

Biological synthesis of silver nano particles by using *Bombax ceiba* plant

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ABSTRACT

The green synthesis of silver nanoparticles (AgNPs) using *Bombax ceiba* leaf extract was successfully carried out, as the change in the color of the solution from blue color to dark brown color exhibits the reduction of the silver in aqueous solution. The exact mechanism for the formation of nanoparticles in living plants is not yet known, nor investigated in depth. The process, conceptually, appears to be close to the mechanisms of bio mineralization due to excitation of surface plasmon vibrations in silver nanoparticles. The pH of the solution during this reaction was in acedic range, which implies that the reaction occurs under acidic condition. It is to be observed that silver nanoparticles exhibit yellowish brown color in aqueous solution. *bombaxycebia* belongs to family plante and having medicinal importance. The aqueous extract of leaves of *bombaxycebia* was used for the synthesis of silver nanoparticles.

KEY WORDS: *Bombax ceiba* leaf extract, uv-visible spectrophotometer, silver nanoparticles.

1. INTRODUCTION

Bombax ceiba, like other trees of the genus *Bombax*, is commonly known as cotton tree. More specifically, it is sometimes known as red silk *Bombax ceiba* -cotton; red cotton tree; or ambiguously as silk-cotton or kapok, both of which may also refer to *Ceiba pentandra*. This Asian tropical tree has a straight tall tree and its leaves are deciduous in winter. 5 petal red flowers appear in the spring before the new foliage. It produces a white fibres like cotton capsule when ripe. To deter attacks by animals its trunk bears spikes. Its wood is too soft to be useful, though its stout trunk suggests that it is useful for timber. The dry cores of the *Bombax ceiba* flower acts as an essential ingredient of the kaeng khae curry as well as the nam ngiao spicy noodle soup of the cuisine of Shan State and Northern Thailand.



Figure.1. *Bombax ceiba* plant

Nanotechnology is facilitating technology which deals with nanometer sized items. The exercise of nano materials in biotechnology the fields of biology and material science. Nanoparticles put for a substantially useful platform, demonstrating unique properties with potentially wide-ranging application. Several research groups have oppressed the use of biological systems for the synthesis of nanoparticles, because of many rewards over non-biological systems The properties of nanoparticles can be derived from a variety of aspects, including the congruent size of nanoparticles and bimolecular, such as proteins and polynucleic acids. Synthesized by biogenic approach, nanoparticles present good polydispersity, dimensions and stability. The nanoparticles are synthesized. Nevertheless, in this method, capping agents are necessary for stabilization of the size of nanoparticles. Nanoparticles have been synthesized, most recurrently by three chemical techniques: a). Dispersion of preformed polymers, b). Polymerization of monomers, c). Ionic gelation or coacervation of hydrophilic polymers.

Dispersion of preformed polymers: A number of methods have been recommended to prepare nanoparticles from PLA (poly- glycolide) and PCA (Poly-ε-caprolactone), by dispersing the preformed polymers.

Polymerization of monomers: Nanoparticles can be prepared by polymerization of monomers. Polymeric nanoparticles derived from copolymers of methacrylic acid, acrylic esters or metacrylics, have been used quite often.

Ionic gelation or coacervation of hydrophilic polymers: During this method, ionic gelation of the material experienced transition from liquid to gel due to ionic interactions. Chitosan, gelatine and sodium alginate is utilized for preparation of hydrophilic nanoparticles by ionic gelation. Nanoparticles can be prepared from a wide range of materials such as proteins, polysaccharides and synthetic polymers, etc.

