ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2016; 2(2): 834-835
www.allresearchjournal.com
Received: 03-01-2016
Accepted: 05-02-2016

VK Gautam
Department of Botany, Deen Dayal Upadhyaya College, University of Delhi, Delhi, India

Correspondence
VK Gautam
Department of Botany, Deen Dayal Upadhyaya College, University of Delhi, Delhi, India

Synthesis of ultra-fine gold nanoparticles using seed extract of *Punica granatum:* A green environment friendly approach

VK Gautam

Abstract
Nanoparticles are of great importance as antimicrobial, anti-fungal and anti-cancer agents. Available common chemical methods of synthesizing nanoparticles are complicated and not environmentally friendly. However, synthesis using plant extracts is easy, prompt and safe for the environment. Plants are suitable materials due to the presence of various secondary metabolites such as polyphenols, tannins and antioxidants which act as strong reducing and capping agents. We have been trying several medicinally important plants for synthesizing nanoparticles of silver and gold. In this study we have used various parts of *Punica granatum* plant such as young leaves and fruit as well as juicy seeds. This plant belongs to the family Punicaceae and possesses several medicinal properties. The aqueous extract of juicy seeds (here after referred to as seeds) was prepared and added to the 2% aqueous solution of $HAuCl_4$ for about 15 minutes with vigorous shaking. The color of the solution changed from yellowish red to dark red indicating the synthesis of gold nanoparticles. Various techniques were applied to characterize the synthesis of AuNPs such as UV-Vis Spectroscopy, HRTEM and XRD.

Keywords: Nanoparticles, metabolites, anti-oxidants

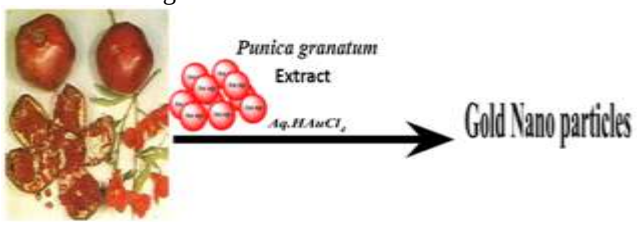
Introduction
Nanotechnology is a fast emerging area of research that has applications in almost all fields of science. One aspect of nanotechnology is the production of nanoparticles of various metals. Such metal nanoparticles have special characteristics as compared to their molecules. These particles have size between 10 to 50 nm and can be dispersed in water or organic solvents easily depending on the method of synthesis and nature of capping or stabilizing agents. The potential applications of nanoparticles are growing rapidly because of their unique properties. In recent years, gold nanoparticles have been the subject of interest in the areas of biosensors, materials science, biotechnology and organic chemistry for various uses such as molecular markers and organic catalysts. Different techniques have been used to develop metal nanoparticles [1-3] but synthesis using plant extract is preferred approach as it is green as well as environmentally friendly.

Punica granatum (pomegranate) belongs to the family Punicaceae, is a small tree, 5-8 m tall. Leaves are simple,oblong, bright green and 5-7 cm long. Flowers are bright red with numerous free stamens and inferior ovary. Fruits are globular berries, covered with reddish brown leathery pericarp. Berries have been used as a health drink in several countries including India. It has also been used in the treatment of several human diseases such as cardiac diseases, diarrhea, hemorrhage and respiratory problems. In addition, *P. granatum* is reported to have antioxidant, anti-atherosclerotic, antibacterial and antiviral properties [4-10]. Sanchez-Lamar *et al*., 2007 have reported the effectiveness of pomegranate in the treatment of respiratory diseases and against influenza virus [4]. In another study, Naz *et al*., 2007 have shown antibacterial activity of *Punica granatum* fruit juice against many bacterial species such as *Staphylococci, Streptococci, Bacillus subtilis, Salmonella, Shigella, E. coli and Vibrio cholerae* [10]. Parmar and Kar (2007) have reported beneficial effects of peel extracts of *Citrus sinensis, Musa paradisiaca* and *Punica granatum* in reversing atherosclerosis and thyroid dysfunction in rats [8]. According to Braga *et al*., 2005 pomegranate extract inhibited growth of *Staphylococcus* bacteria and also reduced the production of enterotoxins [9].

Materials and Methods

The fresh, ripen fruits of pomegranate were purchased from the market and the following steps were used to synthesize gold nanoparticles from fleshy seed coats that are source of juice:

1. Preparation of aqueous seed extract of *Punica granatum*: The fruits of pomegranate were washed with water several times to remove dust and then seeds were separated and meshed using mortar and pestle. The juice was prepared at room temperature and finally kept in a flask in fridge for further use.



