International seminar on Nanoscience and Technology- conferenceproceedings. Sept- 2016
Volume 3, Special Issue - Available Online: http://ijrset.in/Volume3,Special-Issue-II.php Pages: 6-9

ISSN 2394-739X
International Journal for Research in Science Engineering and Technology

GREEN SYNTHESIS OF SILVER NANOPARTICLES USING PAPAYA FRUIT EXTRACT AND ITS ANTIBACTERIAL ACTIVITIES

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ABSTRACT-Silver nanoparticles were synthezied by Green synthesis method and its antibacterial activities were investigated by Well diffusion method. Various spectroscopical studies were done. The absorption peak of silver nanoparticles was studied by ultra violet visible spectroscopy (UV). The functional group was determined by Fourier transform infrared spectroscopy (FTIR). The particle size was determined by x-ray diffraction spectroscopy (XRD). Scanning electron microscopy (SEM) showed the morphology of the silver nanoparticles. Antibacterial activities confirmation of the inhibition of Silver nanoparticles.

Keywords- [Silver nanoparticles, XRD, UV, SEM, FTIR, Antibacterial activity.]

1. INTRODUCTION

Green synthesis of nanoparticles received considerable attention due to the growing need to develop clean, nontoxic chemicals, environmentally benign solvents and renewable materials. Metal nanoparticles are of great interest because of the modification of properties due to size effects, modifying catalytic, electronic and optical properties of the metallic nanoparticles [1]. The green processes of synthesis of nanoparticles are evolving into an important branch of Nanotechnology [7]. Properties of metal nanoparticles are different from those of a bulk materials made from the same atoms [5]. The National Nanotechnology Initiative (NNI), U.S. defined nanoparticle as microscopic particles with at least one of the three dimensions less than 100nm [4]. Silver nanoparticle display unique physical and biological properties and has important medical applications [2]. Silver nanoparticle is one of the inorganic nano materials which are the good antimicrobial agents [3]. Silver nanoparticles do not affect living cells, so not able to provoke microbial resistance. It is believed that silver nanopraticles can attach to the cell wall and disturb cell-wall permeability and cellular respiration [6]. In green synthesis method, the plant extract has been used as reducing agent and capping agent for the synthesis of nanoparticles due to their reducing properties [8]. Analysis of antibacterial property and toxicity of silver

nanoparticles ensure that they are used in medical application [9]. Caricapapaya belongs to family Caricaceae and commonly known as Papaya. It is one of the medicinal plants. The papaya fruits, bark, leaves are being used as medicine to treat various diseases such as warts, corns, constipation, amenorrhoea, general debility, sinuses, eczema, cutaneous tubercles, glandular tumours, blood pressure, dyspepsia, cancer cell growth, diabetes, malaria expel worms and stimulate reproductive organs, syphilis and gonorrhea. C. papaya fruit and leaf extracts are being used to treat dengue fever. C. papaya fruit extract exerting antioxidant and immunostimulant properties against acrylamide toxicity in rats [10-11].

2. EXPERIMENTAL DETAILS

Silver nanoparticles were synthezied by Green synthesis method. 20ml of papaya fruit extract added into 50ml of aqueous solution of 2.5g of silver nitrate ($AgNO_3$) by hand shaking. This mixture was kept at room temperature for 24 hour and slowly it changes to brown color solution as shown in fig.1(c).The precipitate is dried in furnace for 1hour at 100˚C. and thus the silver nanoparticles were prepared[12].

(a) (b) (c)

Figure 1- Photographs of (a) Papaya fruit extract (b) Silver nitrate solution (c) Brown color solution

3. RESULT AND DISCUSSION

The as prepared samples were characterized with U-V absorption spectrometer. The spectra obtained are shown in fig.2. From the figure it is found that the absorption peak range of silver nanoparticles is 425nm and the absorption occurs at the visible region of the spectrum.

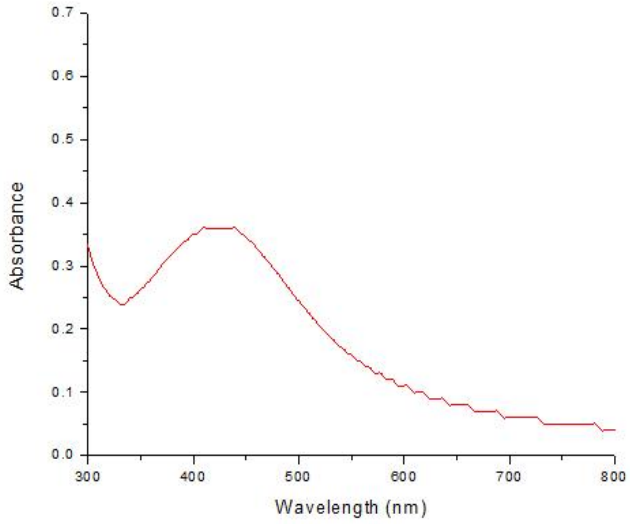

Figure 2- Ultraviolet Visible absorption spectrum of silver nanoparticels.

Figure 3 shows the FTIR Spectra of the prepared silver nanoparticles. Six functional groups at 3465cm^{-1}, 3023 cm^{-1}, 2875 cm^{-1}, 1639 cm^{-1}, 1364 cm^{-1},973 cm^{-1} were obtained for the sample.

