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Biosynthesis of Silvernanoparticles using Aloe Vera Extract and its Antimicrobial Activity

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ABSTRACT

Silver nanoparticles are nanoparticles of size between 1nm to 100nm. Silvernanoparticles have gained increasingly attention due to its unique physicochemical properties of nano sized metal particles which make them successful in biology and medicine field. In present biosynthesis of Silvernanoparticles was studied by using Aloe vera leaf extract. Aloe vera is a medicinial plant with multiple beneficial effects. Aloe vera contain many constituents such as lignin, hemicelluloses, pectin which can be used for reduction of Ag+ ions to produce AgNPs. Silver Nanoparticles exhibit strong absorption in the visible region, sample revealed absorbance peak at 440nm which is specific for silver nanoparticles. The sample is submitted at CUP,Bathinda for particle size measurement by SEM. From the scanning photograph it is clear that particles are rectangular shape with size 500nm. Synthesized aloeveraAgNPsalso showed high antibacterial activity against Pathogenic Strain Escherichia coli and Staphylococcos aureus.

Keywords: AgNPs, Antibacterial activity, Escherichia coli and Staphylococcos aureus

I INTRODUCTION

Nanoparticle is used to describe a particle with size in the range of 1-100nm (Yehia and Al- Sheikh 2014). Nanomaterials are increasingly being used due to its highest antimicrobial,antifungal, antiviral activities (Kahlon*et al* 1991).These activities can be combined with plant extract for making active product. We used many metals for making nanomaterials such as Cu, Zn, Au, Ti, and Ag. Among them silver nanoparticles considered to be the most effective bactericidal properties against a wide range of pathogenic microorganisms including bacteria, yeasts, fungi, and viruses (Narayanan and Park 2014). We choose silver nanoparticles in our project due to their extremely large surface area which can provide a better contact with the microorganisms (Toker et al., 2013). Furthermore they can withstand at higher temperature and exhibit low volatility (Youssef and Abdel-Aziz, 2013). Silver nanoparticles can be produced by a variety of chemical and physical methods.But in the view of sustainable development, there is a need to develop biologically ecofriendly method for synthesis of nanomaterials. Biological system such as bacteria,

plants, fungi and enzymes have been considered best alternate for the synthesis of AgNPs (Mohanpuria and Rana 2008). Among these Plant extracts and eukaryotic fungi are the most suitable ones with unique features like increased growth rapid reproduction and low toxicity. Aloe vera contain phytochemical consititutents such as steroidal lactones, alkaloids, flavonoids, tannins which helps in bioreduction of silver ions and their stability (Narayanan and Sakthivel 2010).According to Bansal et al, 2011 biologically synthesis of silver nanoparticles is the novel approach towards reduction of metal ions.There are various theories suggested that the action of Silver nanoparticles on microbes to cause the antimicrobial effect. They have ability to anchor to the bacterial cell wall and penetrate it causing structural changes in the cell membrane which forms pits on the cell surface where accumulation of nanoparticles takes place (Sondi and Sondi 2004).Our purpose is stepwise synthesis of low cost, environmentally safe silver nanoparticles by using medicinal plant *Aloe vera* at lab scale and check its antimicrobial activity against pathogenic strain such as *E.coli* and *S.aureus*.

II MATERIALS AND METHOD

Preparation of Plant Extract

Fresh leaves of aloe verawere collected from the garden of Department of Agriculture Science, Baba Farid College, Bathinda. The leaves were washed with distilled water and after grinding 10gm leaves was mixed with 100ml distilled water and heated for 15min. Then the extract was filtered through whatman filter paper, collected and stored in refrigerator.

Preparation of Metal solution

Initially 1.575 gm silver nitrate was dissolved in 1000ml distilled water.

Synthesis of nanoparticles

10% of Aloe vera plant extract was mixed with silver nitrate solution in 1:9 proportion and kept at room temperature for 48hr for the development of reddish brown colour.

Characterization of silvernanoparticles

Colour change of nanoparticles

The formation of nanoparticles was confirmed by passing light through the solution as nanoparticles scatter light.Its formation was further confirmed by UV Visible spectroscopy. Silver nanoparticles exhibits strong absorption in the visible region.Ultraviolet spectrum of the sample revealed absorbance peak at 440nm which is specific for silver nanoparticles.UV Visible spectral analysis was done by UV Vis spectrophotometer(EI, Panchkula).

