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ANTIFUNGAL EFFECT OF GOLD AS NANOPARTICLE SYNTHESIS BYFENUGREEK SEED EXTRACT

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ABSTRACT

In this paper, we synthesized the spherical gold nanoparticles (AuNPs) of 70 nm size, using HAUCL solution and the aqueous extract of Fenugreek plant seeds, which can act as a reducing, stabilizing and capping agent, at ambient condition. The formation of gold nanoparticles was confirmed by the first exciton peak of UV Vis. Spectra that was supported by the change in color of the solution. As synthesized Au, nanoparticles were characterized with the help of UV-Vis absorption spectroscopy analysis, Fourier Transform Infrared (FTIR) analysis, and Scanning Electron Microscopy (SEM) analysis. MIC of Gold nanoparticles for fungi is direct proportion to concentration.

KEYWORDS: Gold, nanoparticles, Fenugreek, plant, seeds, fungi.

INTRODUCTION

Synthesis of gold nanoparticles using plant extract is useful not only because of its reduced environmental, but also because it can be used to produce large quantities of nanoparticles. Plant extracts may act both as reducing agents and as stabilizing agents in the synthesis of nanoparticles In view of its simplicity, the use of plant extract for reducing metal salts to

nanoparticles has attracted considerable attention within the last few decades.[1] The properties of gold nanoparticles are very different from that of bulk, as the gold nanoparticles are wine red solution while the bulk gold is yellow solid. The gold nanoparticles can be manufactured into a variety of shapes including nano-rods, nano-spheres, nano-cages, nano-stars, nano-belts and nano-prisms.[2] The size and shape of gold nanoparticles strongly influence their chemical and other properties. The triangular shaped nanoparticles show attractive optical properties in comparison to spherical one.[3] Due to their wide spread applications in targeted drug delivery, imaging, diagnosis and therapeutics due to their extremely small size, high surface area, stability, non-cytotoxicity and tunable optical, physical and chemical properties, gold nanoparticles have revolutionized the field of medicine.[2,4]

In the present research work Trigonella foenum seed extract have been used as a reducing agent. The same extract also acts as a capping agent. T. foenum is widely available plant in tropical country like India. The aqueous extract contains protein, which may act as a bio-ligand. This method gives nanoparticles well separated from each other and no aggregation was observed. Similarly, the anti-microbial activity was also studied. A thorough study on literature of T. foenum reveals that the major components of the plant are protein in which globulin and histidine are major components and contains albumin and Phosphorus. The seed contains Trigonelline (C7H7O2N), Choline, fatty acids, phosphates, lecithin, and nucleo-albumin. Therefore, it is as nutritive as cod-liver oil. It is also used as a Ayurveda medicine against indigestion, bleeding piles, galactagogic, diarrhea, griping pain, anemia, diabetes, goitre, leucorrhoea, and as appetizer and purgative and in treating eye diseases.[5,6]

The aqueous seed extract of Abelmoschusesculentus were used to synthesized gold nanoparticles and its antifungal activities were tested against Puccinia graminis tritci, Aspergillus flavus, Aspergillus Niger and Candida albicans. The synthesized nanoparticles hence, has a great potential in the preparation of drugs used against fungal diseases.[8]

The stable gold nanoparticles of variable size were obtained by using extract of leaves of Pelargonium graveolens and its endophytic fungus as extracellular synthesis.[9]

METHODOLOGY

Material

Fenugreek seed, $HAUCL_4.3H_2O$, Dimeson solution.

Fungi

Candida albicans, Aspergilloses Niger.

Equipment

Weighting sensitive balance, Ultra-violate UV, Nano plus common version 5.22 / 3.00 (zeta potential), SEM, FT-IR.

Preparation methods

A. Fenugreek Extract Method

8g of fenugreek seed was taken, and added 60ml distil water on Beaker, then but in the heater until boiling, the extract was formed, 5ml of extract was taken.

B. Green Method

5ml of HAUCL was taken and completed volume to 50ml of distil water, the beaker of solution was but on heater.

Then the 5ml of extract was added as drop wise to the solution and boiled until the color was changed (endpoint), the reaction was take one minted.

