SYTHESIS AND CHARACTERIZATION OF SILVER NANOPARTICLES USING LUFFA CYLINDRICA PLANT EXTRACT AND STUDY OF THEIR ANTIMICROBIAL PROPERTIES

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Abstract— Nano-particles have now become an integral part of the development of nano-devices but their application in the field of bio-medicine has also opened many new doors for research related applications. In this paper, the nano-particles are synthesized from $AgNO_3$(1mM) using Luffa cylindrica fruit extracts . The nano-particles are further characterized using Fourier Transform Infrared Spectroscopy, Scanning Electron Microscope, Ultra-violet Spectroscopy , Electron-Distribution Spectrum and Anti-microbial activity was studied as well.

Keywords— Nano-particles, Characterization, Luffa cylindrica, Anti-microbial.

I. INTRODUCTION

Nano-particles are particles that are of the 10^{-9} m in size . Metallic nano-particles are known now a days for having their characteristic prospective applications in different fields like electronics, nano-medicine, bio-medicine, nano-technology, as well as antimicrobial studies.There are many other plants used for the synthesis of nano-particles due to different properties . The main plants among them being *Camellia sinensis , Magnolia kobus and Diopyros kaki leaf, Geranium leaf, Acalypha indica leaf, Coriandrum sativum, Sorbus aucuparia leaf, Gliricidia sepium, Rose leaf,Cinnamomum camphora,Aloe vera and neem* .[1].The fruit of *Luffa cylindrica* plant bears quite a lot of medicinal properties . It is known to be having many anti-allergens , anti-fungal and anti- inflammatory agents [2] . Hence the present study is being carried out to synthesize , characterize and study the anti-microbial properties of the said plant

II. DETAILS EXPERIMENTAL

2.1. Aqueous extract preparation

2.1.1 Steam extract preparation

20 gm of Luffa Cylindrica fruit is boiled in 100 ml Double distilled water**.** The flask is kept in boiling water covered with a foil **.**The flask is left in that water for almost 25-30 minutes. High temperature leads to the breakdown of proteins from the cell membrane . Plant proteins and phyto-chemicals are generally water soluble hence we get a proper extract. **Figure 1a**

2.1.2 Crushed extract preparation

20 gm of Luffa Cylindrica fruit is crushed in mortar and pestle and mixed with 100 ml Double distilled water The extract is filtered and collected . Application of blunt force breaks the inter molecular stable forces and deforms the structural conformity leading to release of plant extract. **Figure 1b**

2.2. Standardization and optimization

For standardization, the plant extracts were mixed with 1mM AgNO3 Each sample was subjected to preparation of three ratios These ratios were 9:1 , 8:2, 7:3 i.e. 9 parts AgNO3 in 1 part plant extract to form silver nano particles solution of 20ml For optimization , all these extracts were kept under 4 places of incubation Hot air oven , Room temperature , Sunlight and Ultraviolet radiation for 5, 10 and 15 minutes. The ratio, method of incubation and time of incubation in which maximum nano-particles are settled is chosen for bulk production.

2.3. Bulk production

The chosen ratio, method of incubation and time of incubation is used for bulk production by the same method as described above. After the settlement of particles, extraction is proceeded by centrifugation at 8000 rpm for 20 minutes. The settled particles are mixed with 1ml of acetone and let them dry in a Petri-plate . The nano-particles are scrapped from the surface of the dish using a blade**.**

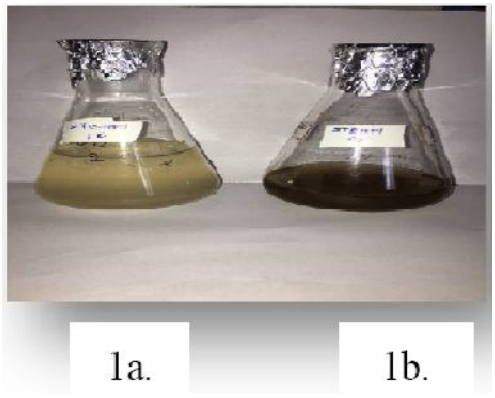

Figure 1

III. CHARACTERIZATION OF NANOPARTICLES

3.1. Fourier Transform Infra-red Spectroscopic Analysis

The chemical composition of the synthesized silver nanoparticles was studied by using FTIR spectrometer **(**Perkin-Elmer LS-55- Luminescence spectrometer**)**. The solutions were dried at 75o C and the dried powders were characterized in the range 4000–400 cm-1 using KBr pellet method.[3]

3.2. Scanning Electron Microscope Analysis

The structure and size of the synthesized silver nanoparticles was studied by using scanning electron microscope to take high resolution images of the nanoparticles.

3.3. Ultraviolet-Visible Spectroscopic Analysis

The optical property of silver nanoparticles was determined by UV-Vis spectrophotometer. After the addition of AgNO3 to the plant extract, the result were taken in different time intervals up to 3Hrs. between 350 nm to 500 nm. .[3]

3.4. Energy Dispersive X-Ray Spectroscopic Analysis

The elemental analysis of silver nanoparticles was determined by EDX spectrophotometer and the results for different elemental constituents were obtained.

