



REVIEW ON THE POWER OF NANO PARTICLES

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ABSTRACT

Nanotechnologies are an expanding area of research where we used to deal with the materials in nanodimension. The conventional procedures for synthesizing metal nanoparticles need sophisticated and costly instruments or high price Chemicals.

Moreover, the techniques are not environmentally safe. Therefore green technology for synthesis of nanoparticles are always preferred which is simple convenient eco-friendly and cost effective green synthesis of nanoparticle is a novel way to synthesis nanoparticles by using biological sources it is gaining attention due to its cost effective eco-friendly and large scale production possibilities silver nanoparticles and one of the most vital and fascinating Nanomaterials around several metallic nanoparticles better involved in biomedical applications it is vital importance in Nano science and now medicines to treat and prevent viral disease in human beings a specially in cancer treatment in current work we discussed different methods for synthesis of Paral like biological chemical and physical along with its characterization we have also discussed vital importance of having to cure life threat 9 diseases like cancer along with antique antifungal antiviral and microbial along with its molecular mode of action etc finally we conclude by discussing future prospects impossible applications of silver nanoparticles.

INTRODUCTION

Currently improving in protecting our environment using Green Chemistry have become important issues in many fields of research the most promising approach for generating new fields in biomedical Sciences is the Pharmaceutical Application of nanoparticles (NPs).

Due to essential of industrial Ira and explosion of World Population larger

amount of hazardous Chemicals and gases released in environment in which adversely affecting on nature do avoid this interpreta nature currently we were this focusing on development of natural products nanopitacles biomolecules a highly compatible with nanotechnology which makes you need assembly for development of metal nano particles of biological molecules which are authentic in cost



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affective From the ancient Heera novel medicinal potential of silver has been known to prove one for its antimicrobial potential.

Silver nano particles and its related products for tremendously venomous ensured broad spectrum antibacterial potential against 16 bacterial species.

Nano Technologies future heroine material science which develops in upgrades collides of particle such a size and morphology which provide entry of non-material in future quality material building in almost every field.

Nanotechnologies have been used to develop nanoparticles based targeted drug carriers.

Metal nanoparticles have a high specific surface area and a high fraction of surface atoms because of the unique physicochemical characteristics of nanoparticles.

In that they include catalytic activity, optical properties and electronic properties, antibacterial properties, and magnetic properties.

The nanoscale materials have emerged as novel “antimicrobial agents” due to their high surface area to volume ratio and their unique chemical and physical properties.

In recent years development of metallic nanoparticles is an emerging field of research in material science. Crystalline nanosilver gained prime importance and has superior applicability in detection of biomolecules, antibacterial, electronics, diagnostic applications in health care systems etc. Apart from novel applicability of AgNPs researchers still in search of advance methods to synthesize eco-friendly and cost-effective tools to develop AgNPs As silver posse's broad-spectrum potential against bacterial and microbial species

which specially utilized in industries it has key role in healthcare systems.

Nitrate group of silver potentially responsible for its broad spectrum antibacterial potential and as it convert in to AgNPs surface area is drastically increased which improve microbial exposure time and area.

Different techniques are available to synthesize AgNPs such as physical, chemical and biological. Though the chemical method is rapid it utilizes capping agents for synthesis which is costly and produces adverse and toxic effects. This demands development of safe, eco-friendly, cost-effective tools for synthesis of AgNPs and focused on biological methods such as green synthesis which is non-toxic and developed using plant origin materials and overcomes disadvantages of earlier approaches.

Moreover, use of plant extracts also reduces the cost of microorganism's isolation and culture media enhancing the cost competitive feasibility over nanoparticles synthesis by microorganisms.

Applicability of AgNPs is primarily due to its nanoscale size and shape as compared to bulk. Due to these unique properties researchers are hunting of novel methods to synthesize AgNPs with prissily controllable size and shape.

Apart from excellent inhibitory potential of AgNPs in recent years most of the pathogenic bacteria developed resistance against it which is major concern of health care system.

Chemical and physical approaches consume ample time, energy, money and generate toxic side effects. Nowadays green synthesis utilize microbes, fungi and medicinal plants which are easily available, convenient to handle and wide source of metabolites to synthesize AgNPs gained

prime importance due to its nontoxic and eco-friendly properties.

Currently AgNPs are synthesized from natural herbs having medicinal potential such as synthesis of various metal nanoparticles using fungi like *Aspergillus terreus*, *Paecilomyces lilacinus* and *Fusarium*.

AgNPs mainly bind to the cell wall and penetrate deep inside the cell wall which produces cellular damage by interacting with DNA, proteins inside the cell which leads to cell death.