2. Biosynthesis of Gold nanoparticles using seed extract : In a glass tube, 5ml of aqueous extract of *Punica* was added slowly to 10 ml aqueous solution of $HAuCl_4$ (2% w/v). The mixture was shaken for 15 minutes at 25^0C. The color of the mixture changed to dark ruby red, indicating the synthesis of gold nanoparticles.
3. Characterization of nanoparticles:The nanoparticles were characterized using various techniques such as HRTEM (High Resolution Transmission Electron Microscope), UV-vis spectrophotometry and XRD. It was found that most of the nanoparticles were round or oval in shape. The size of particles varied between 10-30 nm Fig.1A & B). The particle size can be controlled by varying the quantity of the extract.

Results and Discussion

A green approach for the synthesis of stable gold nanoparticles is reported here without using any stabilizing or reducing agent. The synthesis can be easily performed in a few minutes under mild conditions using aqueous seed extract of *Punica granatum*. Further, the particle size can be easily controlled by changing the quantity of the seed extract. Different techniques were used to characterize gold nanoparticles (AuNPs) such as UV-vis, HRTEM and XRD.

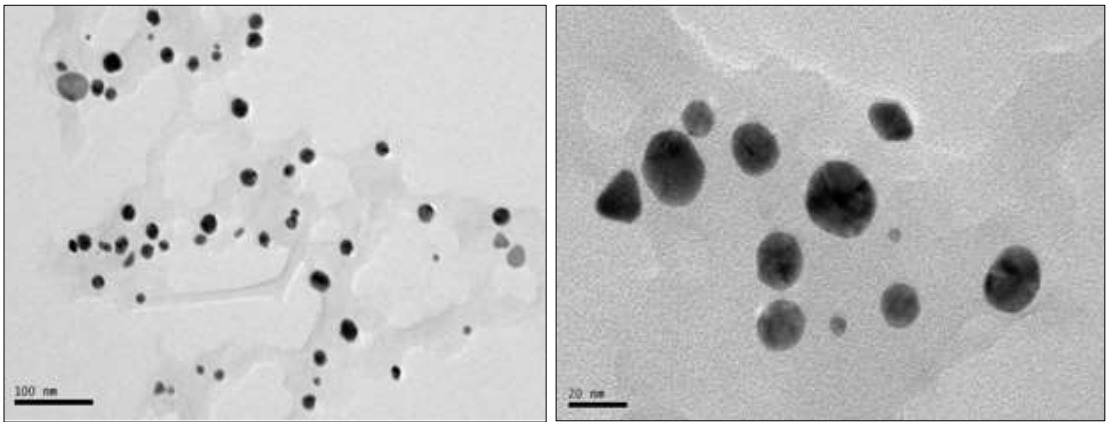


Fig 1A,B: TEM pictures of gold nanoparticles using aqueous seed extract of *Punica granatum*

The synthesized nanoparticles were mainly round or oval shaped with an average size between 10-30 nm (Fig1.A & B). Similar to our results, Kumar *et al*., 2013 have reported synthesis of gold nanoparticles using *Punica granatum* [11]. Sujitha and Kannan (2013) have reported the synthesis of old nanoparticles from three species of *Citrus* using fruit juice [12].

Conclusion

Here we have reported green synthesis of Gold nanoparticles (AuNPs) from seed extract of *Punica granatum*. Further purification can be obtained to exploit the full potential of these nanoparticles in various biological fields including medicine and industry.

References

1. Al-Sayed MA. Acc Chem Res 2001;34:257-264.
2. Brust M. *et al*. J Chem Soc Chem Commun 1994;7:801-802.
3. Liu J. *et al*., Langmuir 1998;14:7337-7339.
4. Sanchez-Lamar A, *et al*., Journal of Ethnopharmacology 2007;115:416-422.
5. Heber D, *et al*. J Agri & Food Chem 2007;55:10050-10054.
6. Parmar HS, Kar A. J Med Food 2008;11:376-381.
7. Aviram M, *et al*., Clinical Nutrition 2004;23:423-433.
8. Parmar M, Kar A. Nutrition Res 2007;27:710-718.
9. Braga LC, *et al*., J Ethnopharmacology 2005;96:335-339.
10. Naz S, *et al*., J of Food Science 2007;72:341-345.
11. Kumar G, *et al*., Colloids and Surfaces B: Biointerfaces 2013;106:208-216.
12. Sujitha M, Kannan S. Spectrochimica Acta Part A: Mol. Biomol. Spectroscopy 2013;102:15-23.