SYNTHESIS CHARACTERIZATION AND ANTIMICROBIAL ACTIVITY OF SILVER NANOPARTICLES

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ABSTRACT *Nanoscience has been established recently as a new interdisciplinary science. It is widely accepted in the context of nanoscience and nanotechnologies, the units should only be those of dimension, rather than of any other unit of scientific measurement. The present study included the chemical reduction of silver ions through trisodium citrate and testing for their antimicrobial activity. The scope of the present study is to synthesize silver Nanoparticles and evaluate its antibacterial activity. The present study to investigate To synthesize silver Nanoparticles and characterization of synthesized silver Nanoparticles confirmed by UV-visible spectrophotometer ,FTIR analysis and SEM analysis and also to analysis the antimicrobial activity of silver nanoparticles.*

Keywords: *Antimicrobial, FTIR , Nanoparticals- Silver , SEM, UV-spectrometer.*

1.INTRODUCTION

Nanoscience has been established recently as a new interdisciplinary science. It can be defined as a whole knowledge on fundamental properties of nano-size objects. The prefix "nano" indicates one billionth or 10-9 units. The nature of this unit being determined by the word that follows. It is widely accepted in the context of nanoscience and nanotechnologies, the units should only be those of dimensions, rather than of any other unit of scientific measurement. It is widely agreed that nanoparticles are clusters of atoms in the size range of 1–100 nm. At present time nanochemistry becomes one of the main growing directions of nanoscience. Metallic nanoparticles exhibit size and shape-dependent properties that are of interest for applications ranging from catalysts and sensing to optics, antibacterial activity and data storage . For instance, the antibacterial activity of different metal nanoparticles such as silver colloids is closely related to their size; that is, the smaller the silver nuclei, the higher the antibacterial activity. The most common approach for synthesis of silver nanoparticles is chemical reduction by organic and inorganic reducing agents.

2.SCOPE AND OBJECTIVES

The scope of the present study is to synthesize silver Nanoparticles and evaluate its antibacterial activity.The objectives of the present study to investigate synthesize of silver Nanoparticles and to characterization of synthesized silver Nanoparticles confirmed by UV-visible spectrophotometer , FTIR analysis and SEM analysis.

3. MATERIALS AND METHODS

3.1 Experimental

Silver nitrate ($AgNO_3$) and Tri sodium citrate ($Na_3C_6H_5O_7$) have been used in the synthesis of silver nanoparticles. To synthesize different-sized AgNPs, the spherical AgNPs were prepared according to the literature procedure by Fang et al.(2005), by reducing aqueous $AgNO_3$ with sodium citrate at boiling temperature. In typical procdure, 50ml of 0.001M $AgNO_3$ was heated to boiling. To this solution, 5ml of 1% trisodium citrate was added drop by drop. The solution was heated at boiling point under continuous stirring. The reaction was allowed to take place until the color changed to a yellow solution. The solution was then cooled to room temperature. The AgNPs in this solution were called citrate-AgNPs.

3.2 UV-Visible spectra analysis

The reduction of pure Ag+ ions was monitored by measuring the UV-Visible spectrum of the reaction medium and the absorption spectra were recorded over the range of 300-700 nm using UV-Vis spectrophotometer .

3.3 Fourier transform infrared spectroscopy

To determine fourier transform infra-red (FTIR) pattern of the $AgNO_3$ nanoparticles was freeze-dried and the dried powder was diluted with potassium bromide in the ratio of 1:100 and recorded the spectrum in perkin elmer FTIR spectrum.

3.4 SEM analysis of silver nanoparticles

The scanning electron microscopy (SEM) analysis of freeze dried sample was performed by mounting nanoparticles on specimen stubs with double-sided adhesive tape and coated with platinum in a sputter coater and examined under JEOL 63861 SEM (Japan) at 10 Kv.

3.5 Preparation of medium

Suspend 2.8 grams nutrient agar in 100ml distilled water. Heat to boiling and dissolve the medium completely. Sterilize by autoclaving at15 Ibs pressure (121°c) for 15minutes. Mixed well and poured into the sterile petri plates. Bacteria as escherichia coli and staphylococcus aureus were used and they were obtained from the microbiology laboratory of bose laboratory, madurai.

4. RESULTS AND DISCUSSION

The synthesis of silver nitrate nanoparticles through trisodium citrate were carried out. Silver is used as reducing agent as silver nitrate has distinctive properties such eco-friendly nanoparticles in bactericidal, wound healing and other medical and electronic application, makes this method potentially exciting for the large-scale synthesis of other inorganic materials (nanomaterials). Silver nitrate and trisodium citrate were used as starting material for the preparation of silver nanoparticles. The silver colloid was prepared by using chemical reduction method . The mechanism of reaction could be expressed as follows.

