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Green synthesis of silver nanoparticle with rose extract for antimicrobial application

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ABSTRACT- Synthesis of nanomaterials and its applications finds an important place in the field of science today. In the present study, silver nanoparticles were synthesized with rose extract and a systematic study was carried out. One gram of rose petals was washed thoroughly with deionized water and shade dried at room temperature for 2 days. Powdered petals were mixed with 100mL of deionized water and stirred at 80 °C for 1 h. This solution was filtered, cooled and stored at 4 °C for further experiments. 0.17 g $AgNO_3$ was dissolved in 100 mL double distilled water for stock solution of $AgNO_3$. The rose extract was mixed with $AgNO_3$ solution at different concentrations and kept at room temperature for 72 hours. The color change was observed at various time intervals. The shape and size of the particles were measured with X-Ray diffractometer. EDAX study confirmed the presence Ag nanoparticles. The surface morphology was studied using a scanning electron microscope. Absorption studies were carried out with UV-Vis spectrophotometer and FTIR spectrophotometer. The in vitro antimicrobial and activity tests for all the synthesized compounds were performed by well diffusion method.

Key words: Nanomaterials, Rose petals, Silver Nitrate

1. INTRODUCTION

Nanotechnology is concerned with nanomaterials. For the example of materials that are at least one of the dimensions of about 1 to100 nanometer. The Word 'nano' comes from the Greek word "nanos" meaning dwarf[1]. The term nano is the 10^{-9} or one billionth of meter. Nanotechnology is the matter on an atomic, molecular and supra-molecular scale[2]. The field of nanotechnology is one of the most active areas of research in modern material sciences. Silver nanoparticles (Ag NPs) are emerging as one of the fastest growing materials due to their unique physical,chemical and biological properties,small size and high surface area. The synthesis of silver nanoparticles using rose petal extract and silver nitrate solution.

2. MATERIALS AND METHODS

2.1 Preparation of Rose extract

The rose petals were washed thoroughly with deionized water and shade dried at room temperature for 2 days. The extraction process was started by adding one gram of dried petals and 100mL of deionized water in to a 250 mL Erlenmeyer flask. This mixture was slowly stirred using a magnetic stirrer at 80°C for 1 h. This solution was filtered, cooled and stored at 4°C for further experiments. This solution serves as 100% extract concentration.

2.2 Preparation of AgNO3 solution

Initially 0.17 g $AgNO_3$ was dissolved in 100 mL double distilled water for stock solution of $AgNO_3$.

2.3 Preparation of nanoparticle

The rose extract and the $AgNO_3$ solution were mixed in the ratio of 1:3, 1:5, 1:7, and 1:9 and kept at room temperature for 72 h for the development of reddish brown color. The best color was formed from the 1:9 ratio of solution.

2.4 Observation of color change at different time interval

The rose extract, having thick red color, became light red color after 8 h of mixing with AgNO3 solution and became deep light red color after 18 h. A light red color appeared after 24 h of incubation and finally the solution became deep reddish brown after 72 h. After 8 days the solution became colorless because the particles were precipitated.

2.5 Characterization of nanoparticles

The solution in each beaker were dried and sent for scanning electron micrograph (SEM). The SEM characterization was carried out using a scanning electron microscope. Infrared Photograph was recorded by Fourier transform infrared spectroscopy(FTIR). Absorbance was measured by U-Vis spectrophotometer and fluorescent spectrophotometer .

2.6 preparation antimicrobial activity

The in-vitro antimicrobial activity tests for all the synthesized compounds were performed by well diffusion method. The ligand and the complexes were tested for their in vitro antibacterial activity against pseudomonas,aeruginosa, Escherichia coli,(gram positive) and staphylococcus aureus and bacillus subtilis(gram positive) and the antifungal activity against candida albigans and aspergillus niger. The concentration of the solution taken was 100µg/Ml. Tthe plates were incubated at 35°c for 24h. Amikacin ketokonazole were used as positive control for bacteria and fungus respectively. The growth of inhibition zones in mm after incubation.

3. RESULTS AND DISCUSSION

3.1 UV-Vis analysis of synthesized Ag NPs

After the addition of rose extract, the color of AgNO3 changed from thick red to reddish brown, which indicated the synthesis of Ag NPs in the aqueous solution. The production of silver nanoparticles synthesized from aqueous rose extract was evaluated through U-Vis spectrophotometer and resulted that the absorbance was in the range of wavelength from 300 to 600 nm in shows the Fig1(a,b).

