella pneumonia	17
								Escherichia coli	21
								Pseudomona aeruginosa	27
11.	*Crataegus douglasi*[24]	Fruit	Aqueous	Ag	29.28	Spherical	Disc diffusion	*Escherichia coli*	9.0
								Staphyllococcus aureus	13.0
12.	*Eucalyptus chapmaniana*[25]	Leaves	Aqueous	Ag	-	Crystal in nature	Well diffusion	*Staphylococcus aureus*	27
								Staphylococcus pneumonia	25
								Klebsiella pneumonia	23
								Escherichia coli	23
								P.vulgaris	23
								Candida albicans	25
13.	*Manikara zapota*[26]	Seed	Aqueous	Ag	5-35	Circular	Agar diffusion	*Candida albicans*	24
								Candida tropicalis	15
								Candida krusei	14
								Candida gulliemondi	17
								Candida lusitaniae	13
14.	*Mimusops elengi*[27]	Leaf	Aqueous	Ag	55-83	Spherical	Kirby Bauer Disc diffusion	*Klbesiella Pneumonia*	8to18
								Staphyloccocus aureus	6.75 to 8
								Microccocus lutes	7 to 11
15.	*Morianda citrifolia*[28]	Leaf	Aqueous	Ag	22-193.5	Spherical	Agar well diffusion	*Candida tropicalis*	28.0-57
								Candida albicans	24.0-1.52
16.	*Ocimum sanctum*[29]	Leaves	Aqueous	Ag	18	Spherical	Kirby Bauer Disc diffusion	*Escherichia coli*	11
								Staphyloccous aureus	10
17.	*Paratheniu m hysterophorus*[30]	Leaf	Aqueous	Ag	30-80	Irregular	Disc diffusion	*Salmonella sp*	0.4 to1.2
								Staphyloccocus sp	0.3 to 0.8
								Pseudomonas sp	0.2 to 0.7
								Escherichia sp	0.1 to0.5
								Penicillium sp	0.1 to 0.3
18.	*Piper longum*[31]	Fruit	Aqueous	Ag	46	Spherical	Disc diffusion	*Staphyloccocus aureus*	1.0 to 1.4
								Bacillus aureus	0.8 to 1.3
								Pseudomonas	0 to 1.8
								Bacillus subtilis	0 to 2.0
19.	*Phyllanthus amarus*[32]	Leaf	Aqueous	Ag	29.78	Spherical	Agar well diffusion	*P.aeruginosa*	10 to 21
20.	*Sesbania grandiflora*[33]	Leaf	Aqueous	Ag	10-25	Spherical	Disc diffusion	*Salmonella enteric*	15.67 to 0.9
								Staphyloccocus	10.54 to 0.23

21.	*Tribullus terrestris*[34]	Fruit	Aqueous	Ag	16-28	Spherical	Kirby Bauer	*Staphylloccocus aureus*	9.75
								Bacillus subtilis	9.25
								Escherichia coli	10.75
								Pseudomonas aeruginosa	9.25
								Staphyloccocus pygens	10
22.	*Trianthema decandra L*[35]	Isolated saponin	Aqueous	Au and Ag	Au=37.7-79.9 Ag=17.9-59.6	Au- Spherical, Cubical, hexagonal Ag- Spherical	Kirby Bauer	*Enterococcus faecalis* *Staphyloccocus aureus* *Staphyloccocus faecalis* *Bacillus subtilis*	Au: 8.2 to 11.5 Ag: 7.8 to 20.3
23.	*Xanthan*[36]	Gum	-	Ag	5-40	Spherical	Disc diffusion	*Staphyloccocus aureus*	12.3 to 12.6
								Escherichia coli	9.7 to 10.7
24.	*Ficus microcarpa*[37]	Leaf	Aqueous	Ag	100	-	Disc diffusion	*Bacillus cereus*	10
								Escherichia coli	12
								Klbesiella pneumoniae	12
25.	*Lantana camara*[38]	Leaf	Aqueous	Ag	-	Spherical	Well diffusion	*Bacillus subtilis*	11 to20
								Staphyloccocus aureus	10 to 18
								Pseudomonas aeruginosa	12 to17
								Escherichia coli	14 to17
26.	*Cochlospermum Religiosum*[39]	Leaf	Aqueous	Ag	40-100	Spherical	Disc diffusion	*Klebsiella Pseudomonas*	11
								Basillus	12
								Staphylococcus	15
								Escherichia coli	20
27.	*Euphobia hirta*[40]	Leaf	Aqueous	Ag	6-71	Spherical	Well diffusion	*Escherichia coli*	88
								Pseudomonas Aeroginosa	86
								Klbsiella pnumonia	94