C. Disc method

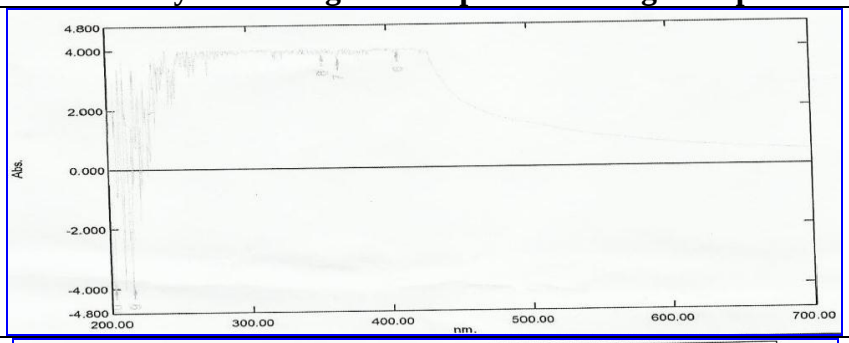
The microbial suspension of Aspergillus Niger and Candida albicans was spread over the media. The standard antibiotic disc was also placed in one side of the petriplates, which is the control and the pretreated antibiotic discs with the synthesized nanoparticles in another side. The inoculated petriplates is covered and it is kept for incubation at 37°C.

RESULTS AND DISCUSSION

Gold nanoparticles were synthesized from Hydrogen tetra chloroaurate solution containing Au+ ions by treating with the Fenugreek Extract (C). The color of the solution changed to purple color within 1 min of reaction with the Au+ ions. The appearance of the purple color indicated formation of gold nanoparticles.

Characterization of the synthesized gold nanoparticles using UV-spectra:

C



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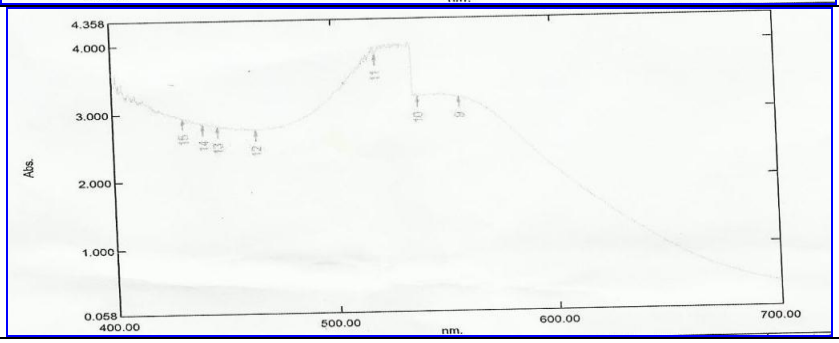


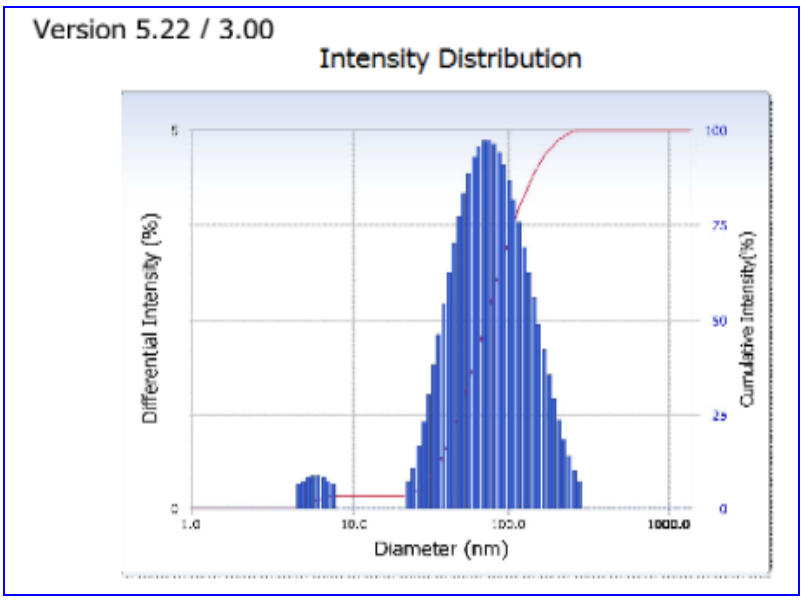
Figure 1: Characterization of the synthesized gold nanoparticles using UV-spectra.

