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Composition, Characterisation and analysis of Argentum Nanoparticles and Argentum Bionanocomposities with Effect of Polymers in their Stability

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Abstract

The present research work deals with the composition and characterization of silver nano-particle and bio-nano-composites with effect of polymer in their stability. Nano-particles are prepared by three methods (a) Chemical reduction method (b) By microbial method (c) By Argentum bio-nanocomposites. These Nano-particles have antifungal, antibacterial activity and also use in development of anticancer drug. They improve the bioavailability by increasing absorption of drug. The average size of argentum nano-particles was found (a) 331.5nm (b) 331.7nm (c) 412.3 nm. U.V–vis spectroscopy confirmed the formation of argentum nano-particles. Antibacterial, antifungal assay was carried out by using E.coli, saureus and aspergillus niger respectively. Synergistic effect of argentums nano-particle with antibiotic amoxicillin was studied and also with antifungal fluconzole. The stability of argentum nano-particles was increased by using polymer (chitosan).

Keywords: : Nano-particles, bionanocomposites, antimicrobial activity

1. Introduction

Argentum nano-particles are one of the promising products in the nanotechnology industry. Argentum nano-particles are ranging between 1nm -100nm in size. Argentum nano-particles can be synthesized by several physical, chemical and biological methods. The field of nanao-technology is one of the most active research areas in modern material science. Owing to their small size, the total surface area of the nano-particles is maximized, leading to the highest values of the activity. Owing to their small size, the total surface area of the nano-particles is maximized, leading to the highest values of the activity. Argentum nano-particles have found applications in diverse areas, including medicine, catalysis, textile engineering, biotechnology and bioengineering, water treatment etc. Ag-NPs have already been tested in various field of biological sciences m drug delivery water, treatment & antibacterial compound against both gram (+) & gram (-) bacterial by various researches. Argentum nano-particles can release a certain amount of heat when placed within oscillating magnetic fields for potential applications to control or eradicate specific tumors.

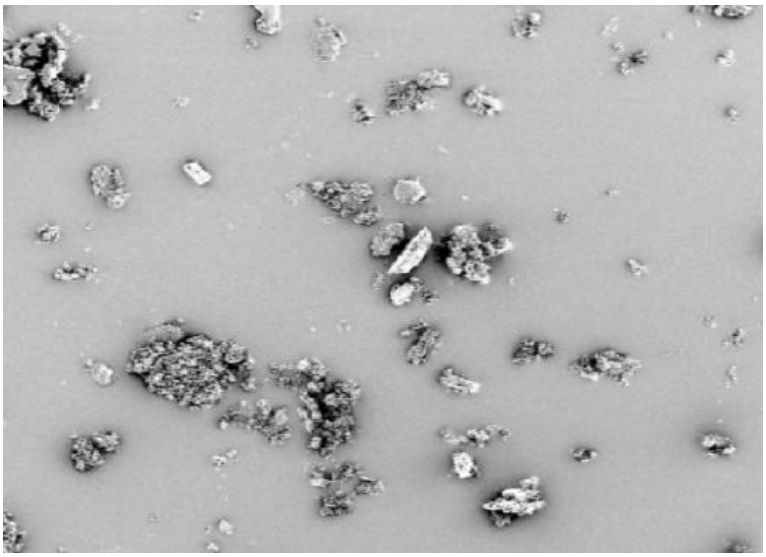


Figure 1

2. Material and Methods

2.1 Argentum Nanoparticle prepare by three methods:-

(a) By chemical reduction method

Argentum nitrate ($AgNo_3$) and tri-sodium citrate $C_6H_5O_7Na_3$ of analytical grade purity were used as starting materials without further purification. The argentum colloid was prepared by using chemical reduction method. All solutions of reacting materials were prepared in distill water. In typical experiment 50 ml of .001M $AgNo_3$ was heated to boiling .To this solution 5ml of 1% tri-sodium citrate was added drop by drop. During the process solution was mixed vigorously. Solution was heated until color's change is evident (pale yellow).Then it was removed from the heating element and stirred until cooled to room temperature.

$$4Ag^{+} + C_6H_5O_7Na_3 + 2H_2O \qquad 4Ag0 + C_6H_5O_7H_3 + 3Na^{+} + H^{+} + O_2$$

(b) By microbial method:-

The *F. oxysporum* strains used were cultivated from air bourne and identified. The fungal inoculates were prepared in a malt extract 2% and yeast extract 0.5% at 28°C in Petri plates. The liquid fungal growth was carried out in the presence of yeast extract 0.5% at 28°C for 6 days. The biomass was filtrated and resuspended in sterile water[100]. In the argentum reduction, the methodology described previously was followed. Briefly, approximately 10 g of *F. oxysporum* biomass was taken in a conical flask containing 100 ml of distilled water. AgNO3 solution (10-3 M) was added to the Erlenmeyer flask and the reaction was carried out in the dark. Periodically, aliquots of the reaction solution were removed and the absorptions were measured using a UV-Vis spectrophotometer.