NEED FOR GREEN SYNTHESIS AND NANOPARTICLES

Silver is a basic element which is non-toxic belonging to thermal and electrical potential.

Silver demand will likely rise as silver finds new uses, particularly in textiles, plastics and medical industries, surgical, dental resins, coated water filters, sanitizers, detergents, soap and wound dressings. Applicability in healthcare for treatment of mental illness, convulsions, de addiction of narcotic products along with sexually transmitted diseases like syphilis and gonorrhea leads to changing the pattern of silver emission as these technologies and products diffuse through the global economy.

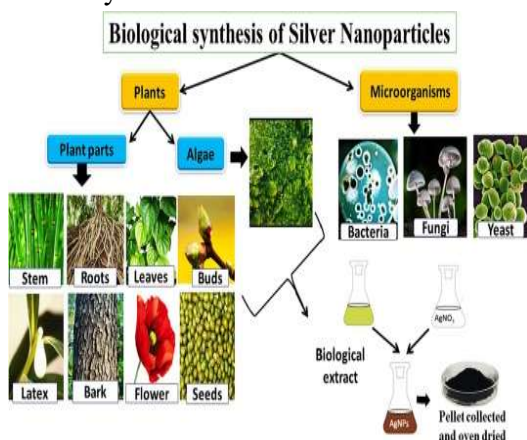


Fig (1); Biological synthesis of silver nanoparticles

Green synthesis is an emerging approach which overcomes demerits of physiochemical approaches by utilization of natural herbs which are nontoxic. Green synthesized nanosilver offers many advantages like utilization of phytochemicals, antioxidants acts as naturally occurring reducing agents, cost efficient, large-scale manufacturing highly beneficial and usage of toxic chemicals, high pressure, energy are avoided.

Nanosilver can be engineered by different techniques such as irradiation, reduction, electrochemical and cryochemical synthesis. Nanosilver can be molded into desired shapes and bear unique properties like permeability by pH and dissolved ions as compared to routine metals.

As AgNPs generate larger surface area per unit mass which improves contact time nanosilver customer market and demand is drastically raised in a wide variety of industries along with healthcare, food packing, textiles, cosmetics etc.

SILVER NANOPARTICLES

Generally AgNPs are nanoparticles of silver having a size range between 1 and 100 nm in size having unique properties such as electrical, optical and magnetic having a wide range of applicability.

Green chemistry is an encouraging approach mainly utilising nanosilver along with natural biomolecules such as polysaccharides, tollens which overcomes drawbacks of conventional methods and produce AgNPs which are eco-friendly, nontoxic and cost effective.

Metallic silver ions are inactive but once it comes into contact with reducing agent ionization occurs and it gets converted in its



active form. Ionic silver is an active form of silver which binds to the cell wall of bacteria leading to major structural changes in cell morphology. AgNPs cause denaturation of RNA and DNA replication which further leads to cell death.

Silver is also called oligodynamic due to its bactericidal potential at minimum concentration. That's why it has been largely used in medical products.

METHODS OF SYNTHESIS OF SILVER NANOPARTICLES:

PHYSICAL APPROACHES

In the physical approach of synthesis of AgNPs evaporation and condensation has major importance.

Temperature gradients play an important role in cooling of vapours at desired rate.

A chance of contamination by solvent has been removed by physical approach as no solvent has been used in physical method and uniform distribution of particle size precisely obtained.

Minimum inhibitory concentration in toxicity studies can be easily achieved by production of nano scale nanoparticles in high concentration.

AgNPs are also synthesized by laser ablation of metallic particles.

One important advantage of laser ablation technique compared to other methods for production of metal colloids is the absence of chemical reagents in solutions.

Therefore, pure and uncontaminated metal colloids for further applications can be prepared by this technique.

Wide range of materials can be synthesized in nanoparticles by physical methods such as Au, Ag and PbS etc. Synthesis of AgNPs by tube furnace has ample disadvantages such as requiring larger space, high power, rapid rise of environmental temperature etc. AgNPs synthesized by laser ablation

strongly depend on laser wavelength, time of laser pulse, laser fluence, the ablation time duration and the effective liquid medium.

Ejection of AgNPs synthesized by laser ablation requires little power and particle size is precisely dependent on laser fluence. However morphology, size and shape of AgNPs mainly depend on contact of laser light passing.

Also, the formation of nanoparticles by laser ablation is terminated by the surfactant coating.

The nanoparticles formed in a solution of high surfactant concentration are smaller than those formed in a solution of low surfactant concentration.

