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Green synthesis of nanoparticles and their characterization

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Abstract

In the 21 st decade, nanotechnology is back bone of research. These nanoparticles have special attention in the all area of world. The particle structures manipulation rang from 1-100nm and has high properties can be synthesis by different methods. Today, the biosynthesis of nanoparticles are the most favourite one, non- toxic and safe.

In the biological synthesis of deferent nanoparticles. We using bacteria, viruses, fungi and plants, but the last one is the most widespread in the studies for the research, because plant extracts are full of bioactive compounds such as ketones, aldehydes, polyphenols, caffeine, and carbohydrates .These compound are effective in reduction which facilitate the synthesis reaction for manufacturing nanoparticles. After synthesized the nanoparticles, were characterizing her details like shape, size,homogenity ,surface morphology … by using various techniques as UV–Vis absorption spectroscopy-ray diffraction)XRD), Fourier trans mission infrared (FTIR) spectroscopy, dynamic light scattering (DLS), scanning electron microscopy (SEM) and trans mission electron microscopy (TEM).

So, this biological way do not need the toxic chemicals, it is safe, eco-friendly and low cost. Furthermore, NPs synthesized via green route are more stable and effective in comparison with those produced by physico–chemical method.

Keywords: biological synthesis, characterization, nanotechnology, nanoparticles, plant extract.

1. Introduction

Nanotechnology is one of the emergent cutting-edge technologies in a variety fields of science including biology, chemistry, and material science[1].This technology allow manufacturing nano-scale products, have a nanoscale dimensionthat ranges between 1–100 nm, with a large surface area, uniquephysiochemical properties ,they are called nanoparticles[2].

This nanoparticles can be synthesized using several methods including chemical, physical, and biological methods. However, the chemical and physical methods are expensive, and dangerous for the environment due to the toxic chemical compounds used as reducing agents[1,3],but Green method is the best due to has many advantages compared to chemical and physical methods: it is non-toxic ,environmentally-friendly, economical and more sustainable[4].

2. Method

2.1 Biological synthesis of nanoparticles using plant extract

We can uses different Plant parts such as leaves, stems, roots, shoots, flowers, barks, seeds, for prepare a plant extract [7]**(Fig. 1)** .

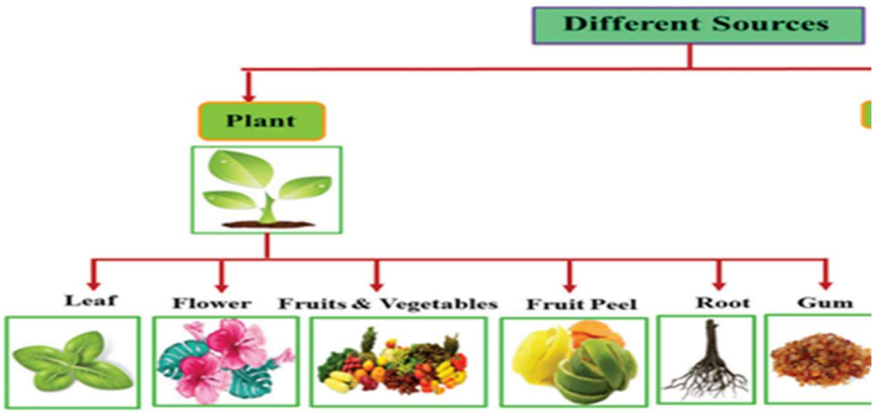

Figure.1 plant part uses for synthesisnanoparticles[8].

The mode of use of plant extracts for the synthesis of nanoparticles is simple, in that the extract is mixed with a metal salt solution at a different temperatures and kept under constant stirring[9]**(Fig. 2)**.