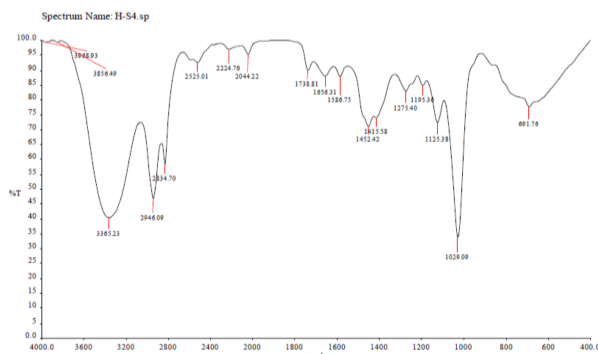
$$4Ag^{+} + C_6H_5O_7Na_3 + 2H_2 \longrightarrow Ag^{0} + C_6H_5O_7H_3 + 3Na^{+} + H^{+} + O_2 \uparrow$$

4.1 ULTRAVIOLET/VISIBLE (UV/VIS) SPECTROSCOPY

The absorption band in the 350 nm to 450nm region is typical for the silver nanoparticles. With increasing particles size, the Plasmon absorption shifts toward red.

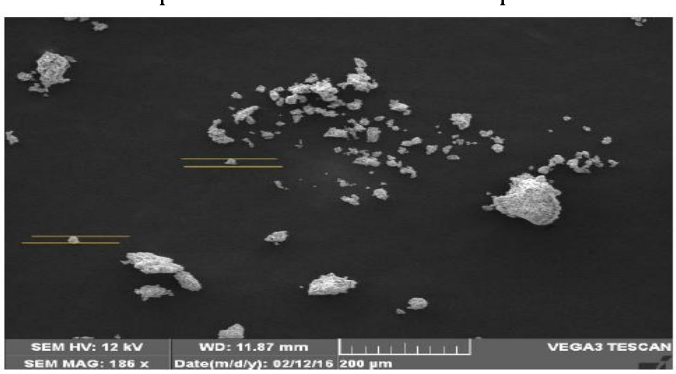
4.2 FOUEIER TRANSFORM INFRARED SPECTROSCOPY (FTIR) ANALYSIS

The band of carboxyl or carbonyl group at 1660 to 1500 and 1390 to 1260 cm^{-1} region. This may be the reason for the reduction of the transmittance at this region in the case of spectrum of nanoparticles. The shift of the band from 1656 to 1586 indicates the formation of metal carbonyl groups. It is due to the stabilization of Ag nanoparticles by the -COO- group of trisodium citrate. This asymmetric shift can be comparable with the data presented by previous works .



4.3 SEM ANALYSIS

SEM analysis was carried out to understand the topology and the size of the Ag-NPs, which showed the synthesis of higher density polydispersed spherical Ag-NPs of various sizes. The SEM analysis showed the particle size 84.90 nm as well the spherical structure of the nanoparticles.



4.4 ANTIMICROBIAL ACTIVITY TABLE

MICROORGANISM	SILVER NITRATE (30µl)	SILVER NANO PARTICLES (30µl)	STD (CHLOROMPHENICAL) (30µl)	CON (30µl)
ESCHERICHIA COLI (mm)	8	10	18	0
STAPHYLOCOCCUS AUERUS (mm)	7	10	19	0

5. CONCLUSION

The following conclusion obtained from the study The aqueous silver ions exposed to the trisodium citrate results in the synthesis of silver nanoparticles, it was confirmed by the formation of brown colour. Synthesized silver nanoparticles further confirmed in UV Visible spectrum and FTIR. These synthesized silver nanoparticles were further confirmed by using SEM. The SEM analysis showed the particle size between 84.90nm as well the spherical structure of the nanoparticles. Proven antibacterial activity against different microorganisms such as E. coli and S. aureus established. It is confirmed the silver nanoparticals are capable of rendering high antibacterial efficacy and hence has a great potential in the preparation of drugs used against bacterial diseases. Application of Ag nanoparticles based on these findings may lead to valuable discoveries in various fields such as medical devices and antimicrobial systems. The present study exhibit a simple method of synthesis of silver nanoparticles from a novel primitive chemical source. This method can be further used for industrial production of nanoparticles at room temperature and with a of newer and more potent antimicrobial agents.

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