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Synthesis of nanoparticles from weeds a better alternative of weed utilization: A review

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Abstract
In the area of green chemistry the recent most burning topic is green synthesized nanoparticles from plant sources and their sustainable used. To invent a technology it must be rapid and ecofriendly, the green synthesis of nanoparticles from weeds seems to be a viable option. Nanoparticles have brilliant applications in the field of cosmetics, biosensor, and Nano medicine and also showed better performance in the field of agriculture. The potential of synthesizing nanoparticles from weeds and its used has been still unexplored. Now days silver nanoparticles are the one of the most studied nanomaterial because of its small size, high stability and low reactivity. The natural compounds (alkaloids, amino acids, polysaccharides, vitamins, enzymes etc.) that are present in plants are responsible for the synthesizing silver nanoparticles. The present review describes the green synthesis of silver nanoparticles from weeds and their applications.

Keywords: Silver nanoparticles, weeds, ecofriendly

Introduction
Now a day's synthesis of nanoparticles from weeds is emerging area of research because of beneficial use of weeds. The green synthesized nanoparticles from weeds have many used in biological fields. In modern research the word nanotechnology has its own meaning which deals in strategy of nanoparticle synthesis, different shapes of nanoparticles, size of nanoparticle that ranges from 1 to 100 nm. The synthesis of nanoparticles from ecofriendly material like plant parts (root, stem, leaf), algae, fungi, bacteria have many sustainable use and harmonious to biomedical as well as pharmaceutical applications because in this no harmful chemical is used in the protocol of nanoparticle synthesis. In all emergent area of research i: e physical, chemical and biological sciences nanoparticles have great use [20]. In many areas nanoparticle gaining attention such as biomedicines, cosmetics, drug delivery, healthcare, eco environment, food and feed, water disinfectant, antimicrobial filter, wound dressing material, air filtration, sensor etc. [12, 13].

There are many ways of nanoparticle synthesis physical, chemical and biological. Among all biological method of synthesis of nanoparticle is best because in this no chemical is used and best suited to environment. The biological method of synthesis of nanoparticles is non-toxic, ecofriendly, biocompatible as well as cost effective [14]. The nanoparticle takes more attention in all fields because of large surface area to volume ratio that has remarkable antimicrobial properties. The researchers take more interest in developing resistant strains and antibiotics [1]. India has rich biodiversity which has great value. Advancement in nanotechnology increased the value of plant genetic resources for the beneficial use. The weeds possess useful natural products and biochemical that are very useful in medicinal industries. The plant materials are rich source of antioxidants and have high reducing capacity so these are responsible for reduction of metal compounds in to their respective nanoparticles. The synthesis of nanoparticles from weeds and their use as an antimicrobial agent is best used of weeds besides this the synthesized nanoparticles are also toxic free. The nanoparticles synthesized from weeds are also cost effective as compare to nanoparticles synthesis from microorganisms because it reduces the cost of micro-organisms isolation and their culture. The nanoparticles can be synthesized from different metals like copper, magnesium, zinc, gold, titanium, alginate with different use [3, 11].

Among all metals silver nanoparticles take more focus because of their antimicrobial properties. The green synthesized silver nanoparticles from plants are known as 'Noble Nano metal' in medical industry. Due to great medicinal as well as antimicrobial properties sliver nanoparticles have been incorporated in number of consumer products like medicines,

cosmetics, surgery, pharmacy etc. So there is need to synthesis silver nanoparticles in such an alternative way which is not only environmental safe but also cost effective. The bio-chemicals of weeds provide a better platform to synthesize silver nanoparticles being free from toxic chemicals hence, this review describes compiled study of synthesized silver nanoparticles from different weeds and their effective use. To the best of our knowledge this review is the first study case.

Synthesis of silver nanoparticles using weeds as plant extract

There are many ways of synthesizing silver nanoparticles i: e chemically, biologically, reduction, photochemical, electrochemical etc. Among all these the synthesis of silver nanoparticles from weeds (biological) was very cheap because it's utilized the harmful weeds as beneficial mankind purposes. The biological method of synthesizing silver nanoparticles was very cost effective, nontoxic, biocompatible and ecofriendly. The biological synthesized nanoparticles does not pollute the environment and more stable than other chemical synthesized nanoparticle. The nanoparticles were synthesized by number of metals like Zn, Pd, Cu, Au, Pt, Ag etc. but Ag is more stable and has maximum antimicrobial properties. Because of great antimicrobial properties of Ag its takes more attention in Nano medical industry. In medical industry it is used in drug delivery for wound care, textile industry, cosmetics, environment cleaning, Nano medicine, antiseptic, waste water treatment etc.