Uses: The roots are restorative, sweet, astringent, stimulant, cooling, Alternative, aphrodisiac, demulcent, emetic and tonic. It is used in the Treatment of dysentery, diarrhea, and menorrhagia, styptic and for Wounds. The gum is demulcent in nature & cooling, astringent, stimulant, aphrodisiac, and tonic. It is useful in hemoptysis, dysentery and influenza, pulmonary tuberculosis, burning sensation, enteritis and menorrhagia. Bark is demulcent, tonic, mucilaginous and emetic and is used for healing wounds and to stop bleeding. Flowers are good for skin troubles

and haemorrhoids and astringent. Seeds are useful in treating gonorrhoea and chronic cystitis. A paste made from prickles is good for restoring skin color especially on the face. Young fruits are helpful in chronic inflammations, ulceration of bladder and calculus affections.

2. METHODS AND MATERIALS

Instrumentation: REMI electronic hot plate with adjustable temperature is used for the extraction of the plant material. TECHOMP double beam UV –Visible spectrophotometer with quartz cuvettes of 10mm path length is used for the spectral analysis. The microscopic observation was carried out using Nikon eclipse E 100 electronic microscope.

Preparation of silver nitrate solution (1mM): Accurately weighed 3.397 grams of silver nitrate was taken in a 200ml volumetric flask containing 100ml of water. Mix well until the compound dissolves completely and then make up to a volume of 200ml. Results a 1mM concentration of silver nitrate solution was obtained.

Preparation of silver nitrate solution (0.1mM): Accurately weighed 0.33grams of silver nitrate was taken in a 200ml volumetric flask containing 100ml of water. Mix well until the compound dissolves completely and then make up to a volume of 200ml. Results a concentration of 1mM silver nitrate solution was obtained

Preparation of Plant Extract: Fresh leaves of *bombaxy cebia* was collected and kept in shady place for dry. The dried leaf was chopped into fine pieces with the help of mixer grinder. It was collected, weighed for 1 g, and then mixed in 100 mL of double distilled water. This mixture was boiled at 60°C in the water bath for one hour. The solution then was cooled at room temperature and filtered by Whatman filter paper No. 1. The filtrate was stored at 4°C for further experiment.



Figure.2.Plant extract

Synthesis of Silver Nanoparticles: Silver nanoparticles (AgNO_3) were synthesized by reducing the freshly prepared 1mM silver nitrate and stored under dark conditions with the bark extract. The reaction mixture of freshly prepared silver nitrate solution and bark extract, respectively. Initial color of the solution was prepared in ratio of 9:1.

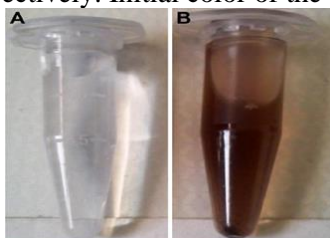


Figure.3. Freshly prepared silver nitrate solution (A) and bark extract (B)

UV-Visible Spectroscopy: The silver nanoparticles show the plasmon resonance at 400 to 450 nm in the UV-Visible spectrum. The UV-Visible spectrum of synthesized silver nanoparticles was analysed by spectrophotometer (LAB INDIA UV 300+).

Electron Microscopy observation: Microscopic analysis of the silver nanoparticles provides the information regarding the dimensions including the surface, shape. The sample was prepared by sonicating the sample solution for 15 minutes at room temperature. A small drop of sonicated sample was dried on a glass slide and observed under Nikon eclipse E 100 electronic microscope.

3. RESULTS AND DISCUSSIONS

The green synthesis of silver nanoparticles using *Bombaxy cebia* leaf extract was successfully carried out, as the change in the color of the solution from blue color to dark brown color exhibits the reduction of the silver in aqueous solution. The exact mechanism for the formation of nanoparticles in living plants is not yet known, nor investigated in depth. The process, conceptually, appears to be close to the mechanisms of biomineralization due to excitation of surface plasmon vibrations in silver nanoparticles. During this reaction process the pH of the solution was in acidic range, which implies that the reaction occurs under acidic condition. It is well known that silver nanoparticles exhibit yellowish brown color in aqueous solution. *Bombaxy cebia* belongs to family Plante and having medicinal importance. The aqueous extract of leaves of *Bombaxy cebia* was used for the synthesis of silver nanoparticles.

