

# Green Synthesis of nanoparticles : A review

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## Abstract

Nanoparticles are widely used for different applications. The synthesis methods plays an important role to formed the nanoparticles. In the present article we have reported the green synthesis method of the different nanoparticles. ZnO and silver nanoparticles due to their extensive properties we have included to explain the green synthesis method. Different plant parts and microorganism also included to formed these nanoparticles. Different plants which are extensively used in formation of this two nanoparticles are also described.

**Keywords;** Green method, Plant extract, Zinc Oxide nanoparticles, Silver nanoparticles.

## Introduction

In the last few decades due to the wide properties and applications, nanoparticles play an important role in the modern day research. Due to their small size, porosity, good electrical conductivity, good mechanical properties nanoparticles are extensively used in different applications such as solar cell, photovoltaic cells, antibacterial, photocatalysis and many more. The size of the nanomaterials less than 100 nm considered as a nanocubes, nanobelts, nanotriangular and nanoribbons. The size of the nanoparticles are depends on the structure of the nanoparticles, their morphology, their crystal structure and the alignment of the particles. Due to their varsity of the size and shape the chemical and physical properties of the nanoparticles also plays an extinguishly bridge between the bulk and atom size particles. Hence they are widely used in medicine, catalysis, defense, and biological applications[1].

These nanoparticles have been synthesized by various methods on the basis of their usage, nature and applications. Generally nanoparticles are widely used in industrial and household things, so during the formation of nanoparticles creates a lot of pollution, hazardous gaseous and harmful products. To keep in mind for all this things nanoparticles have been synthesized. The synthesized nanoparticles are cost effective, ecofriendly, and potentially used in various applications. To maintain the all the parameters nanoparticles have been synthesized by environmentally to prevent the pollution. The plant extract, microorganisms, and the other methods are used for the synthesis of different nanoparticles. These methods are greener, cost effective, and energy harvesting over the chemical methods which was used earlier by different researchers. The coating of the biological nanoparticles are also plays an important role in human health as well as animal health [2].

In the present article we have synthesized different types of nanoparticles by using greener methods. For the synthesis of these nanoparticles we have used microorganisms, plant extract, and plants part. We have also included the various applications of this nanoparticles for humans as well as industrial purpose. In this article we also summarized why this greener nanoparticles are better than synthesized by chemical methods.

## **Various types of nanoparticles synthesized by greener methods**

### **Zinc oxide nanoparticles**

Zinc oxide nanoparticles have been widely used in different applications due to their wide band gap (3.37 eV) and their high catalytic activity. Zinc oxide nanoparticles are also used in antibacterial, antifungal, drug delivery and anti cancer applications. Due to their strong activity against the gram positive and gram negative bacteria it's synthesis concern become more important. Various synthesis methods have been optimized for the formation of ZnO nanoparticles such as sol-gel, auto combustion and green method. In all the methods green method is the prominent used method for the biological applications[3].

ZnO nanoparticles was synthesized followed by the plant leaves and flowers which was washed using DDW. After that the leaves and flowers was dried at room temperature and crushed by using mortle and pestle. Then the dried part of the plant was dissolved in DDW and concentrate using the boiling of the DDW under the magnetic stirrer and filtered it using by the Whatmanpaper. The obtained clear solution is the plant extract and boiled with the different precursor of the Zinc at desired temperature. The ratio of the plant extract and the precursor of the nanoparticles was optimized using the temperature, pH, and the various parameter of the nanoparticles. The obtained nanoparticles colou is yellow. These nanoparticles was further characterized by different techniques such as XRD, TEM, FTIR and Raman spectroscopy to confirmation of the synthesized nanoparticles[4].

### **Silver nanoparticles**

Silver nanoparticles are extensively used in food products from last centurries. This nanoparticles are widely used for drinking purpose and eatable materials. These nanoparticles are also used in medicinal applications from ancient years. In Hindu religion silver nanoparticles are used in “panchamrit” prepared by curd and other ingredients. Silver was also used as a antimicrobial agent. There are various methods which was follows for the synthesis of silver nanoparticles such as laser ablation, sol-gel, chemical reduction and green method[5].

For the greener synthesis of Ag nanoparticles the different part of angiosperms plants such as leaf, bark, stem and roots were taken in the cell culture, organic medium and biopolymers. Generally the most common plants which are used for the biosynthesis of silver nanoparticles are Aloe vera, Cocosnucifera, Ocimumtenuiflorum

and many more. These nanoparticles act as a stabilizing agent as well as a reducing agent and ecofriendly in nature[6].

Generally water used as a reducing agent and a suitable solvent for the synthesis of these nanoparticles apart for that the other solvents such as methanol, ethanol, and ethyl acetate was used for the extraction of plants. If varied the solvents the shape, size and the structure of the nanoparticles was also varied. Silver nanoparticles was synthesized by Fusarium palnt and no capping agent was used for the stabilization of this nanoparticles. Apart for that few researchers synthesized silver nanoparticles by using biopolymers and to stabilize these nanoparticles they used starch as a capping and reducing agent[7].

## Conclusions

The green synthetic approach of the nanoparticles is the best approach to protect the environment and our earth. No hazardous products, gaseous products, and the harmful chemical was used for the synthesis of nanoparticles. These nanoparticles were also used for the human beings for their treatments. The various types of plants are mentioned to synthesis of the zinc oxide and silver oxide nanoparticles. In future this way to synthesize the nanoparticles are the better way to protect our environment.

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