Synthesis of gold nanoparticles (G) solution with Fenugreek extract (C) may be easily observed by ultraviolet-visible (UV-Vis) spectroscopy. The wavelength in 400-700 nm range operated at a resolution of 1 nm the high peak is 518.80 in point 4.

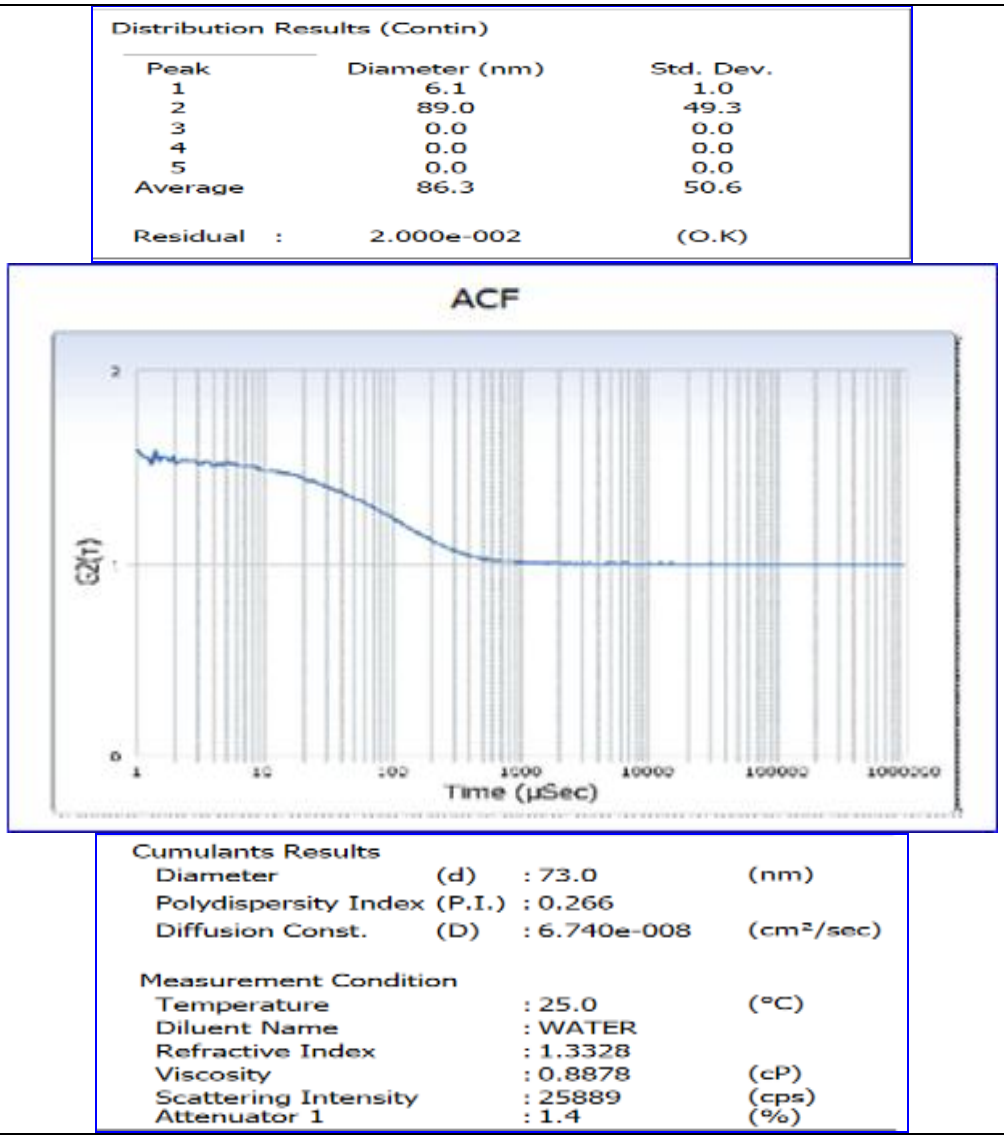
Characterization of the synthesized gold nanoparticles using Zeta potential

G

	Mobility (cm²/Vs)	Zeta Potential (mV)	Electric Field (V/cm)
Peak Value	-4.292e-004	-55.04	16.20



Zeta potential by (-) Minus is indicated the particle size in Nano-Size.