One advantage of laser ablation compared to other conventional methods for preparing metal colloids is the absence of chemical reagents in solutions. Therefore, pure colloids, which will be useful for further applications, can be produced by this method.

CHEMICAL APPROACHES

Chemical reduction is the most frequently applied method for the preparation of AgNPs as stable, colloidal dispersions in water or organic solvents.

Most commonly used reductant is citrate. In aqueous solution reduction of silver occurs and nanosized colloidal silver ions are generated.

Stability of any colloidal dispersion has prime importance and which could be achieved by stabilizing agent (dodecanethiol) which adsorbs on the surface and produces protective sheath. It can avoid agglomeration and crystal growth of the system.

During the synthesis of AgNPs minute changes in parameters (Polymers) makes drastic changes in size, shape, morphology,

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polydispersibility index, self assembling and zeta potential (Stability).

Frequently used ingredients in synthesis of AgNPs and AuNPs are glycol derivatives Polyvinyl pyrrolidone (PVP) and Polyethylene glycol (PEG). Polyacrylamide plays dual functions such as reducing and stabilizing agents in synthesis of AuNPs.

Surfactants containing functional groups such as amines, thiols and acids play an important role in stability of colloidal dispersion which protects the system from crystal growth, coalescence and agglomeration. Currently AuNPs developed by modified tollens method utilize saccharides and silver hydrosols and reducing agent which yield AgNPs in the range of 50–200 nm and 20–50 nm respectively.

BIOLOGICAL APPROACHES

Biotechnology is an emerging tool to develop biological synthesis of AgNPs.

Besides this magnetic nanoparticles have great antibacterial potential due to improved surface area to treat raised microbial resistance against many antibiotics and medicines.

Currently green chemistry is a rapidly growing technique utilized for synthesis of AgNPs with naturally occurring stabilizing, reducing and capping agents to synthesize AgNPs without toxic adverse effects.

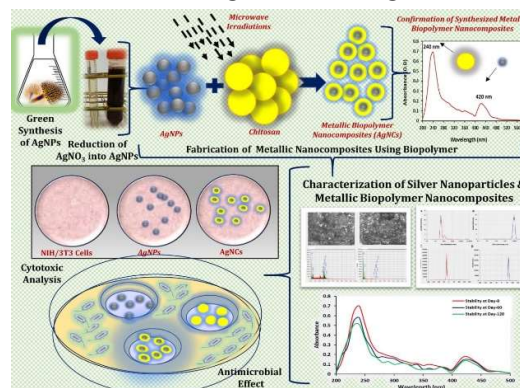
Reduction of metal ions by combined efforts of herbs and certain enzymes, proteins, microorganisms, bacteria and fungi etc. in biological synthesis has been successfully reported.

Fig: (2) Synthesis of Silver Nanoparticles by Fungi

High production yield AgNPs synthesized by fungi obtained when compared to

bacteria due to fungi secreting a higher amount of proteins that are directly responsible for increased production.

Higher production rate is mainly due to silver ions entering into the fungal cell wall



which leads to reduction of silver ions by fungal enzymes such as naphthoquinones and anthraquinones.

Slower rate and process is only disadvantage associated with fungal synthesis of AgNPs hence green synthesis approach is more preferred over the other techniques.

SYNTHESIS OF SILVER NANOPARTICLES BY PLANTS

Green synthesis is an excellent tool that can be utilized for synthesis of AgNPs as it uses natural origin medicinal herbs and its extracts which contain wide range of metabolites specifically water soluble flavones, quinones causes rapid and quick reduction of silver when compared to fungi and microbes.

Green chemistry approach is safe, cost efficient, easily scalable to mass productions, and easily available raw materials at cheaper cost.

Phytochemicals directly take part in reduction process of the silver ions during synthesis of AgNPs.

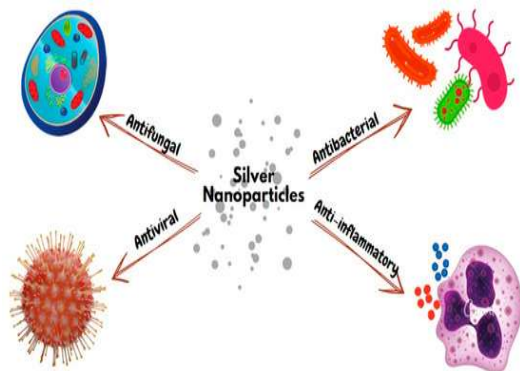


Fig (3): Applications of Silver Nanoparticles

ANTIMICROBIAL ACTIVITY

Products prepared with silver nanoparticles have been permitted by no. of accredited bodies including USFDA, USEPA, Korea's testing body and SIAA of Japan Institute of research.