(c) Preparation of argentum bio-nano-composites:-

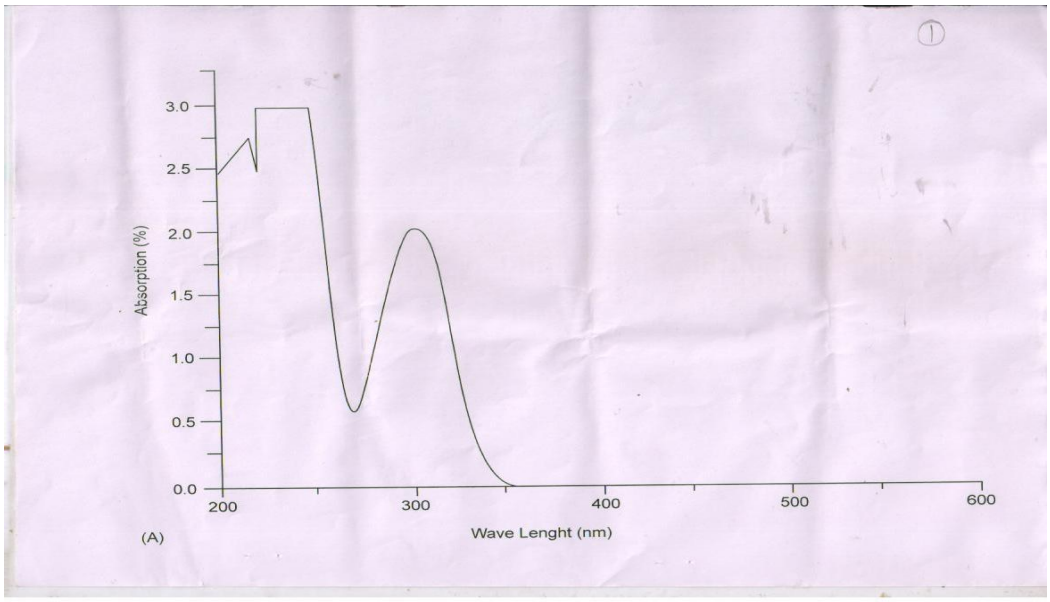
Chitosan (0.5 g) was dissolved in acetic acid (25 ml, 1.0 wt %) solution. On the other hand, gelatin (0.5 g) was dissolved in warm (40 °C) distilled water (25 ml). Next, both suspensions were mixed together and AgNO3 (50 ml, 0.01 M) was added directly into the suspensions. The AgNO3/Cts/gelatin suspension was stirred for 2.0 hours. The NaBH4 (20 ml, 0.04 M) was added immediately to the suspension of AgNO3/Chito/gelatin. A color change from colorless to dark brown was observed. The suspension was stirred for

another 1.0 hour, and then obtained Ag/Cts/gelatin BNCs were made into thin films for characterization.