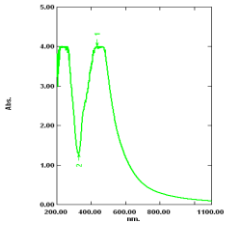
Fig.1(a)

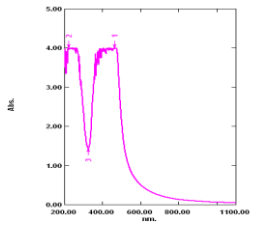
Fig.1(b)

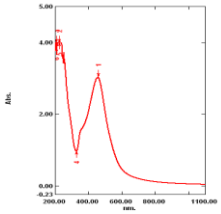
Fig.1(c)

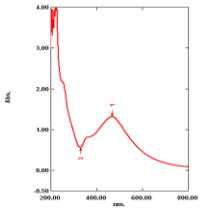
Fig.1(d)

Fig.1. UV-Vis analysis of AgNPs for different concentrations

3.2 Surface Morphology of synthesized silver nanoparticles

The surface morphology study of the nanoparticles revealed that the silver nintrate nanoparticles predominates and absolutely spherical in shape. Most of the nanoparticles were roughly spherical in shape with smooth edges. The surface morphology of nanoparticles was investigated using SEM and observation showed synthesized nanoparticles was not in direct contact even within the aggregates, indicating stabilization of the synthesized nanoparticles.

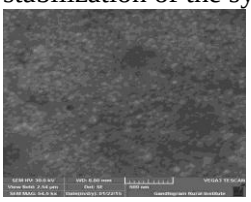
Fig.2(a)

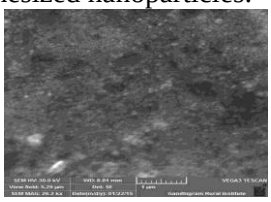
Fig.2(b)

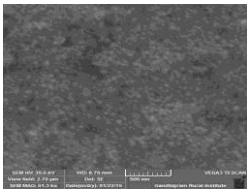
Fig.2(c)

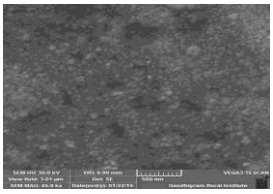
Fig.2(d)

Fig.2.SEM Images for different concentrations

3.3FTIR analysis of synthesized silver nitrate nano particles

The Fourier transform infrared spectroscopy spectrum of prepared AgNo3 nanoparticles. The peak observed at 378cm-1 are assigned N-O Symmetric stretch Fig3(a,b,c,d).

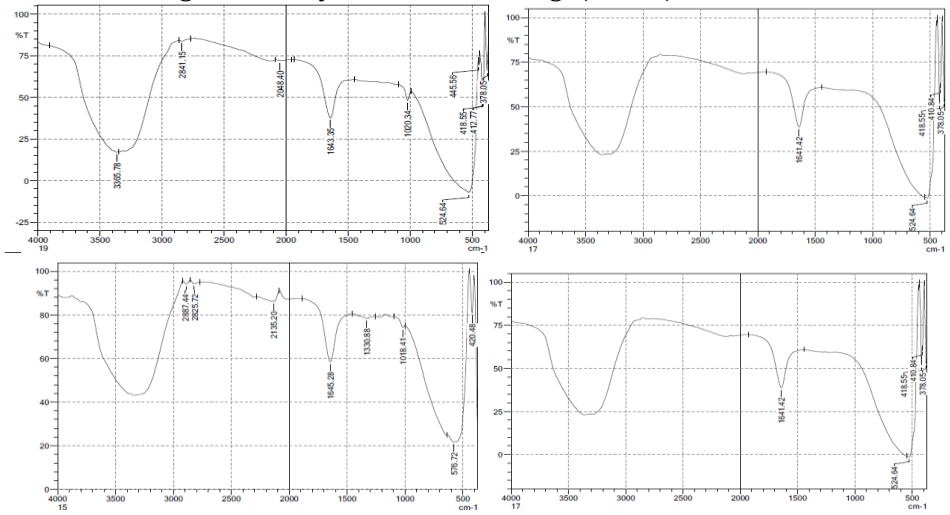

Fig.3(c) Fig. 3(d)

Fig. 3. FTIR analysis of Ag NPs for different concentrations

3.4 X-ray diffraction (XRD) analysis

The crystalline nature of Ag nanoparticle was confirmed from X-ray diffraction (XRD) analysis. X-ray diffraction is used to characterize crystallographic structure, and grain size in powder solid samples. Fig. 4(a)-49d0 shows the XRD pattrn of Ag nanoparticles for different concentrations. The XRD pattern shows peaks at (112),(210), (123). The intensity of the peak increases with the concentration.