Surface Morphology of Nanoparticles

Scanning Electron Microscope Study

The solution of Aloe vera extract Silver nanopaticles in each beaker was dried and Sent for particle size measurement by CUP,Bathinda.The SEM characterization was carried out using a Scanning Electron Microscope.

Source of Organism and Composition of Growth Media

Broth preparation

1.3 gm of nutrient broth was mixed with 100ml of distilled water and 2 drops of antibiotic was added. The Conical flask was cotton plugged and autoclaved at 15lb/inch² pressure /121° c for 15min.

Inoculation

After cooling the broth medium, bacteria (*E.coli*, *S.aureus)* inoculated with a needle from a pure culture medium to the broth medium and were kept 37°C temperature in incubator at 24-48hrs.

Medium Preparation and Antibacterial Activity

3.8 gm of Mueller Hinton agar was mixed with 100ml Distilled water and boiled .3-4 drops of antibiotic was added to prevent bacterial growth and pH of the solution was maintained between 7.3±0.1.The conical flask was cotton plugged and autoclaved at 15lb/inch² pressure/ 121° c for 15min. Then the agar media was poured into sterilized petridish and after solidification.50µl bacterial broth culture was spread on each plate with the help of spreader.Then a hole was made with a hole borer in each plate.100µl of AgNPs solution with aloe veraextract, leaf extract only and only AgNPs were poured in each hole of plate and kept for 48hrs at 37°C temperature for further observation.

III RESULT AND DISCUSSION

Result showed that Nanoparticles were synthesized using the aloe vera extract from silver nitrate.The colour of synthesized AgNPs clearly changes to reddish brown within 72hrs of incubation at room temperature in Fig.1 and exhibit strong absorption in the visible region.


Silver
2017-11-6 13:14


AgNO3
2017-11-6 13:14

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Fig. 1 Change of colour after 72hrs a. Silver Nitrate and Aloe Vera extract b. Only Silver Nitrate solution

UV- vis spectrum of the sample revealed absorbance peak at 440nm which is specific for AgNPs in (Fig 2).

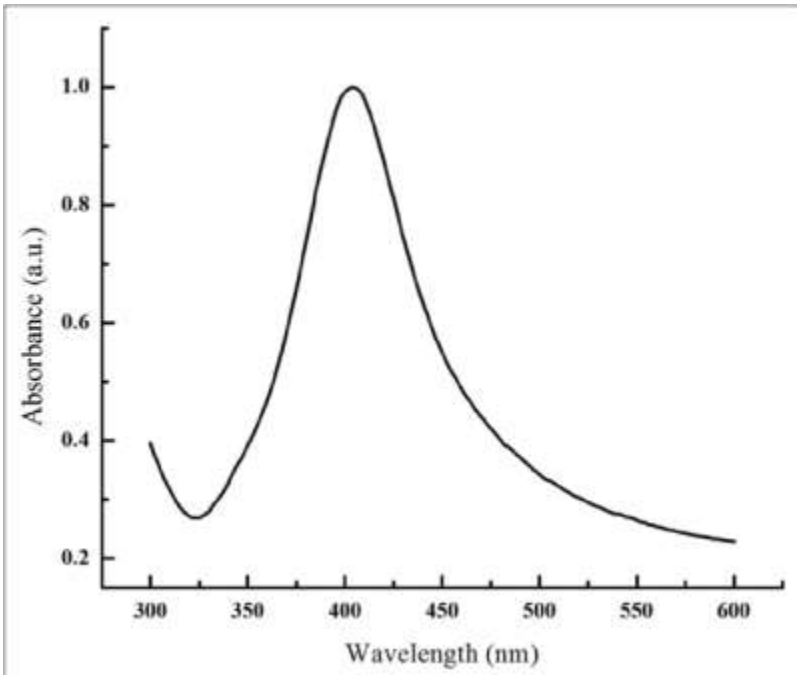

Fig.2 UV –Visible spectra of silver nanoparticles

From the scanning photograph in (Fig 3), it is clear that the particles are heterogenous in shape such as rectangular, triangular and spherical with uniform distribution.

