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An Overview of Synthesis of Silver Nanoparticles by Plant Extract

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Introduction

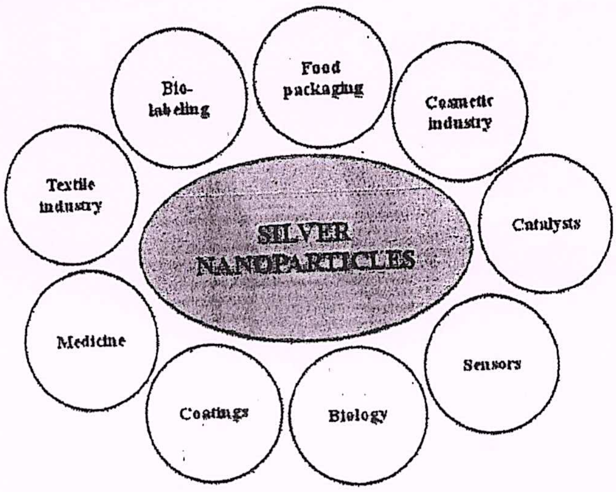
Nanotechnology is one of the most rapidly increasing areas of nanoparticle manufacturing. Biosynthesis of nanoparticles and its applications in medicine delivery have been witnessed by many researchers. There is growing anticipation that nanotechnology, when applied to medicine, may lead to considerable improvements in illness diagnosis and treatment. Nanomedicine, an emerging new discipline that is the result of an union of nanotechnology with medicine, is one of the fields in which nanotechnology finds broad applications. Nanoparticles can be made utilising a variety of techniques, including physical, chemical, and biological ones.

Although the chemical method of synthesis may produce vast quantities of nanoparticles in a short amount of time, environmental benign synthetic for nanoparticles synthesis has sparked interest in biological ways that do not produce toxic compounds as a byproduct. Many biological techniques for synthesis of intracellular and extracellular nanoparticles employing microorganisms such as plants, fungi, and bacteria have been documented to date. Plants provide a superior platform for nanoparticle manufacturing since they are free of hazardous chemicals and act as natural capping agents. Adansonia digitata leaf extract The avocado tree (Persia americana) is a flowering plant that is endemic to south central Mexico. It belongs to the Lauraceae family of flowering plants. Avocado also refers to the fruit of the tree, which is a huge berry with a solitary seed and is botanically a large berry. Avocado is not a commercial fruit crop in India. This plant was brought to the United States from Sri Lanka throughout the twentieth century. It is grown in Karnataka, Maharashtra, Tamil Nadu, Kerala, and Sikkim in the eastward Himalayan state of Sikkim on a very minor scale.

Varieties: Mexican, Guatemalan, and West Indian horticulture breeds have all been attempted in India and found to be acceptable for tropical and sub-tropical environments. West Indian race selected breeds are grown in Karnataka, Maharashtra, and Tamil Nadu.

Fig. 1: ***Avocado*** **leaves**

AgNPs have a variety of different uses, such as catalysts in chemical reactions, bio-labeling, spectral selective coatings for solar energy absorption, food additives, and the textile sector, as shown in Figure 1.



AgNPs can be made in two different ways: "topdown" and "bottom-up," utilising standard or unusual procedures. Although there are a variety of traditional methods for making AgNPs (for example, solution, chemical/photochemical reactions in reverse micelles, thermal decomposition of various silver compounds, electrochemical, sonochemical, radiation, and microwave-assisted routes), they all involve hazardous chemicals, low compound conversions, high energy requirements, and wasteful purifications.

Plants used to Extract Silver Nanoparticles

For the manufacture of silver nanoparticles, five different natural plants were used. O. tenuiflorum (Tulsi), S. tricobatum (Thudhuvalai), S. cumini (Naval), C. asiatica (Vallarai), and C. sinensis (Orange) leaves and peel were harvested.

Materials and Methods

1. Chemicals and Plant Material Collection

All of the chemicals were analytical grade and were utilised without further purification. Silver nitrate (AgNO3) with a purity of 99.5 percent was acquired from Sigma-Aldrich. In the Bitung region of North Sulawesi, Indonesia, fresh leaves of I. balsamina and L. camara were harvested (Figure 2). Throughout the research, distilled water was utilised to make aqueous solutions.

2. Leaf Extract Preparation

The fresh leaves were then cut into small pieces and combined with 100 mL of distilled water. in a beaker. It was let to cool to room temperature after cooking for 25 minutes at 65°C with frequent stirring. Centrifuged for 19 minutes at 83 G-force, the mixture was filtered using Whatman 40 filter paper. AgNO3 precursor solution was prepared using the extract, which was refrigerated until needed.

3. Synthesis of Ag Nanoparticles

A 10 mM AgNO3 stock solution was made by dissolving AgNO3 powder in distilled water and making a succession of 1 mM, 2 mM, 3 mM, 4 mM, and 5 mM AgNO3 solutions. In a flask with a volume of 50 mL, An aqueous extract of I. balsamina fresh leaves was mixed with the AgNO3 solutions in a 1: 1 (v/v) ratio. The flask was wrapped in aluminium foil and heated for 5 hours in a waterbath at 60°C. For the antibacterial activity test, the combination was also kept in the refrigerator and evaluated using a UV-Vis spectrophotometer and TEM. The aqueous extract of L. camara fresh leaves was likewise subjected to the same technique.

The Advantages of Nanoparticles

Nanoparticles have three main benefits: (1) increased bioavailability by improving aqueous solubility, (2) increased resistance time in the body (raising half-life for clearance/increasing specificity for cognate receptors), and (3) drug targeting to specific locations in the body (its site of action).

Conclusion

Silver nanoparticles are gaining popularity due to their vast range of biomedical uses. When compared to their bulk parent materials, silver nanoparticles, which are typically smaller than 100 nm and contain 20–15,000 silver atoms, have different physical, chemical, and biological properties. The size and form of silver nanoparticles have a big impact on their optical, thermal, and catalytic capabilities. Silver nanoparticles have also become the most extensively utilised sterilising nanomaterials in eating and medical products, including as fabrics, food storage bags, refrigerator surfaces, and personal care products, due to their broad-spectrum antibacterial activity. Silver nanoparticles' antibacterial properties have been employed to inhibit bacterial development in a range of settings, including dentistry, surgery, wound and burn care, and biomedical equipment. Silver ions and silver-based compounds are known to be extremely harmful to microorganisms. When silver nanoparticles are introduced into bacterial cells, they cause significant structural and morphological alterations, which can lead to cell death. Scientists have discovered that silver nanoparticles' antibacterial impact is mostly due to the persistent release of free silver ions from the nanoparticles, which operate as a transport for silver ions.

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