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Biosynthesis of Gold Nanoparticles by using Epicarp of Pomegranate Fruit

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Abstract

The use of fruits in the synthesis of nanoparticles emerges as an ecofriendly and exciting approach. In this study, the epicarp of pomegranate was screened and found to successfully produce gold nanoparticles. Gold (Au) nanoparticles can be produced through the interaction of Au (III) ions with epicarp extracts which were analysed using UV-Visible spectroscopy, Transmission electron microscopy, Energy dispersive X –ray. In this report we found that epicarp of pomegranate fruit was very suitable for the synthesis of gold nanoparticles. The results demonstrated that spherical gold nanoparticles were of 20 nm in size.

Keywords: Gold nanoparticles; Energy dispersive X-ray; Transmission electron microscope;Ultra-violetspectrophotometer.

Introduction

In the area of nanotechnology, the development of technique for controlled synthesis of metal nanoparticles (Gericeke *et al*., 2006). Metal nanoparticles exhibit unique electronic, magnetic, catalytic and optical properties that are different from those of bulk metals for instance, a great deal of effort has been put into the biosynthesis of inorganic materials especially metal nanoparticles, using microorganisms and plants(Zhang *et al*., 2008).A simple and viable alternative to chemical synthetic procedure and physical methods (Chandran *et al*., 2006). In this paper the biological synthesis of crystalline spherical gold nanoparticles in high yield by the reaction of aqueous chloroauerate ions with the extract of epicarp of pomegranate fruit has been reported. This fruit has been used in many medical applications as a result of its antipyretic (30), antioxidant (31) and cathartic properties (32). There is much interest in developing green synthesis technique for synthesis of gold nanoparticles due to their potential applications in biosensor, improving radiation therapy, tumour treatment in cancer (Khlebtsov *et al*., 2010).

Materials and Methods

Materials

Chloroauric acid ($HAuCl_4$) was obtained from SRL chemical, and fresh riped Pomegranate fruit.

1. Epicarp extract of Pomegranate fruit: A 10 g of epicarp was weighed and washed thoroughly, boiled it 100 ml of sterile Distilled water, Filtered with the help of Whatmann filter paper no 1. The resulting extract was used for further analysis.
2. Synthesis of Gold nanoparticles using epicarp of pomegranate fruit: 5 ml of epicarp extract 45 ml of 10-3 M aqueous HAuCl4 separately. The effect of the amount of extract on the synthesis of gold nanoparticles was studied by observing the sample formed by using UV-Vis spectroscopy and TEM measurement after allowing the reaction mixture to stand for 30 hrs, during which time reduction of Au3+ in all the reaction mixture had saturated. Here in, we report for the first time synthesis of silver nanoparticles reducing the gold ions present in the solution of chloroauric acid by the cell free aqueous extract of epicarp of pomegranate fruit.
3. UV-Vis Absorbance spectroscopy studies: The reduction of Au^{3+} ions was monitored by UV-vis spectrum of the reaction medium after 30 hrs, diluting a small aliquot of the sample into distilled water, centrifuged it 10, 000 rpm for 10 min again wash it two times at 7000 rpm for 2 min the dilute the pellet with 1 ml of distilled water, the UV-Vis spectrophotometry UV-2450 (Shimadzu).
4. Transmission electron microscopy (TEM): Tem sample of the gold nanoparticles synthesized using the epicarp of pomegranate fruit extract was prepared by placing a drop of reaction mixture over carbon coated grid and allowing the solvent to evaporate.
5. Energy dispersive X- ray (EDX): EDX used for the determination of metallic elements present in the sample by dropping the suspension onto clean electric glass.

Results and Discussion

Addition of epicarp extract of pomegranate fruit to10^{-3} M aqueous $HAuCl_4$ solution led to theappearance of a dark purple in colour indicating the formation of gold nanoparticles (Fig 1).The UV- Vis absorption spectrum recorded from this solution shows the characteristic surface plasmon resonance (SPR) band of gold nanoparticles centered at 540 nm. (Fig 2).Transmission electron microscope reveals that formation of spherical gold nanoparticles size of synthesized nanoparticles was 20 nm that is shown in Fig (3). EDX used for elemental analysis in sample that is Copper (Cu) due to copper grid and Gold because of gold nanoparticle in solution (Fig 4).The biological synthesis of gold nanoparticles have favourable advantage other than chemical method.

Figure 1: (A) Epicarp extract, (B) Colour changed after 24 hours incubation of extract with 10^{-3} M solution of $AuCl_4$.

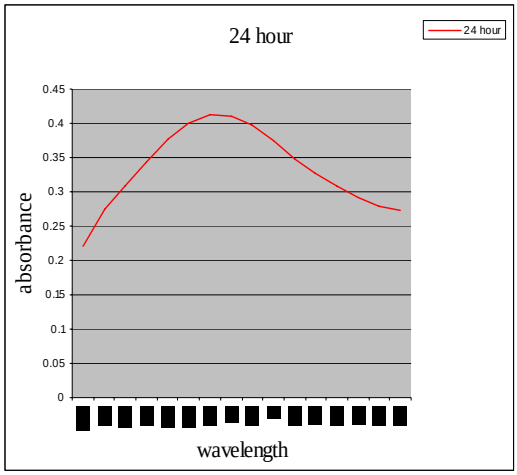

Figure 2: UV- Vis spectrum of synthesized silver nanoparticles after 24 hrs of reaction.

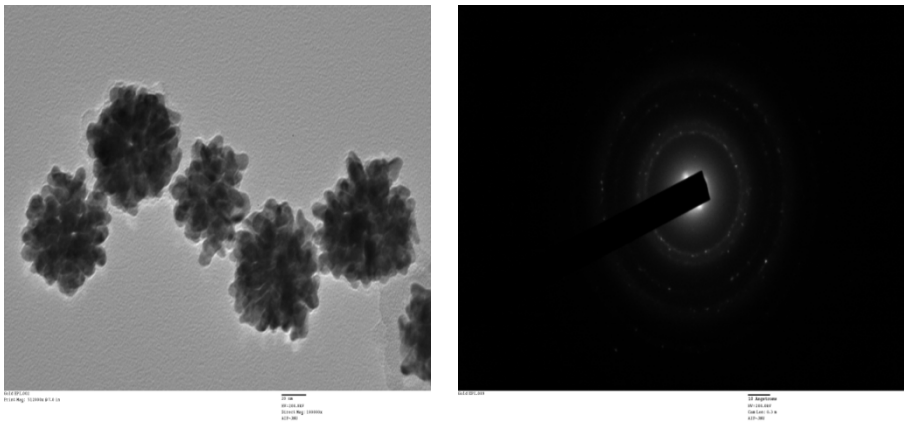

Figure 3: (A) Shows Gold nanoparticles and (B) shows a single nanoparticle was 10 Aº.

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