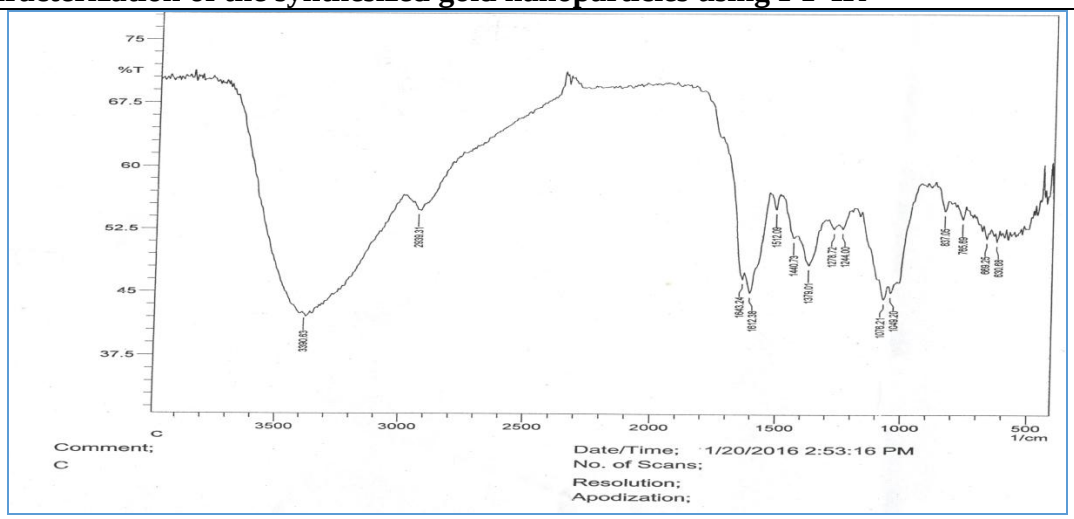


Dynamic light scattering (AuNPs): 73 nm.

Figure 2: Characterization of the synthesized gold nanoparticles using Zeta potential.

Characterization of the synthesized gold nanoparticles using FT-IR

C



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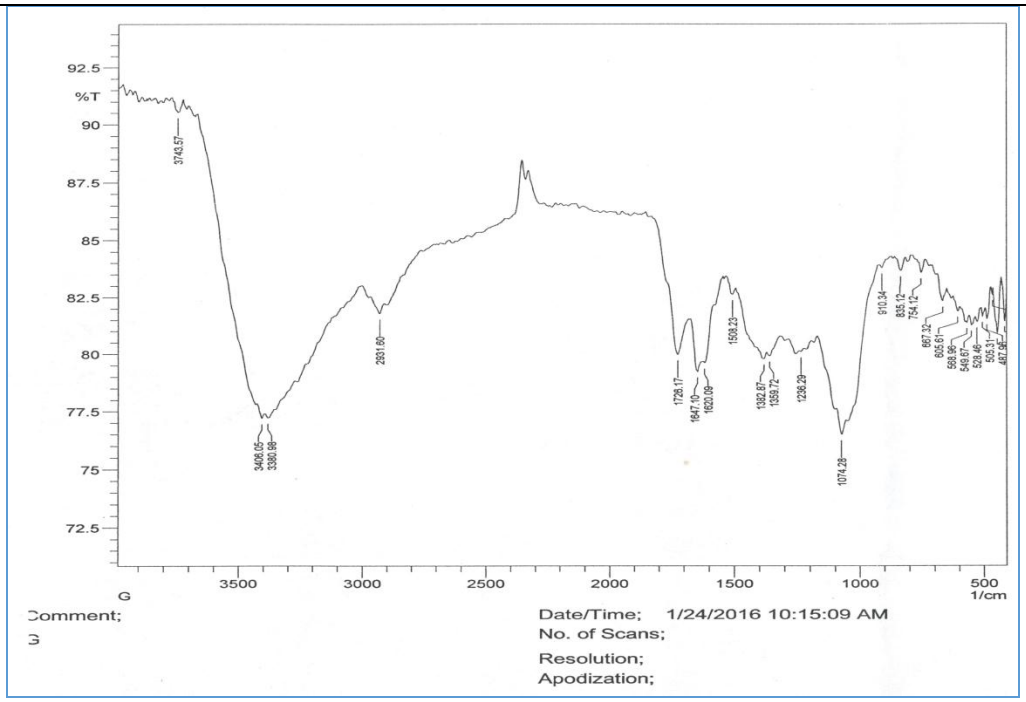


Figure 3: Characterization of the synthesized gold nanoparticles using FTIR.