CONCLUSION

Thus, in the present review, the synthesis of silver nanoparticle is possible due to reduction of ion by compounds present in the plant extract. The synthesized silver nano particle using "green chemistry" are safe, effective, environmental friendly and biomedical importance. The ancient system of medicine has reported that silver based nanomedicine plays an important role. Silver nanoparticles have a lot of therapeutic and social values due to its antimicrobial properties since microorganisms are the major source of diseases.

REFERENCES

1. Rai, A., Singh, A., Ahamad , Sastry, M., Role of halide ions and temperature on the morphology of biologically synthesized gold nanotriangle Langmuri, **22**:736-741(2006).
2. Klaine, S.T., Alvarez, P.J., Bately, G.E., Fernandes, T.F., Handy, R.D., Lyon, D.Y., Nano material in tha environment behavior, Fate, bio availability and effects,*Environ Toxical chem.,***27**:1825-51(2008).
3. Gerick, M., Pinches, A., Biological synthesis of metal nanoparticles Hydrometallurgy., **83**:132-140(2006).
4. Gopinath, V., MubarakAli, D., Priyadarshini, S., Priyadarshini, N.M., Thajudda, N.,Velusamy, P., Biosynthesis of silver nanoparticles from Tribulus terestris and it is antimicrobial activity: a novel biological approach colloids and surface, B; Bio interfaces., **96**: 6974(2012).

