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SYNTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES USING LEAF EXTRACT OF AZADIRACHTA INDICA

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Abstract
In recent science Nanotechnology is a burning field for the researchers. Nanotechnology deals with the Nanoparticles having a size of 1-100 nm in one dimension used significantly concerning medical chemistry, atomic physics, and all other known fields. Nanoparticles are used immensely due to its small size, orientation, physical properties, which are reportedly shown to change the performance of any other material which is in contact with these tiny particles. These particles can be prepared easily by different chemical, physical, and biological approaches. But the biological approach is the most emerging approach of preparation, because, this method is easier than the other methods, ecofriendly and less time consuming. The Green synthesis was done by using the aqueous solution of Azadirachta indica leaf extract and AgNO3. Silver was of a particular interest for this process due to its evocative physical and chemical properties. A fixed ratio of plant extract to metal ion was prepared and the color change was observed which proved the formation of nanoparticles. The nanoparticles were characterized by UV-vis Spectrophotometer, FTIR, DLS, Zeta Analysis, XRD, and SEM. The nanoparticles were found have the size ranges from 160-180 nm.
KEYWORDS: [Nanoparticles, silver, leaf extract, neem, green synthesis.]

INTRODUCTION

Due to swift industrialization and urbanization, our environment is undergo huge smashup and a large amount of perilous and superfluous chemical, gases or substances are released, and so now it is our need to learn about the secrets that are present in the Nature and its products which leads to the growth of advancements in the synthesis processes of nano particl es. Nanotechnology applications are highly suitable for biological molecules, because of their exclusive properties. The biological molecules undergo highly controlled assembly for making them suitable for the metal nanoparticle synthesis which was found to be reliable and eco friendly.

NANOPARTICLES:

The term "nanoparticles" is used to describe a particle with size in the range of 1nm- 100nm, at least in one of the three possible dimensions. In this size range, the physical, chemical and biological properties of the nanoparticles changes in fundamental ways from the properties of both individual atoms/molecules and of the corresponding bulk materials. Nanoparticles can be made of materials of diverse chemical nature, the most common being metals, metal oxides, silicates, non-oxide ceramics, polymers, organics, carbon and bio molecu les . Nanoparticles exist in several different morphologies such as spheres, cylinders, platelets, tubes etc.

Types of nanoparticles:

Nanoparticles can be broadly grouped into two, namely, organic nanoparticles which include carbon nano particles (fullerenes) while, some of the inorganic nanoparticles include magnetic nanoparticles, noble metal nanoparticles (like gold and silver) and semi-conductor nanoparticles (like titanium oxide and zinc oxide). There is a growing interest in inorganic nanoparticles i.e. of noble metal nanoparticles (Gold and silver) as they provide superior material properties with functional versatility. Due to their size features and advantages over available chemical imaging drug agents and drugs, inorganic particles have been examined as potential tools for medical imaging as well as for treating diseases.

Methods for nanoparticle synthesis: Physical approaches: Most important physical approaches include evaporation-condensation and laser ablation. Various metal nanoparticles such as silver, gold, lead sulfide, cadmium sulfide, and fullerene have previously been synthesized using the evaporation-condensation method.

Need for green synthesis:

Biosynthesis of nanoparticles is a kind of bottom up

approach where the main reaction occurring is reduction/oxidation. The need for biosynthesis of nanoparticles rose as the physical and chemical processes were costly. Often, chemical synthesis method leads to presence of some of the toxic chemical absorbed on the surface that may have adverse effect in the medical applications.

Literature review:

Brijesh et al., 2020: Nanoparticles have been successfully used in nanochemistry to enhance the immobilization and activity of catalysts, in medical and pharmaceutical nanoengineering for delivery of therapeutic agents, in chronic disease diagnostics, and in sensors. Besides, It was observed that the particle size with variable shape. However, most of them showed spherical shape in nature with some triangular morphology. Regmi et al., 2016: The synthetic methods used for the preparation of AgNPs often use toxic chemicals as a reducing agent such as NaBH4, citrate, ascorbate etc.. Recently, there has been an increased emphasis on the topic of green synthesis of silver nanoparticles. Green synthetic route for the synthesis of nanoparticles have received much attention to overcome these fallacies. Plants extract synthesis of nanoparticles is gaining importance due to its simplicity and eco-friendly.