C:3390.63 means: 3400–3250 (m) N–H stretch 1°, 2° amines, amides

G:3406.05 and 3380.98 means: (3500–3200) (s,b) O–H stretch, H–bonded alcohols, phenols.

FTIR analysis also gives a set of peak values unique for the sample along with information of the plant peptides that are present in the sample as the plant extract acts as a reducing agent figure-5. FTIR analysis is used to confirm the presence of plant peptides visible due to the bending produced by amide bonds.

Characterization of the synthesized gold nanoparticles using SEM.

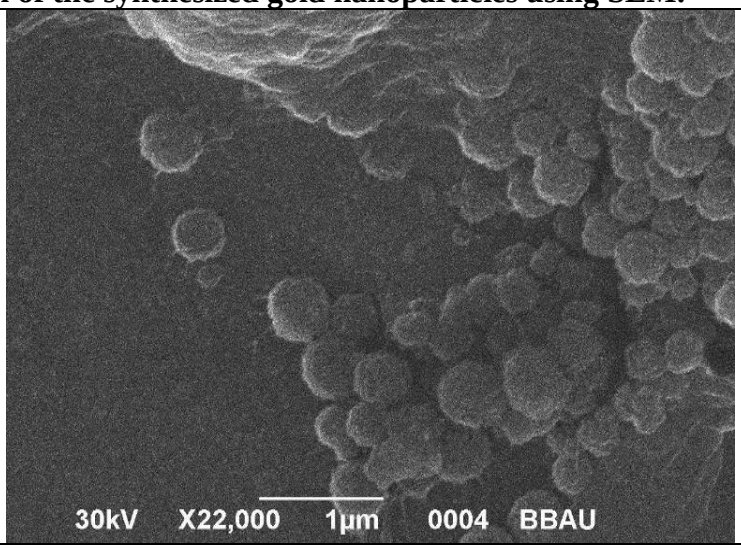


Figure 4: Characterization of the synthesized gold nanoparticles using SEM.

The electronic images show gold nanoparticle as spherical shape

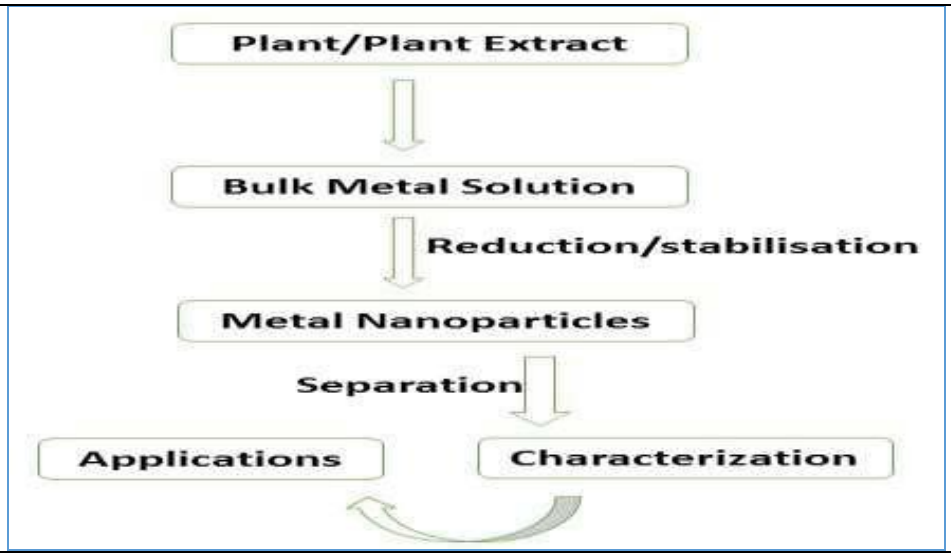


Figure 5: Overview of different steps in plant-extract-mediated nanoparticles synthesis.[1]