5. Plante, I.J.L., Zeid, T.W., Yangab, P., Mokari,T., Synthesis of metal sulfide nanomaterials via thermal decomposition of single source precursors, *J Mater chem.,* **20**: 6612-6617(2010).
6. Cheng ,Y., Yin, L., Lin, S., Wiesner, M., Bernhard, E., Liu, J., Toxicity reduction of polymer-stabilized silver nanoparticles by sunlight. *J phys chem.,* C **115**: 4425-443(2011).
7. Hirsch, T., Zharnikov, M., Shaporenko, A., Stahl, J., Weiss, D., Wolfbeis, O.S., Size controlled electrochemical synthesis of metal nanoparticles on monomolecular templates. Angew chem Int Ed. **44**: 6775-6778 (2005).
8. Korochenkov, O.A., Cantarero, A., Shpak, A.P., Kunitskii,Y.A., Senkevich, A.I., Borovoy, M.O., Doped Zns: Mn nanoparticles obtained by sonochemical synthesis.Nanotechnol., **16**: 2033-2203 (2005).
9. Nadagouda, M.N., Speth, T.F., Varma, R.S., Microwave:assisted green synthesis of silver nano structure. Accounts chem. Res **44**: 469-478 (2011).
10. Leela, A., Vivekanandan, M., Tapping the unexploited plant resource for the synthesis of silver nanoparticle. *African J. of Biotechnol.,***7**: 3162-3165(2008).
11. Gurunathan, S., Kalishwaralal, K., Vaidyanathan, R., Deepak,V., Pandian, S.R.K., Muniyandi, J., Biosynthesis, Purification and Characterization of silver nanoparticles using Escherichia coli. Colloids surf B.,**74**: 328-335(2009).
12. Parashar, V., Parashar, B., Pandey, A.C., Parthenium leaf extract mediated synthesis of silver nanoparticles: a novel approach towards weed utilization. *Dig J Nanometer Bio structu.,* **4**: 45-50 (2009).
13. Kumar, V., Yadav, S.K., Plant mediated synthesis of silver and gold nanoparticles and their applications. *Journal of chemical Technology and Biotechnology.,* **8**: 151 157 (2009).
14. Usha , C., Gladys Angelin Rachel, D., Biogenic synthesis of silver nano particles by *Acacia nilotia* and their antibacterial activity. *International journal of scientific research.,* **3**: 6.2277-8179 (2004).
15. Sivakumar singh, P. vidyasagar , G.M., Bio synthesis Characterization and antidermato phytic activity of silver nano particle using *Annona reticulata* leaf extract.
16. Srinivas naik, L., Paul mark, K., Sree vennela, P.,Venkata ramana devi,Green synthesis of silver nano particles using *strawberry* leaf extract (*Arbutus unedo*) and evaluvation of its antimicrobial activity a novel study. *International journal of nano material and bio structure.,* **7**: 47-50 (2013).
17. Rebeccathombre. Fenali Parekh,Neeta Patil. Green synthesis of silver nano particles using seed extract of *Argyreia nervosa. International journal of Bio sci.,* **5**: 144 -119 (2014).
18. Seema grag, Amrish Chandra, Avijit, Mazumder, Rupa mazumder, Green synthesis of silver nanoparticles using *Arnebia nobilities* root extract andwound healing potential of its hydrogen. *Asian journal of pharmaceutical* 2014.
19. Umesh, B., Jagtap. Vishwas, A., Bapat.Green synthesis of silver nano particles using *Artocarbus heterophyllus Lam* –Seed extract and its antibacterial activity, Industerial crops and., **46**: 132-137 (2013).
20. Haytham, M.M., Ibrahim.Green synthesis and characterization of silver nanoparticles using *banana* peel extract and their antimicrobial activity against representation microorganism, *Journal of radiation research and applied science.,* **8**: 265-275 (2015).
21. Utkarsh kaushik, S., Joshi, C., Green synthesis optical properties antimicrobial activity and its mechanism using *citrus. Asian journal of pharma clin res.,* **8**,6: 179 - 184(2015).
22. Balamurugan, M., Saminathan, R., Characterization of *Corianter sativum* mediated silver nano particles and evaluation of its antimicrobial and wound healing activity.IOSR.,**1**,2,:22 -25(2014).
23. Mansour ghaffari, Moghaddam, Robabeh Hadi ,Dabanloa.Plant mediated green synthesis and antibacterial activity of silver nanoparticles using *crataegus douglasii* fruit extract. *International journal of industrial and engineering chemistry.,***1540**: 6(2013).