Synthesis of nanoparticles from weeds has drawn more attention because of inexpensive, nonpathogenic, sustainable and quick single step process. The plant extract have natural tendency to reduce and stabilize silver ions because of presence of a number of biomolecules like terpens, tannins, alkaloids, phenolics, aminoacids, saponins and vitamins [20]. A large number of weeds are reported that reduce reduced silver ions and its importance (Table 1).

The process of nanoparticle synthesis was collection of weeds from appropriate place then washed 2-4 times with tab water to remove soil; followed with distilled water. These; were dried on filter paper to remove excess water. These were crushed with 2.0 ml of methanol (80%) then stirred at 200 rpm on orbital shaker and last filtered with Whatmann filter paper no. 1. The supernatant was used for reducing silver nitrate solution. 10 ml of extract was mixed drop wise in the beaker of freshly prepared 90 ml AgNO 3 solution (3.0 mM) with constant stirring. Color of the reaction mixture changed from white to light brown that indicates silver nanoparticle synthesis. The confirmation of silver nanoparticles was done by UV-Vis Spectrophotometer in the range between 400 to 700 nm. The functional groups of plant extracts that reduced silver ions were checked by FTIR spectroscopy (Fourier Transform Infrared Spectroscopy) (19). The shape and size of silver nanoparticles was confirmed by SEM (Scanning Electron Microscope) and TEM (Transmission Electronic Microscopy).

Table 1: Green synthesis of silver nanoparticle and their microbial activity by different scholars using weed extract as reducing agent

Sr. No.	Name of weed	Part used in nanoparticle synthesis	Metal	Size	Shape	Use	Reference
1.	*Desmodium*	Entire plant	Ag	5-20 nm	Oval and elliptical	Antimicrobial activity	[2]
2.	*Parthenium hysterophorus*	leaf extract	Ag	20-25 nm	Spherical shape	Antibacterial, antifungal, anti-inflammatory, and antioxidant properties	[4]
3	*Cyperus rotundus*, *Eleusin indica*, *Euphorbia hirta*, *Melastoma malabathricum*, *Clidemia hirta* and *Pachyrhizus erosus*	Entire plant	Ag	20.5 nm 55.0 nm 56.25 nm 108.35 nm 57.4 nm 40.6 nm	Spherical and irregular	Antibacterial ability and used in river and sewage water treatment	[18]
4.	*Alternanthera dentate*	Leaves	Ag	50-100 nm	Spherical	Antimicrobial activity	[15]
5.	*Boerhaavia diffusa*	Whole plant	Ag	25 nm	Spherical	Antimicrobial activity	[16]
6	*Tribulus terrestris*	Fruit	Ag	16-28 nm	Spherical	Antimicrobial activity	[9]
7	*Abutilon indicum*	Leaves	Ag	7-17 nm	Spherical	Antimicrobial activity	[5]
8	*Calotropis procera*	Plant	Ag	19-45 nm	Spherical	Antimicrobial potential	[8]
9	*Portulaca oleracea*	Leaves	Ag	<60 nm	-----	Antimicrobial potential	[7]
10	Datura metel	Leaves	Ag	16-40 nm	Quasilinear superstructures	Antimicrobial potential	[11]
11	Argimone mexicana	Leaves	Ag	30 nm	------	Antimicrobial potential	[17]

Due to small size of Ag nanoparticles it has great antimicrobial properties. It is well known antimicrobial agent over a wide range of different groups such as gram positive and gram negative, fungus as well as viruses. The Ag ions easily bind with bacterial cell and nuclear membrane so results in structural changes that lead to cell breakage and death. The bind silver nanoparticles alter the structure of DNA so inhibit the process of replication transcription and translation [6]. The synthesized silver nanoparticles using weeds extract have been used as antimicrobial agent for different microbes.

Use of weeds extract for the synthesis of silver nanoparticles like killing two birds from one stone that can form a dense effect in coming decades. It can minimize the weeds from beneficial land and its beneficial used for the synthesis of silver nanoparticles. Many reports have been published already about green synthesized nanoparticles from weeds that already discussed. Research is needs to explore more weeds that are economically and environmentally safe to synthesized green silver nanoparticles which have not yet been studied.

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