Antimicrobial and antimicrobial potential of AgNPs containing silver sulfadiazine is incorporated into medicines and used in burns to avoid infections.

Nowadays AgNPs are involved in the expanding field of nanotechnology and appear in many consumer products that include acne vulgaris cream and for deodorizing sprays.

The antimicrobial properties of silver nanoparticles depend on size, environmental conditions (size, pH, ionic strength) and capping agent.

Recently an improvement in antimicrobial activity synergistic effect has been reported when silver nanoparticles combined with ampicillin, amoxicillin and chloramphenicol on the contrary reports showed antagonistic interaction between silver nanoparticles and amoxicillin or oxacillin antibiotic combined with silver nanoparticles have suggested improve therapeutic activity.

ANTIBACTERIAL ACTIVITY

Silver nanoparticles are one of the most attractive nonmaterial for commercialization applications.

As antibacterial agents silver nanoparticles were used for a wide range of applications from disinfecting medical devices and home appliances to water treatment.

AgNPs are promisingly used in drastic fields such as healthcare products, food storage, textile and medicinal devices.

In antibacterial potential AgNPs free silver ions are released at slower rate along with higher surface area which produces noxious environment and this is the main reason for broad spectrum antibacterial potential of AgNPs.

AGNP IN CANCER CONTROL

AgNPs has prominent anticancer potential as it discourages mitochondrial respiratory chain, increases reactive oxygen species (ROS) rate of synthesis which finally leads to DNA damage and cancerous cell death.

Yu-Guo Yuan in 2018 revealed that the combination of camptothecin and silver nanoparticles treatment significantly increases the levels of cancer cells.

It increases oxidative stress markers and decreases antioxidant markers compared to single treatment.

Overall these results suggested that camptothecin and silver nanoparticles cause cell death by inducing the mitochondrial membrane permeability change and activation of caspase.

The synergistic cytotoxicity and apoptosis effect seems to be associated with enhanced ROS formation and depletion of antioxidants.

Certainly a combination of CPT and silver nanoparticles provide advantageous effect in treatment of cervical cancer compared to immunotherapy.

ANTIDIABETIC ACTIVITY OF AGNPS

Tephrosiatinctoria stem extracts mediated silver nano particle synthesis was evaluated for control of blood sugar levels.

AgNP's scavenge free radicals, reduced the levels of enzymes that bring about hydrolysis of complex carbohydrates (α -glucosidase α -amylase) and as a result of which there is an increase in consumption rate of glucose. The promising antidiabetic activity is shown by *Ananas Comosus* (L.) silver nanoparticles. In a dose dependent manner. AC-AgNP inhibits α -glucosidase enzyme in the stomach. Which is helpful in non-insulin diabetic patients.

Also the silver nanoparticles synthesized with *Argyrea nervosa* leaf extract showed great antidiabetic activity.

They inhibit mainly enzymes that digest the carbohydrates into monosaccharide and reduce blood glucose level.

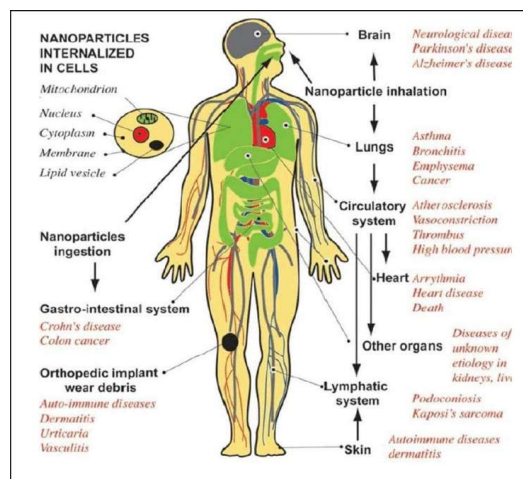


Fig (4): Disease associated with silver nanoparticles.

CONCLUSION

Over the past few decades, nanoparticles of noble metals such as silver exhibited significantly distinct physical, chemical

and biological properties from their bulk counterparts.

The current chapter specifically encounters synthesis, characterization, and bio-applications of silver nanoparticles, with special emphasis on anticancer, antimicrobial activity and its mechanisms. Green chemistry is being exploited for developing silver nanoparticles. Several methods utilized to create silver nanoparticles utilizing plant extracts as reducing or capping agents.

The current chapter represents different methods of preparation of silver nanoparticles and application of these nanoparticles in different fields.

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