24. Ghassaan Mohamad Sulaiman. Wasnaa Hatif Mohammed. Thorri Radam marzoog. Ahmed Abdul Amir Al Amerery,Abdul Amir, H. Abu Baker Mohamad. Green synthesis, Antimicrobial and cytotoxic effect of silver nano particles using *Eucalyptus Chapmaniana* leaves extract. *Asian pac J Torp Biomed.*,**3**,1: 58-63 (2013).
25. Otari, S.V., Patil, R.M., Ghosh,, S.J., Pawar, S.H., Green phytosynthesis of silver nano particles using aqueous extract of *Manilkara zapota (*L.*)* seedsanditsinhibitoryactionagainst Candida species. Materials Letters.
26. Prakash, P., Gnanaprakasam, P., Emmanuel, R., Arokiyaraj,M., Saravanan. Green synthesis of silver nanoparticles from leaf extract of *mimusops elengi Linn.* For enhanced antibacterial activity against multi drug resistant clinical isolates.Colloids and surfaces B.*Bio inter faces.*,**108**:255-259 (2013).
27. Ravikumar, P. Satish kumar, S.Antifungal activity of extracellularly synthesized silver nano particles from *Morinda citriforial. I.J of Technical Reseach and application.*, **2**,4:108-11 (2014).
28. Sivaranjani, K., Meenakshi sundaran, M., Biological synthesis of silver nanom particles using of *ocimum Basillicum* leaf extract and their antimicrobial activity.IRJP.,**4**:1(2013).
29. Charusheela.Ramteke. Tapan Chakrabarti.Bijaya Ketan Sarangi. Ram Avatar Pandey.Synthesis of Silver Nanoparticles from the Aqueous Extract ofLeaves of*Ocimum sanctum*for Enhanced Antibacterial Activity .Journal of chemistry., 278925(2013).
30. Bhoominathan.Srinivasan.Synthesis of Silver NanoParticles Using Herbal Extract and its Anti-Microbial Activity.J Phylogen Evolution Biol.,**3**:1(2013).
31. Jayachandra Reddy, N., Nagoor Vali, D., Rani, M., Sudha Rani, S., Evaluation of antioxidant, antibacterial and cytotoxic effects of green synthesized silvernanoparticles by *Piper longum* fruit. Evaluation of antioxidant, antibacterial and cytotoxic effects of green synthesized silvernanoparticles by Piper longum fruit. Material science and engineering C., **34**:115-122(2014).
32. Khushboo Singh. Manju Panghal. Sangeeta Kadyan. Uma Chaudhary Jaya Parkash Yadav. Green silver nanoparticles of *Phyllanthus amarus*as antibacterial agent against multi drugresistant clinical isolates of Pseudomonasaeruginosa.I .J of n ano medicine.,**8**: 3357(2013).
33. Das, J., Paul Das, M., Velusamy, P., Sesbania grandiflora.leaf extract mediated green synthesis of antibacterial silver nanoparticles against selected human pathogens Spectrochimica acta part A Molecular and Bio molecular spectroscopy.,**10**:265-270(2013).
34. Gopinath, D., Mubarak Ali, S., Priyadarshini, N., Meera Priyadharsshini, N., Thajuddin, P., Velusamy, Biosynthesis of silver nanoparticles from *Tribulus terrestris* and itsantimicrobial activity: A novel biological approach colloids and surface B: *Bio interfaces.*, **96**: 69-74(2015).
35. Geethalakshmi, R., Sarada, D.V.L., Characterization and antimicrobial activity of gold and silvernanoparticles synthesized using saponin isolated from *Trianthema decandra L.* Industerial crops products., **51**:107-115(2013).
36. Wei Xua, Weiping Jina. Liufeng Lina. Chunlan Zhanga,.Zhenshun Lia. Yan Lia. Rong Songa. Bin Lia, Green synthesis of *xanthan* conformation-based silver nanoparticles:Antibacterial and catalytic application, carbohydrate polymers.,**101**:961-967(2014).
37. Shanmuga Praba, P., Vasantha, V.S., Jeyasundari, J., Brightson, Y., Arul Jacob. Synthesis of plant mediated silve nano particles using ficus microcarpa leaf extract and evalution of their antibacterial activity. *Eur chem Bull.*,**4**,3:116-120(2015).
38. Kumara samyraja, D., Jeganathan, N.S., Antimicrobial activity of bio synthesis silver nanoparticles prepared from the leaf extract of *Lantana camara*. *Int Res J Pharm.*,**4**,5: 203-207(2013).
39. Sasikala, A., Savithramma, N., BiologicalSynthesisof Silver Nanoparticles

from *Cochlospermum Religiosum* and their Antibacterial Efficacy. *J Pharm sci and re.*,**14**,6:1836-1839(2012).

40. Annamalai, A., Christin, V.L.P., Sudha, D., Kalpana, M., Lakshmi, P.T.V., Green synthesis, characterization and antimicrobial activity of gold nanoparticles using *Euphorbiahirta L.* leaf extract,colloids and surfaces B:Biointerfaces 2013;108:60-65.

41. Vijay Kumara, P.P.N., Pammib, S.V.N, Pratap Kolluc, Satyanarayanad, K.V.V, Shameema, U. Green synthesis and characterization of silver nanoparticles using *Boerhaavia diffusa*plant extract and their anti bacterial activity. Interstial crops and products.,**52**:562-566(2014).