Abstract — Green synthesis of nanoparticles is a novel way to synthesis nanoparticles by using biological sources. It is gaining attention due to its cost effective, eco-friendly and large scale production possibilities. In this present study Azadirachta indica was taken to investigate their potential for synthesizing silver nanoparticles. The silver nanoparticles synthesized were confirmed by change of colour to dark brown due to the phenomenon of surface plasmon resonance. The characterisation studied was done by UV-vis spectroscopy, Fourier Transmission infrared spectroscopy (FTIR). All the plants synthesized silver nanoparticles show good antimicrobial activity against clinically important pathogens Staphylococcus aureus, Klebsiella pneumoniae, Vibrio cholera and Escherichia coli.

Keywords — Green synthesis, UV-Visible Spectra, FTIR

I. INTRODUCTION

In recent days nanotechnology has induced great scientific advancement in the field of research and technology. Nanotechnology is the application of science and technology to control matter at the molecular level. At the nanoscale level, the properties of matter are significantly different from their macroscopic bulk properties. Nanotechnology is also referred to the ability for designing, characterization, production and application of structures, devices and systems by controlling shape and size at the nanometer scale. Nanotechnology is the study and application of small object which can be used across all fields such as chemistry, biology, physics, material science and engineering. [1]

However, there is still need for economic commercially viable as well as environmentally clean synthesis route to synthesize the silver nanoparticles. Silver is well known for possessing an inhibitory effect toward many bacterial strains and microorganisms commonly present in medical and industrial processes. In medicines, silver and silver nanoparticles have a ample application including skin ointments and creams containing Silver to prevent infection of burns and open wounds, medical devices and implants prepared with silver-impregnated polymers. In textile industry, silver-embedded fabrics are now used in sporting equipment[6]. Nanoparticles can be synthesized using various approaches including chemical, physical, and biological. Although chemical method of synthesis requires short period of time for synthesis of large quantity of nanoparticles, this method requires capping agents for size stabilization of the nanoparticles.

II. MATERIALS AND METHODS

A. MATERIAL

Plant Sample of Azadirachta indica leaves, chemical regent such as Silver Nitrate (AgNO₃), Nutrient agar, Nutrient broth.

B. CHARACTERIZATION TECHNIQUES

i. UV-Visible Spectra Analysis:

Absorbance spectroscopy is used to determine the optical properties of a solution. A Light is send through the sample solution and the amount of absorbed light is measured.. The silver nanoparticles were confirmed by measuring the wave length of reaction mixture in the UV-vis spectrum of the Perkin Elmer spectrophotometer at a resolution of 1 nm (from 300 to 600 nm) in 2 ml quartz cuvette with 1 cm path length.

ii. Fourier Transmission Infrared Spectroscopy (FTIR):

FTIR is chemical analytical method which measures infrared intensity v/s wavelength or wave number of light. FTIR spectroscopy detects the vibration characteristics of chemical functional groups[4]. The silver nanoparticle synthesis FTIR data measures interaction between Ag salts and protein molecule. The characterizations of functional groups on the surface of AgNPs by plant extracts were invested[1].

III. SYNTHESIS OF SILVER NANOPARTICLES

The following procedure is adopied for preparation of plant extract. Initially healthy plant samples were collected from the locality of Ratnagiri, India and were cleaned properly in tap water. The samples were shade dried and homogenised to fine powder using a motor. 25 gram of powder is taken and mixed into the 100 ml of distilled water. Were the mixture boiled in a 500 ml Erlenmeyer flask were temperature is maintained 90°C up to 15 to 20 min. The solution was then kept at room temperature to cool down. The plant extract was then filtered out by using vacuum filtration[5].

Plant extract was incubated in dark for 24 hours at room temperature. After 24 hours, 10 ml plant extract pipette out and take into the 500 ml Erlenmeyer flask.
Take 0.1 N silver nitrate solutions in burette and added to the 10 ml of plant extract and stirred continuously. Change in the colour of the solution from pale yellow to dark brown, stop the addition of silver nitrate solution[4].

IV. RESULTS AND DISCUSSIONS

A. FORMATION OF SILVER NANOPARTICLES

Reduction of silver ions into silver nanoparticles during exposure to plant extracts was observed as a result of the colour change from pale yellow to dark brown. The formation of silver nanoparticles was preliminary confirmed by the color changes from pale yellow to dark brown. Development of dark brown colour is due to the Surface Plasmon Resonance phenomenon property of silver nanoparticles. The metal nanoparticles have free electrons, which give observed around nm in case of Azadirachta indica[2].

B. FTIR ANALYSIS

FTIR spectrum clearly illustrates the biofabrication of silver nanoparticles mediated by the plant extracts. Figure 2 shows the FTIR spectrum of azadirachta indica mediated synthesised silver nanoparticles, the silver nitrate salt and dried azadirachta indica plant extract, in AgNO3 peaks were observed at 3692cm-1 which is associated OH stretching which having function group alcohol, phenol. Azadirachta indica plant extracts peaks were observed at 1699.94 cm-1, 1560.13 cm-1, 1095.37 cm-1, 563.112 cm-1, 523.57 cm-1, 504.27 cm-1 which are associated C=O stretch, CH stretch, C–N stretch, C–Br stretch respectively. Azadirachta indica plant extracts peak were observed at 1699.94 cm-1, 1560.13 cm-1, 1095.37 cm-1, 563.112 cm-1, 523.57 cm-1, 504.27 cm-1 synthesized silver nanoparticles were observed surrounded by proteins and metabolites such as tarpemoids having functional group as above[1].

C. UV-VIS SPECTROPHOTOMETER ANALYSIS

The reduction of pure Ag+ ions was monitored by measuring the UV-Vis spectral of the reaction medium at 5 hours after diluting small aliquot of the sample into distilled water[3]. UV-VIS spectrophotometer (carry 4000 UV/Vis spectrophotometer). The absorption maxima for the biosynthesized nanoparticles were noted in the visible range of 300-500 nm. The typical absorption maxima for silver nanoparticles synthesized was obtained at around 362 nm as shown in figure 3.

V. CONCLUSIONS

Biological synthesis of nanoparticles has upsurge in the field of nanobiotechnology to create novel material that are eco-friendly cost effective stable nanoparticles with great importance for a wider application in the area of electronics, medicines and agriculture. In these current work nanoparticles were synthesized...
biologically using the azadirachta indica leaves extract. These method is purely as per green chemistry as well as completely toxic free chemical synthesis method in this respect nature has provide exciting possibilities of utilizing biological system for this purpose.

The UV absorption peak at 362nm clearly indicates the synthesis of silver nanoparticles. The SEM studies were helpful at deciphering their morphology and distribution. FTIR studies confirmed the bio fabrication of the silver nanoparticles by the action of different photochemical with its different functional groups present in the extract solution.

REFERENCES