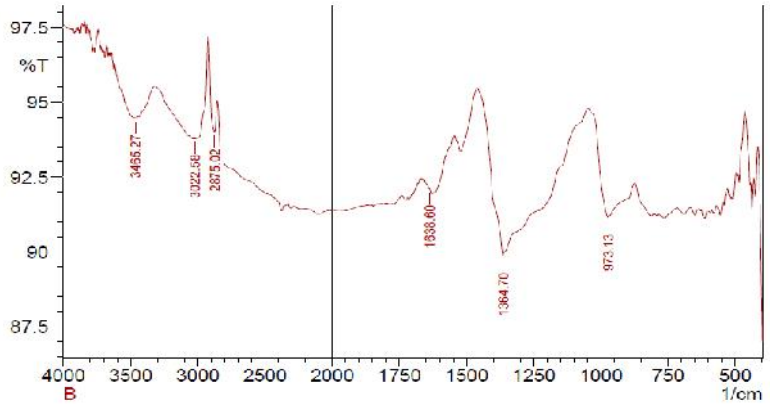

Figure 3 - FTIR spectrum of silver nanoparticels.

Figure 4 shows the XRD pattern of silver nanoparticels. The particle size calculated was 8.3788nm and very well matches with JCPDS (Joint committee Powder Diffraction Standards) Card No.89-3722. From the XRD, it is confirmed that the silver nanoparticles has cubic structure.

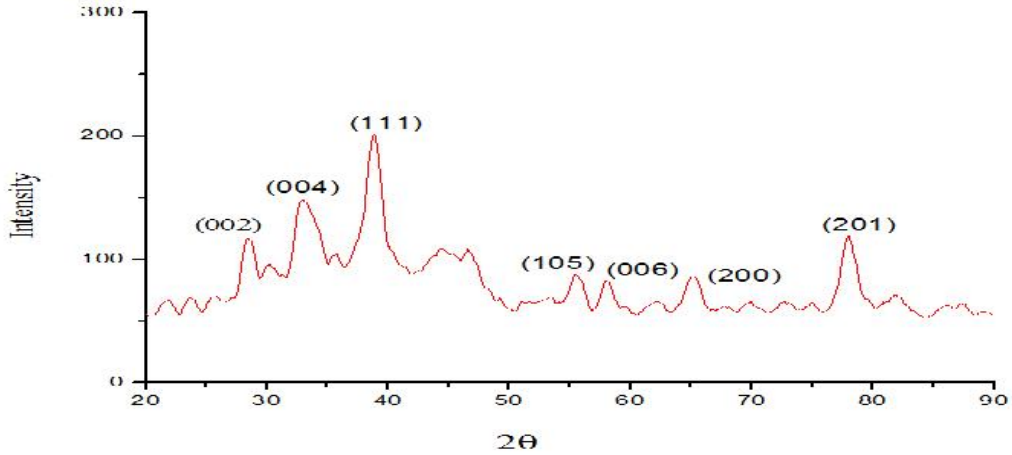

Figure 4- XRD pattern of silver nanoparticels.

Figure 5 shows the SEM images of silver nanoparticels which shows rock like structure.

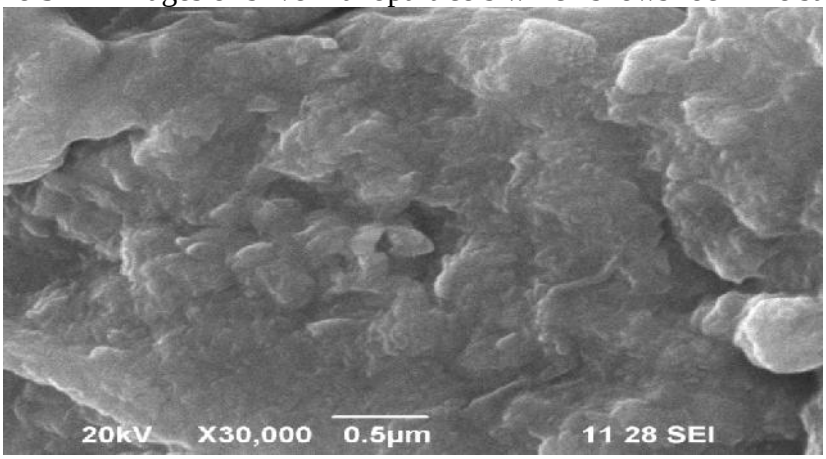

Figure 5- SEM image of silver nanoparticels.

Figure 6(a) - shows the antibacterial activities of silver nanoparticels on Salmonella typhi where the zone of inhibition sample is 13mm and the standard disc is 18mm.

Activity index = $\frac{\text{Inhibition zone of sample (mm)}}{\text{Inhibition zone of standart (mm)}}$

= $\frac{13(mm)}{18(mm)}$ =0.7222

Figure 6(b) - shows the antibacterial activities of silver nanoparticels on Salmonella typhi where the zone of inhibition sample is 13mm and the standard disc is 17mm.

Activity index = $\frac{\text{Inhibition zone of sample (mm)}}{\text{Inhibition zone of standart (mm)}}$

= $\frac{13(mm)}{17(mm)}$

=0.7647

6(a)

6(b)

Figure 6 - (a) Antibacterial activity of silver nanoparticels on Salmonella typhi (6b) Antibacterial activity of silver nanoparticels on Staphylococcus albus.

CONCLUSION

Silver nanoparticles were synthezied by Green synthesis method and its antibacterial activities were investigated by Well diffusion method. The absorption peak of silver nanoparticles was studied by UV. The functional group is determined by FTIR. The particle size was determined by XRD and the surface morphology of nanoparticles were determined by SEM. Antibacterial activities were investigated by well diffusion method at 37˚C.

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