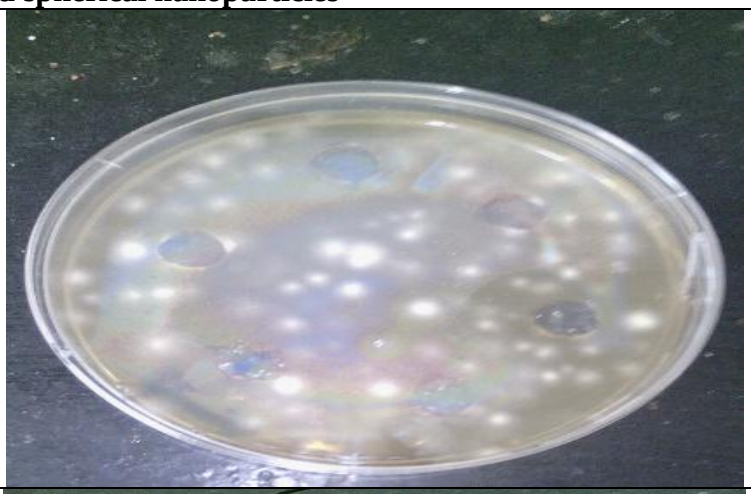
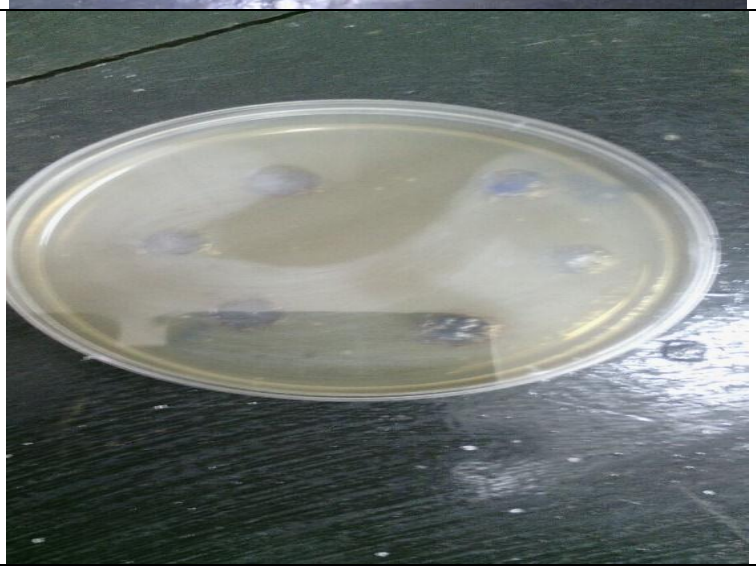
Zone inhibition of gold spherical nanoparticles	
Figure 6: Aspergillose niger.	
Figure 7: Candida albicans.	

Table 1: Minimum Inhibitory concentration of gold spherical nanoparticles.

Conc. / Fungi	G - Distil Water			G - Dimeson solution		
	4µl	6µl	10µl	4µl	6µl	10µl
Aspergillose niger.	- ve	- ve	- ve	- ve	- ve	- ve
Candida albicans.	- ve	- ve	- ve	- ve	- ve	- ve

-ve means no effect may be due to low concentration was used.[7]

CONCLUSION

In this present study, the synthesis of gold nanoparticles was synthesized by green method using Fenugreek seed extract, which acts as a reducing agent to reduce gold metal to nano-size particles. The synthesized gold nanoparticles were subjected to analysis such as SEM, UV Vis Spectroscopy, and FTIR in order to characterize them. To the best of our knowledge, this is the best information of the observations of the unique structures of fenugreek seeds extract mediated Au nanoparticles. This opens a way to understand the synthesis mechanism of Au nanoparticles formed from other plant seeds extracts.

It is proven that the gold nanoparticles synthesized from Fenugreek extract seem to be promising and effective antibacterial agent.

MIC of Gold nanoparticles for bacteria and fungi is direct proportion to concentration.[7]

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