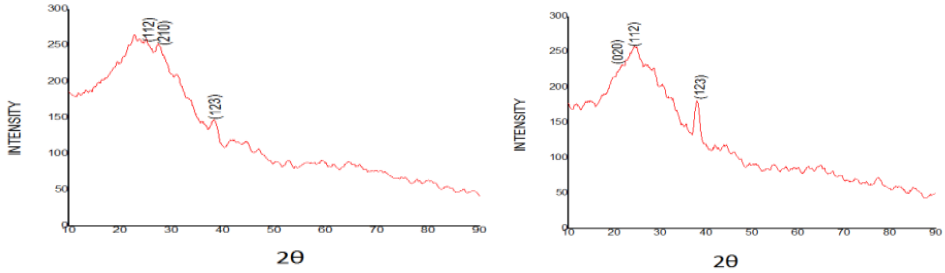

Fig.4(a)

Fig.4(b)

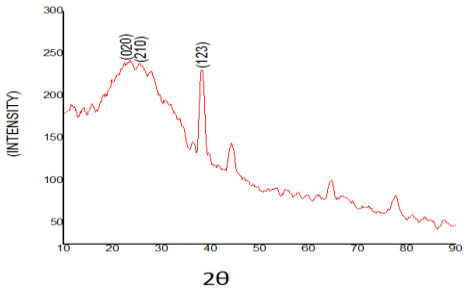

Fig.4(c)

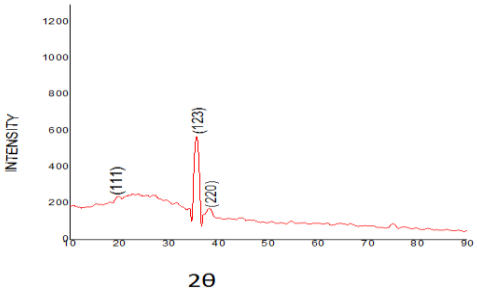

Fig.4(d)

Fig. 4(a)-4(d) XRD for different concentrations

ANTIMICROBIAL ACTIVITY

The in vitro antimicrobial and activity tests for all the synthesized compounds were performed by well diffusion method. The ligand and the complexes were tested for their in vitro antibacterial activity against pseudomonas,aeruginosa, Escherichia coli,(grapositive) and staphylococcus aureus andbacillus subtilis(gram positive) and the antifungal activity against candida albigans and aspergillus niger. The concentration of the solution taken was 100µg/Ml. the plates were incubated at 35°c for 24h. Amikacin ketokonazole were used as positive control for bacteria and fungus respectively Fig5[3-4].

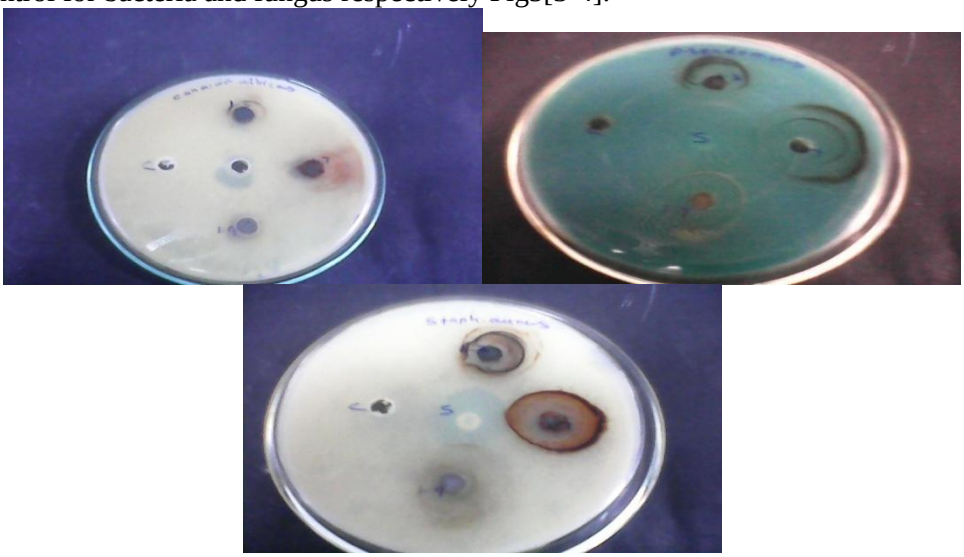

Fig5: antimicrobial activity

CONCLUSION

In recent years, the development of efficient green chemistry methods for synthesis of metal nanoparticles has become a major focus of researchers. They have investigated in order to find an eco-friendly technique for production of well-characterized nanoparticles. We have used rose petal extract and the silver nitrate as the precursors to prepare ion to be reduced silver nitrate nanoparticles. The antimicrobial activity test for all the synthesized compounds were performed by well diffusion method for the following bacterias klebsiella, pseudomonas, candida, staph, aspergillus.

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