As the leaf extract of *Bombaxi cebia* was mixed in the aqueous solution of the silver ion complex, it started to change the color from colourless to brown due to reduction of silver ion; which indicated formation of silver nanoparticles. The change in color due to the bio-reduction of silver in presence of plant extract was checked periodically. The color was changed from colorless to dark brown was observed on increasing the time. The maximum dark brown was observed at an incubation time of 16Hrs. *Bombaxi cebia* completes the process with in 16H. Hence this time was sufficient for the synthesis of nanoparticles using the selected plants. After the completion of bioreduction of silver, the formed particles were collected. For this the solution was centrifuges the solution at 3000rpm for five min. the pellet was washed with water and then used for further studied.

Characterizations of synthesized nanoparticles using UV spectral analysis: The development and stability of the reduced silver nanoparticles in the colloidal solution was examined by using UV-visible spectral analysis. The obtained nano-particles were dissolved in few ml of distilled water. The UV-visible spectrum recorded from reaction mixture was plotted. The synthesized silver nanoparticles evaluated through double beam UV-visible spectrophotometer at a wavelength region of 360–800nm; a characteristic peak at 515nm for *Bombaxi cebia* for 0.01N silver nitrate solution showed that the typical optical spectra for silver nanoparticles was 500nm–550nm in visible light region, confirming the formation of nanoparticles. The similar type of the nanoparticles peaks were reported in literature. The obtained wavelength maxima observed was compared with previous reports and the reports support the obtained wavelength was found to be for the bio-reduced silver nanoparticles. The wavelength maxima obtained for the synthesized silver nanoparticles synthesized from *Bombaxi cebia*. The wavelength scanning spectrum of silver nanoparticles synthesized using *bombaxi cebia* at silver nitrate concentration of 0.01N and 0.1N was given. The shape and surface morphology of the synthesized nanoparticles was studied using microscopic observation. Results shows that the nanoparticles was found to be irregular in shape and the particle surface was found to be rough. The microscopic images of the synthesized nanoparticles was given in figure.

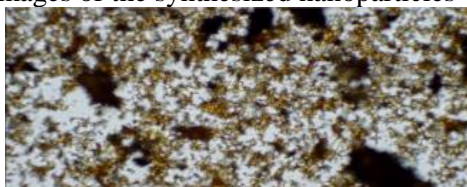


Figure.4. Microscopic image of the synthesized nanoparticles

Free radical is a molecule with an unpaired electron and is involved in bacterial and parasitic infections, lung damage, inflammation, reperfusion injury, cardiovascular disorders, atherosclerosis, aging and neoplastic diseases. They are also involved in autoimmune disorders like rheumatoid arthritis etc. Therefore, research for the determination of the natural antioxidants source is important. Hence the synthesized silver nanoparticles were evaluated for antioxidant activity.

4. CONCLUSION

Biological synthesis of nanoparticles using microorganisms, enzyme, and plant part extracts has been the subject matter of researchers in the recent past as an eco-friendly alternative to a variety of chemicals involve synthetic/ chemical methods. Using plants as bio reductants can have advantages over other biological processes like using microbial population because it eliminate elaborate process of maintaining cell culture and can be suitable scaled up for large-scale synthesis.

The development of reliable, eco-friendly processes for the synthesis of nanomaterial's is an important aspect of nanotechnology today. Biological synthesis process provides a wide range of environmentally acceptable methodology low cost production and minimum time required. We have studied a simple biotechnological process for synthesis of silver nanoparticles using leaf extract of *Bombaxi cebia*. The nanoparticles were in different shapes and the particle surface was found to be rough.

The antioxidant activity of synthesized nanoparticles was studied. Total antioxidant activity was studied using ammonium molybdate method and peroxide scavenge Activity was studied using Hydrogen peroxide. Results found that the synthesized copper nanoparticles was found to having potent antioxidant activity at lowest concentration.

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