3.5. Anti-Microbial Analysis

The anti-microbial analysis of silver nanoparticles was carried out by well-diffusion method and analysis for E.coli bacteria was studied

IV. RESULTS AND DISCUSSION

4.1. Fourier Transform Infra-red Spectroscopic Analysis

FTIR measurements were carried out to identify the biomolecules for capping and efficient stabilization of the metal nanoparticles synthesized. The FTIR spectrum of silver nanoparticles in case both of Luffa cylindrica ratios showed the band between 3440-3500 cm-1 corresponds to O-H stretching H-bonded alcohols and phenols. The peak found around 500-750 cm- showed a stretch for C-H bond, peak around 1350-1500 cm-1 showed the bond stretch for N-H. whereas the stretch for Ag-NPs were found around 500-550 cm-1.**Figure 2**

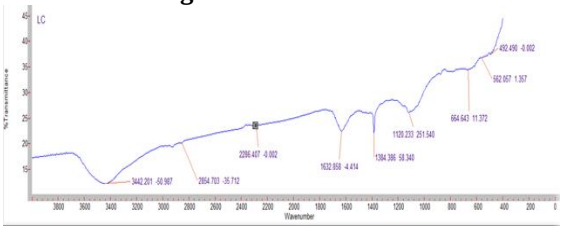

Figure 2

4.2. Scanning Electron Microscope Analysis

The structure and size of the synthesized silver nanoparticles was shown to be in the range of 500-980nm. The increased size of the nanoparticles was due to the binding of protein on the surface of nanoparticles. **Figure 3**

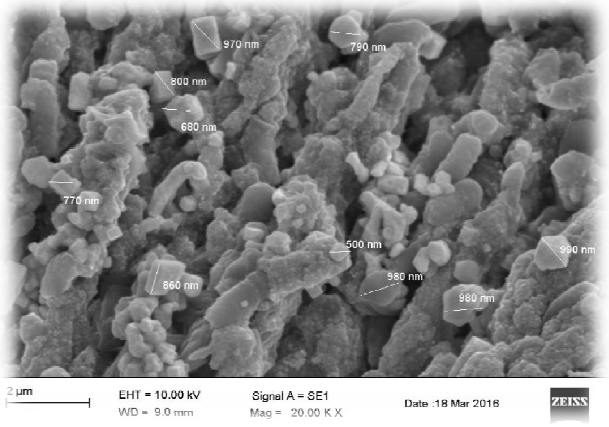

Figure 3

4.3. Ultraviolet-Visible Spectroscopic Analysis

The sharp bands of silver nanoparticles were observed around 384 nm in for *Luffa cylindrica* . The extract has more potential to reduce Ag ions into Ag nanoparticles. **Figure 4**

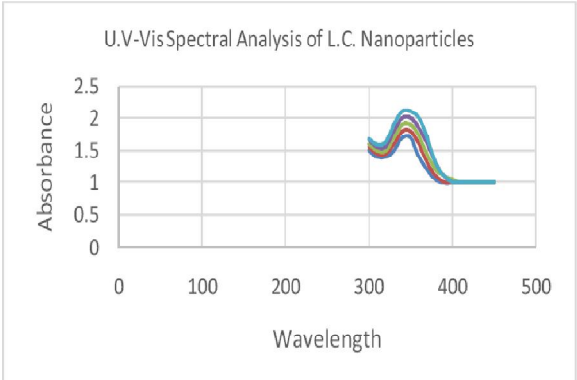

Figure 4

4.4. Energy Dispersive X-Ray Spectroscopic Analysis

The elemental analysis of silver nanoparticles was determined by EDX spectrophotometer and the peak was obtained for silver and the second peak was obtained for chloride elements . **Figure 5,6**

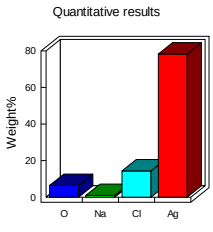

Figure 5

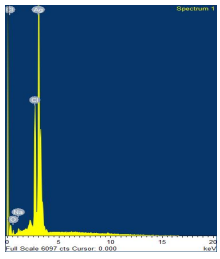

Figure 6

4.5. Anti-Microbial Analysis

The anti-microbial analysis of silver nanoparticles was carried out by well-diffusion method and zone of

inhibition was measured by Hi-Antibiotic zone scale[4]. **Figure 7,Table 1.**

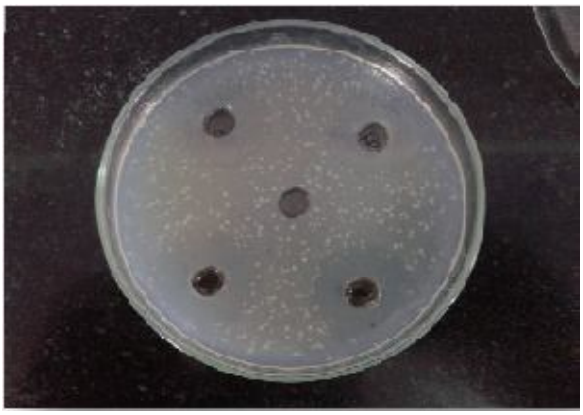

Figure 7

Table 1 : Table showing zone of inhibition for microbes

Amount of Extract	Diameter of region
25 µl	20 mm
50 µl	23 mm
75 µl	25 mm
100 µl	28 mm

CONCLUSION

The rapid biological synthesis of silver nanoparticles using Ocimum sanctum and Luffa cylindrica extract provides environmental friendly, simple and efficient route for synthesis of benign nanoparticles. The synthesized nanoparticles were estimated to be of size 680-800 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, aldehydes, etc., which were found from the characterization using UV-vis spectrophotometer, SEM, and FTIR techniques. The antimicrobial properties of nanoparticles are studied and the zone of inhibition was found out to be relevant for both gram positive and gram negative bacteria.

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