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Gold Nanoparticles Synthesized from Plant Materials and Application of Bioremediation and Pharmacological

Abhijeet Mane*

Department of Physiology and Biophysics, University of Punjab, India

Abstract

These days, nanotechnology and nanoscience are attracting a lot of attention because of their unique characteristics and diverse range of uses. One of the most important metal nanoparticles, gold nanoparticles (AuNPs), has a wide range of uses in both research and industry. The market for AuNPs is expanding quickly. Due to the drawbacks of the chemical and physical procedures, much attention has been given to the creation of novel strategies for the synthesis of AuNPs with good morphological features employing biological sources. The synthesis, characterisation, and uses of AuNPs are influenced by a number of variables, including contact duration, temperature, pH of the solution medium, concentration of gold precursors, and volume of plant extract. Since the morphological characteristics of AuNPs must be evaluated, characterising synthetic AuNPs is crucial. Potential for use in a variety of applications. This study emphasises different ways to make AuNPs, factors affecting how the metal is biosynthesized from plant extract, various methods for characterising AuNPs, and their potential for use in bioremediation and biomedical applications.

Keywords: Gold nanoparticles; Synthesis; Plant materials; Bioremediation and pharmacological

Introduction

Due to their exceptional catalytic properties, anticancer properties, medical diagnostic application, antimicrobial activity, biomedical application, sensory application, food preservation, agriculture, pesticide and insecticide application, metal nanoparticles have demonstrated enormous potential in a variety of applications [1]. When compared to other metal nanoparticles, AuNPs continue to be dominating and prominent because of their uses in photo thermal therapy, medication delivery, immune chromatography identification, biosensors, photo catalysis, and electronics [2]. In order to create AuNPs, a variety of techniques including physical, chemical, and biological procedures have been employed [3]. The following benefits of biological techniques of producing AuNPs are compatible with biology and have extensive uses in the medical field [4]. Algae, plants, fungus, and microorganisms are used, and hazardous chemicals are not needed, which boosted its effectiveness [5]. When compared to other conventional methods, this approach is more rewarding due to its applications in the pharmaceutical and biomedical fields, ease of execution and low energy consumption, cost effectiveness because external stabilising agents are typically not needed, potential for large-scale synthesis, and reproducibility in production [6].

Discussion

The phytochemicals found in plants, including carbohydrates, flavonoids, terpenes, alcohol, phenolic, proteins, and glycosides, have demonstrated a great deal of ability for reducing metal ions from their greater oxidation state to low reduction potential [7]. The phytochemicals found in plants have the ability to act as antioxidants, which speeds up the production of AuNPs from the gold precursor (chloroauric acid solution) [8]. Due to their potent antibacterial properties, AuNPs made from plant extracts are widely used in medication delivery, tissue imaging, and the detection of clinical infections [9]. Connected to the phytochemicals in the plant's extracts [10]. Despite the wealth of literature on the synthesis, characterisation, and uses of AuNPs produced from plant extracts, there is still more work to be done in this area because of the variety and potential of plants to produce AuNPs in a variety of shapes. We give a brief overview of the latest advancements in green synthesis and characterisation methods used in the creation of AuNPs in this study. As a result, we focused on the most recent developments in the bioremediation and biomedical uses of AuNPs produced through biological means from plant materials. Physical methods for making AuNPs include evaporation, condensation, high energy ball milling sputter deposition, pyrolysis, diffusion, laser ablation, and plasma arcing. These processes are frequently employed in conjunction with each other. the application of the evaporation-condensation method Physical methods for making AuNPs include evaporation, condensation, high energy ball milling sputter deposition, pyrolysis, diffusion, laser ablation, and plasma arcing. These processes are frequently employed in conjunction with each other. In order to create AuNPs, the evaporation-condensation method uses a tube furnace operating at atmospheric pressure, where the source material inside a boat centred in the furnace is converted into the carrier gas. Despite the benefits of this approach, the following are some of its drawbacks: a great amount of room is required to house the tube furnace, and a lot of time and energy are squandered in creating stable temperature conditions. Another method used in the physical synthesis of AuNPs is laser ablation; this procedure takes place in a chamber under vacuum with the presence of Colloidal nanoparticle synthesis benefits from this method. As a physical method for the synthesis of AuNPs biochemical, spray pyrolysis, energy ball milling by impact collisions, and plasma-arcing in the presence of high temperatures have been used.

Conclusion

This biochemical serve as reducing agents to lessen the cytotoxicity

***Corresponding author:** Abhijeet Mane, Department of Physiology and Biophysics, University of Punjab, India, E-mail: AbhijeetMane9580@gmail.com

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connected with the use of pricey and toxic reagents in the chemical method of AuNPs synthesis. Because they include hydroxyl (-OH) functional groups that can transfer electrons to the gold ions, biological components such amine, alkaloids, flavonoids, amides, proteins, tannins, and carbohydrates are to blame for the reduction of gold precursor. The employment of microorganisms in the manufacture of AuNPs is extremely advantageous because mycelia, fruiting bodies, and enzymes are all readily available around the world. Despite that, these drawbacks of this methodology are its slowness, toxicity, and the high expense of some species' incubation. It has been reported that Agaricus bisporus and Pleuritic Florida mushrooms have been used in the synthesis of AuNPs. Turbinaria confides, an algae, has been used as reducing agents in the production of AuNPs, according to literature sources. Findings have shown that Fusarium oxysporum, Aspergillum sp., and Trichoderma viride are used in the synthesis of AuNPs. The creation of AuNPs has been reported to benefit bacteria including Staphylococcus epidermidis, Salmonella typhi, Pseudomonas aeruginosa, Escherichia coli, Rhodopseudomonas capsulate, and Klebsiella pneumonia.

Acknowledgement

None

Conflict of Interest

None

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