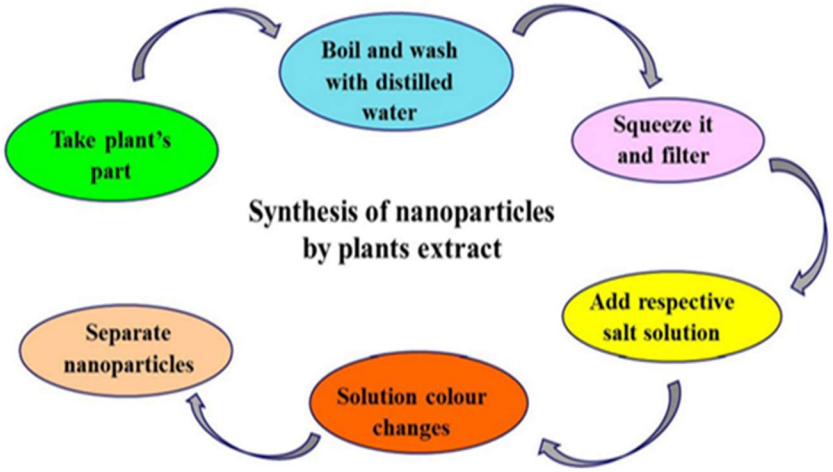

Figure. 2 Green synthesis of nanoparticles using plant extract .

2.2 Characterization of Nanoparticles:

We use several techniques for characterization the NPs:

UV–visible spectrometry: The production of nanoparticles is clearly indicated by a steady increase in the characteristic peak with increasing reaction time and concentration of biological extracts with salt ions[10].

Transmission electron microscopy (TEM): The morphology of the nanoparticles was recorded by using a TEM[11].

Fourier transformation infrared spectroscopy (FTIR):FTIR is a commonly used method for detecting functional groups in pure substances and mixtures and comparing compounds[12].

X-ray diffraction (XRD):X-ray diffraction used to identify important aspects in a compound, such as the types and nature of the crystalline phases present[13].

Scanning Electron Microscopy (SEM): Magnetic nanoparticles' size and shape are examined using SEM [7].

Particle size and zeta potential: The zeta potential analyser was used to detect surface charge [7].

3. Results

Based of many previous studies that manufacturing nanoparticles using different plants, shows that in the **table 1.**

Table 1 Summary of some nanoparticles synthesized from plantextract [14].

Nanoparticles	Size and shape	Plant extracts
Au NPs	51.8 ± 0.8 nm; spherical	Ziziphus zizyphus (Ennab)
Ag NPs	70.7 ± 22 192.0 ± 53 nm; spherical	Aloe vera
ZnO NPs	51.2 nm 41.0 nm 51.6 nm	chamomile flower. Olea europaea (olive leaves). Lycopersicon esculentum M (red tomato fruits).
CuO NPs	80 nm	Walnut leaf
Fe2O3NPs	25–55 nm	Punica granatum (pomegranate)
MgONF	<20 nm	Rosmarinus officinalis L. (rosemary)

4. Discussion

It has been known that the plants have a potential to reduce reduce metallic ions [15,17]. Because of these interesting properties, plants have been considered a more environment-friendly friendly route for biologically synthesizing metallicnanoparticles and for detoxification applications [16,17].

Plant extracts containing bioactive alkaloids, phenolic acids, polyphenols,proteins,sugar,and terpenoids are believed to havean important role in firstreducing the metallic ions and then stabilizing them. Importantly, thesynthesis of nanoparticles from reducing metal salts via plants is begins by mixing a sample of plant extract with a metal salt solution .

Biochemical reduction of the salts starts immediately and the formation of nanoparticles is indicated by a change in the colourof the reaction mixture. During synthesis, there is an initialactivation period when process metal ions are converted from their mono or divalent oxidation states to zero-valent states and nucleation of the reduced metal atoms takes place [18].

5. Conclusion

Today, the greensyntheses of nanoparticles are area of focused research by researchers. Because the synthesis of nanoparticles from diverse plant parts are cost-effective, nontoxic route, easy availability, and environment-friendly nature than physical and chemical routs.In the future will be exploted to manufacture several nanoparticles with different types of plants and application them in various fields .

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