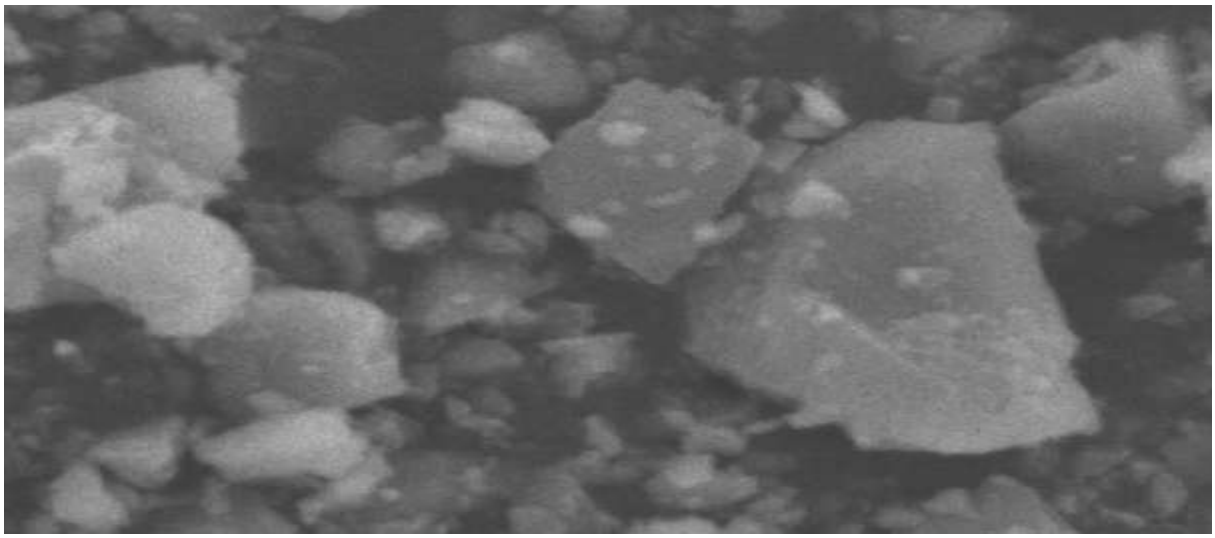

Fig.3 SEM of synthesized silver nanoparticles

SynthesisedAgNPs showed highest antibacterial activity against pathogenic flora by application of 100µl of 1M Silver nanoparticles in (Fig 4).

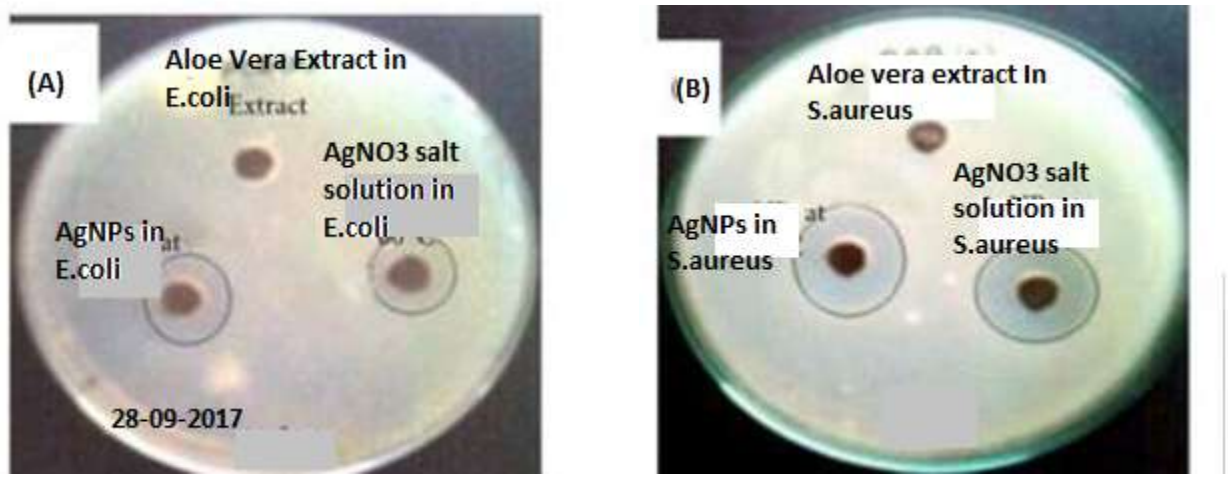

Fig.4 Zone of Inhibition with a) AgNPs in *E.coli* and *S.aureus* b) Aloe vera extract in *E.coli* and *S.aureus* c) AgNO3 salt solution in *E.coli* and *S.aureus*

IV CONCLUSION

In the present study we focus on the biosynthesis of silver nanoparticles by using aloe vera extract. With the help of UV Visible spectrophotometer and Scanning Electron Microscope for the measurementof size of silver nanoparticles. Further we demonstrate the possible application of AgNPs in medical field as it shows highest antibacterial activity against pathogenic flora.This approach is further used commercialized in the term of cost effectiveness and environment friendly product.

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