MATERIALS AND METHODS

Synthesis of Silver Nanoparticles from Azadirachta indica (Neem) leaves: Fresh leaves of Azadirachta indica, were collected and washed several times with water to remove the dust particles and then sun dried to removethe residual moisture and grinded to form powder. Then plant extract was prepared by mixing 1% of plant extract with deionized water in a 250ml of (Borosil, India) conical flask. Then the solution was incubated for 30 min. 41 and then subjected to centrifuge for 30 min. at room temperature with 5000 rpm. Four concentration ratios of plant and metal ions were prepared (30:1 & 240:1) by increasing the concentration of plant extract concentration in the solution. 0.17% of 1mM AgNO3 metal ion was added in the prepared plant extract.

RESULTS AND DISCUSSIONS

Uv-vis spectrophotometer analysis:

Reduction of silver ions into silver nanoparticles during exposure to plant extracts was observed as a result of the color change. The color change is due to the Surface Plasmon Resonance phenomenon. The metal nanoparticles have free electrons, which give the SPR absorption band, due to the combined vibration of electrons of metal nanoparticles in resonance with light wave. The sharp bands of silver nanoparticles were observed around 421 nm in case of Azadirachta indica

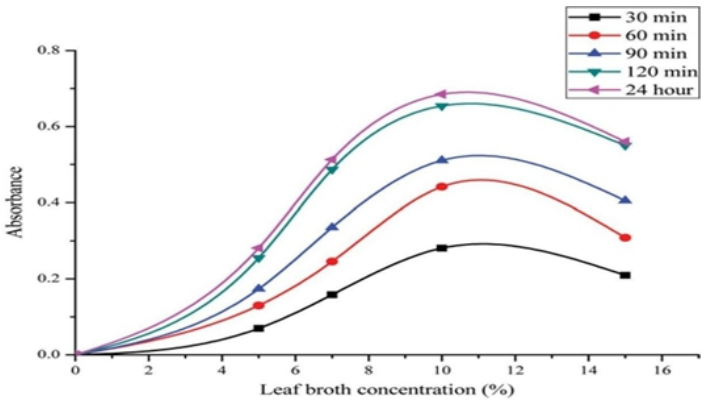

Fig.1: UV-vis spectra of Azadirachta indica 30:1 ratio at different time interval

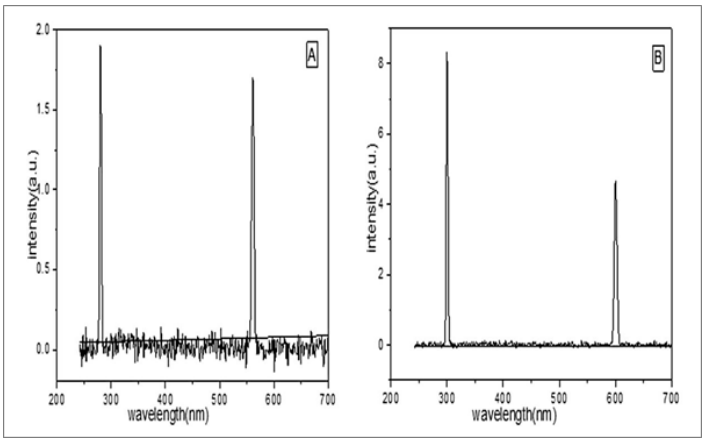

Fig.2: UV-vis spectra of Azadirachta indica 240:1 ratio at different time interval

CONCLUSION

The rapid biological synthesis of silver nanoparticles using Azadirachta indica leaves extract provides environmental friendly, simple and efficient route for synthesis of benign nanoparticles. The synthesized nanoparticles were of spherical and sheet shaped and the

estimated sizes were 160-180 nm. The size were bigger as the nanoparticles were surrounded by a thin layer of proteins and metabolites such as terpenoids having functional groups of amines, alcohols, ketones, aldehydes, etc., which were found from the characterization using UV-vis spectrophotometer, SEM, DLS, Zeta Analyzer, XRD, and FTIR techniques. All these techniques it was proved that the concentration of plant extract to metal ion ratio plays an important role in the shape determination of the nanoparticles.

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