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A REVIEW ON BIOSYNTHESIS OF NANOPARTICLES USING PLANT EXTRACT

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ABSTRACT:
In this review article we focus on the biosynthesis method of nanoparticle using different plant extract. In recent years, nanoparticles synthesis is the key research area in all fields due to their significant behavior and different properties. Because of their small size, shape they are extensively used in cosmetics, medicinal and electronic fields. The synthesis of nanoparticles using physical, chemical method is very toxic and hazardous compared to biological methods. However, using biosynthesis method we can reduced the toxicity of reactions which is the requirement of present society. By using different plant extract it is possible to synthesize different metal and metal oxide nanoparticles such as gold, silver, iron, zinc- oxide, etc. which is eco- friendly and also cost effective. This article contains a summary of some selected research papers on biosynthesis of metal and metal-oxide nanoparticles using Plant extract with their synthesis, characterization and applications in various fields.

Keywords :- Biosynthesis, Nanoparticles, Microorganism, Photo thermal therapy .

INTRODUCTION :

During last two decades Nanoparticles have been extensively studied due to their exceptional behavior as compared to bulk one. Hence, Nanoparticles are considered as building block of next generation of technology. Due to their different catalytic, magnetic, optical, physical and chemical properties they showed a wide application in all fields such as electronic, medical etc. Among all the particles metal and metal-oxide nanoparticles have been extensively studied. Among them silver nanoparticles most widely used in microelectronics, photocatalysis, etc. (1-2). Silver has been used in the form of metallic silver, silver nitrate, or silver sulfadiazine to treat burns, wounds, and severe bacterial infections. It was shown that hybrids of SNPs with amphiphilic hyper branched macromolecules display effective antimicrobial surface coatings. The most important applications of SNPs and GNPs are in the medical industry, such as topical ointments to prevent infection in burns and open wounds. Similarly, GNPs have been considered as an important area of research because of their unique and tunable surface plasmon resonance (SPR) and their applications in biomedical science including drug delivery, tissue or tumor imaging, photo thermal therapy, and immune chromatographic identification of pathogens in clinical specimens. The GNPs are used for developing biosensors, DNA labelling, and vapor sensing (3).

Synthesis of Nanoparticles by plants is a green chemistry. Production of nanoparticles can be achieved through different methods. Chemical approaches are the most popular methods for the production of nanoparticles. However, some chemical methods cannot avoid the use of toxic chemicals in the synthesis process. Since noble metal nanoparticles such as gold, silver and platinum nanoparticles are widely applied to human contacting areas, there is a growing need to develop environmentally friendly processes of

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nanoparticles synthesis that do not use toxic chemicals. Biological methods of nanoparticles synthesis using microorganism, enzyme, and plant or plant extract is ecofriendly compared to chemical and physical methods.

Using plant for nanoparticles synthesis can be advantageous over other biological processes by eliminating the elaborate process of maintaining cell cultures. It can also be suitably scaled up for large-scale synthesis of nanoparticles. Plant extracts are used for the metal ions bio-reduction to form nanoparticles. It has been demonstrated that plant metabolites like sugars, terpenoids, polyphenols, alkaloids, phenolic acids, and proteins play an important role in metal ions reduction into nanoparticles and in supporting their subsequent stability(4-5).

METHODS AND MATERIALS :

For biosynthesis of nanoparticles plant parts are collected and wash with double distilled water and these parts are sun-dried in order to remove unwanted particles. After that the plant parts are dried in shade cut and powdered for further use. One of the methods to prepare the plant extract is by using this powder. The Powder is taken and mixes with distilled water and boiled for some time to get the plant extract. This mixture is then cool down and then the solution is filtered using what man filter paper. The prepare extract is added to the metal salt aqueous solution for further reaction.

The change in colour of solution of mixture after sometime confirms the reduction reaction process and formation of nanoparticles. For preparation of silver nanoparticles the silver nitrate solution is mixed with plant extract in the same way for preparation of gold nanoparticles chloroauric acid is mixed with plant extract. This prepared mixture is then heated and centrifuge to separate the nanoparticles. It is observed that nanoparticles prepared by using this method are mostly spherical in shape.

Characterization Of Nanoparticles

Characterization techniques are used to find particle size, shape, size distribution, surface area, crystal structure. A wide variety of nanoparticles are synthesized by green approach and characterized by ultraviolet–visible spectroscopy, Fourier transform infrared spectroscopy (FTIR), Raman spectroscopy, Transmission electron microscopy (TEM), scanning electron microscopy (SEM), energy dispersion analysis of X-ray (EDAX), X-ray diffractometer (XRD).

RESULT AND DISCUSSION :

Plant Name	Part	Nanoparticle	Size	Activity Studied
Brown alga	Plant	Copper	5-45nm	Antibacterial
Memecylon edule	Leaf	Silver Gold	50-90nm 20-50nm	Medicinal, Industrial
Datura metel	leaf	Silver	16-40nm	
Citrus limon	leaf	Silver	>100nm	Antifungal
Trianthema Decandra	Plant	Gold Silver	33-65nm 36-74nm	Antimicrobial
Azadirachta indica	Leaf	Gold		
Elaeqnus latifolia	Plant	Silver	30-50nm	Pharmological, Electronical
Jatropha curacus	Seed	Silver	15-50nm	
Artemisia nilagirica	Plant	Silver	70-90nm	Medicinal, Industrial
Coelus amboinius Lour	Leaf	Gold	4.6-55.1nm	Biomedical, Pharmaceutical

Ag nanoparticles

For the green synthesis of silver nanoparticles, silver metal ion solution and a reducing biological agent requires. The easiest and inexpensive method for silver nanoparticles production is silver ion's reduction and stabilization by a fusion of biomolecules such as polysaccharides, vitamins, amino acids, proteins, saponins, alkaloids, terpenes, and phenolics. Silver nanoparticles are synthesized using different plant are listed in table. This method produces clean, reliable, cost effective and eco- friendly silver nanoparticles.

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Au nanoparticles

Gold nanoparticles are also studied extensively because of their intresting properties in Cancer cell treatment, removal of dyes, drug delivery, packaging, coatings etc. This study shows that gold nanoparticles can be synthesized using different plant parts and chloroauric acid. Similar to silver nanoparticles, gold nanoparticles are also synthesized using this method. And also the reaction is very fast, clean and cost effective as that of other biosynthesis methods.

CONCLUSIONS :

The above study proves that the green synthesis method is eco-friendly, safer and less toxic as compared to that of other methods. These synthesized nanoparticles can be used in biomedical applications such as antimicrobial, antifungal, anti-inflammatory and anticancer activity. In this review we have discussed selected papers on silver and gold nanoparticles synthesis which shows that these metal nanoparticles have significant antimicrobial and antifungal properties.

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