2.2 Method of Characterization:-

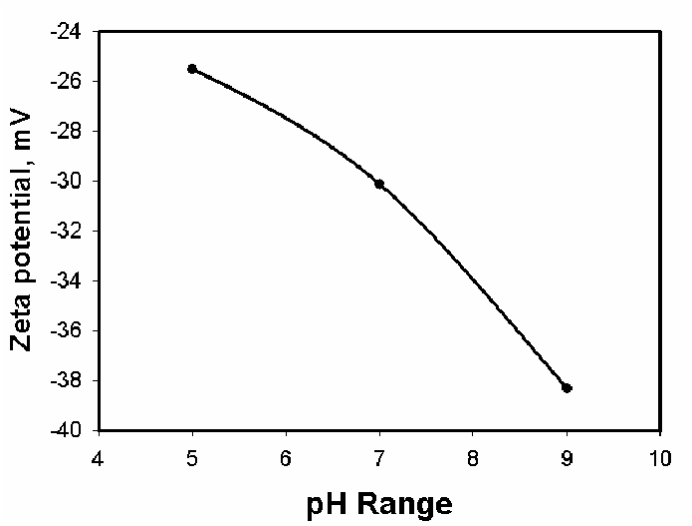
- **U.V- vs Spectroscope**

  UV-visible spectroscopy is one of the most widely used techniques for structural characterization of argentum nano-particles. The Argentum nano-particles were characterized in a Perkin-Elmer UV-VIS spectrophotometer. UV-VIS absorption confirmed the formation of argentum nano-particles prepared in liquid. The color changes indicated that the AgNPs were formed. This statement is proven by UV-visible spectrum. No absorption band is observed in the 300- 500 nm range for $AgNo_3$ and AgNO3/Chitosen/gelatin suspension, showing that no AgNPs formation has occurred in the sample respectively. After the addition of tri-sodium citrate and NaBH4 respectively, surface Plasmon resonance bands were detected around 440–452 nm, indicating the formation of AgNPs.



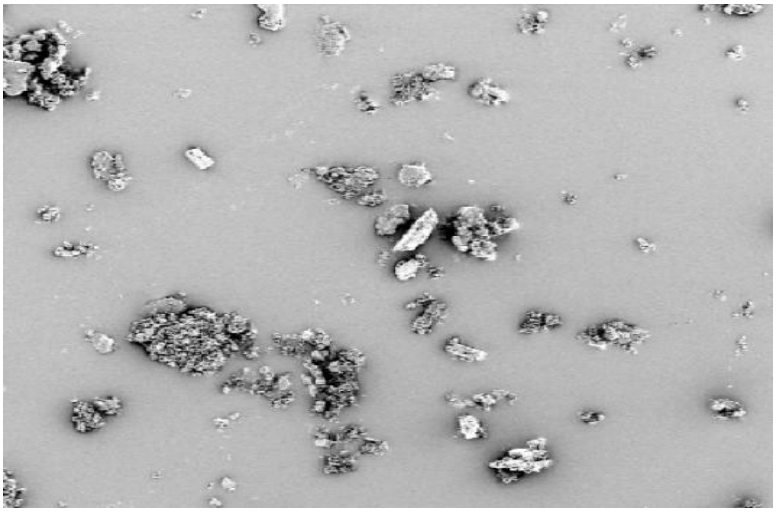
- **zeta potential**

  Surface zeta potentials were measured using the laser zeta meter (Malvern zeta seizer 2000, Malvern). Liquid samples of the nano-particles (5ml) were diluted with double distilled water (50 ml). The pH was then adjusted to the required value. The samples were shaken for 30 minutes. After shaking, the equilibrium pH was recorded and the zeta potential of the argentum particles was measured. A zeta potential was used to determine the surface potential of the argentum nano-particles. In each case, an average of three separate measurements was reported. Zeta values were measured and found to fall between−25.5 and −38.3 mv. These values provide full stabilization of the nano-particles at different pH.



Scanning electron microscopy (SEM)

The SEM image of Argentum nano-particles synthesized by microbial, chemical reduction method and Ag bio-nano-composites. It gave a clear image of highly dense argentum nano-particles. The SEM image showing argentum nano-particles synthesized confirmed the development of argentum nanostructures.



3. Results and discussion

Argentum nano-particle was synthesized according to the protocol discussed in the 'Method of preparation'. On mixing the fungal inoculate, tri-sodium citrate and sodium boro-hyride respectively with aqueous solution of the Ag ion complex, a change in the color from colorless to yellowish brown was observed. It was due to the reduction of Ag ion which indicates the formation of Ag nano-particles. In chemical reduction method AgNo3 reduced by tri-sodium citrate and which undergoes the reduction process, color changed from colorless to dark brown.

In ,microbial method the Fusarium oxy-sporium biomass were pale yellow color before the addition of AgNo3 and this changed to a brownish color on completion of the reaction with Ag

ions for 28 hrs. The appearance of a pale yellow color in solution containing the biomass suggested the formulation of argentum nano-particles.

In argentum bio-nano-composites method prepared AgNo3/Chitosan/gelatin suspension which undergoes the NaBH4 reduction process color changed colorless to dark brown. These color changes indicated that the argentum nano-particles were formed.

4. Conclusion

The following conclusion are made

- Ag nano-particles were synthesized successfully by chemical reduction and microbiological method, respectively and also argentum BNCs are formed.
- The detail characterization of the nano-particles was carried out using UV-Vis spectroscopy, Scanning Electron Microscopy (SEM) and SEM image analysis, the average particle size was found to be 311.50 nm, 311.78 nm and 420.34nm respectively for Ag.
- The argentum bio-nano-composites are more stable than normal argentums nano-particles due to coating of Chitosan polymer

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