Chapter 25
Synthesis of Silver Nano Particles on Sol-Gel Base and Its Effect Against Water Purification

Amneesh Singla, Manjeet Singh Goyat and Suridhi Sahu

Over the past few decades, our main and big problem is how to purify saline sea water, contaminated and waste water. The most serious problems worldwide are water pollution by toxic contamination various technologies has been proposed to water purification like ion exchange, water precipitation, membrane filtration, coagulation and other electrochemical method. From past few decades, nanotechnology has drawn few attentions because Nano materials are widely used for water purification. In the present review article, Nano-material synthesis is discussed, which is used in water purification. This review article will give the synthesis of silver nanoparticles by sol gel technique with the help of Silver Nitrate ($AgNO_3$) and Tri-sodium Citrate ($C_6H_5O_7Na_3$). Silver nanoparticles are used in purification of water. This study will help researchers in giving better and economical use of silver nanoparticles in purification.

25.1 Introduction

The nanocrystal silver Nano particles have attended the attraction due to widely potential applications in many fields such as catalyst optoelectronics, surface enhanced scatterings (SERS), chemical and biological sensing and especially called as most common antibacterial material [1]. In addition to traditional methods of their production, new methods have also been developed. Among various metallic Nano particles, silver Nano particles have been widely investigated because of its unusual property exhibition raised due to their size which bring a wide range of possibilities with respect to technical applications [2]. A key issue among these techniques is the control of particle size, which is very important in various applications. Implementation of some techniques is not cost effective and therefore,

A. Singla (✉) · M.S. Goyat · S. Sahu
University of Petroleum and Energy Studies, Dehradun, Uttarakhand, India
e-mail: amneesh82@gmail.com

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most researcher focus on the chemical reduction method because of its low cost and ease of operating appratus [2, 3].

In this study, silver Nano particles are synthesized by using sol-gel technique by chemical reduction of $AgNO_3$ in the presence of Tri-sodium Citrate ($C_6H_5O_7Na_3$) as a stabilizing agent and acetone and double distilled water as a reduction agent at room temperature. The structure and nature of the resultant particles were characterized by using analytical methods [4–6].

X-ray powder diffraction (XRD), atomic force microscope (AFM), zetasizer rand UV-Vis spectroscopy.

25.2 Experiment Procedure and Characterisation

Materials to be used
Silver Nitrate ($AgNO_3$), Tri-sodium Citrate ($C_6H_5O_7Na_3$), Acetone, double distilled water.

25.2.1 Experiment Procedure

Weighing Procedure
First of all, we weighed reactants used in the method. While weighing, the technical weighing equipment is cleaned by brush, so it doesn't slow the kinetics of the reactions taking place, by not mixing the chemical of other properties in our compound [7]. While weighing, we used butter paper and that is also considered in our weighing calculation [8, 9].

Magnetic Stirring Process
In magnetic stirring process, the torque and temperature knob is operated properly. We needed temperature of 80° while dissolving both the reactants separately in a beaker with 50 ml of water which is distill [7]. After temperature reached at 80° then we have turned off the knob of temperature and only torque knob is on, which worked for 15 min for both dissolving solution, so that it mixes properly [9, 10].

Dissolving the solution
While dissolving both the solution we needed burette, which is washed with distilled water then filled with the solution of tri-sodium citrate. Slowly we mixed tri-sodium citrate with silver nitrate solution. After periods of minutes, we observed that pale yellow (golden) color solution appeared. The solution is colloidal in nature [11].

25.2.1.1 Characterisation

The prepared sample is now taken for characterization by X-ray diffraction and UV-Vis spectroscopy.

UV-VIS spectroscopy is done firstly because for this procedure we need diluted solution of sample prepared. A typical sample cell (commonly called as cuvette);

From an experimental point of view, three considerations must be made:

- A longer path length, I through the sample will cause more UV light.to be absorbed—linear effect.
- The greater the concentration of the sample, the more UV light will be absorbed —linear effect.
- Some electronic transitions are more effective at the absorption of photons than molars—molar absorptivity.

Figure 25.1 the X-axis determines wavelength and Y-axis determines absorbance angle.

X-ray powder diffraction (XRD) is a rapid analytical technique primarily used for phase identification of a crystalline material and can provide information on unit cell dimensions. The analyzed material is finely ground, homonised, and average bulk composition is determined. The atomic planes of crystals cause an incident beam of X-rays to interfere with one another as they leave the crystal. The phenomena is called X-ray diffraction.

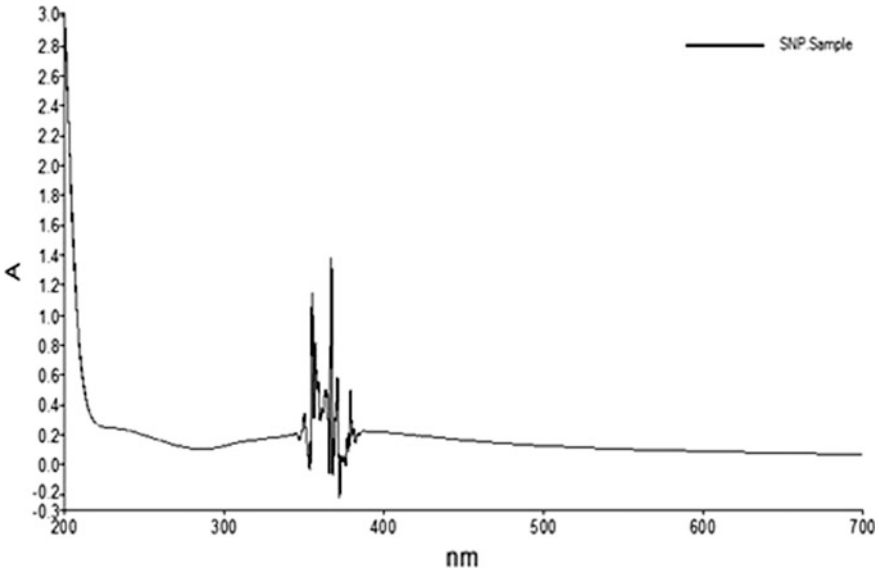

Fig. 25.1 The X-axis determines wavelength and Y-axis determines absorbance

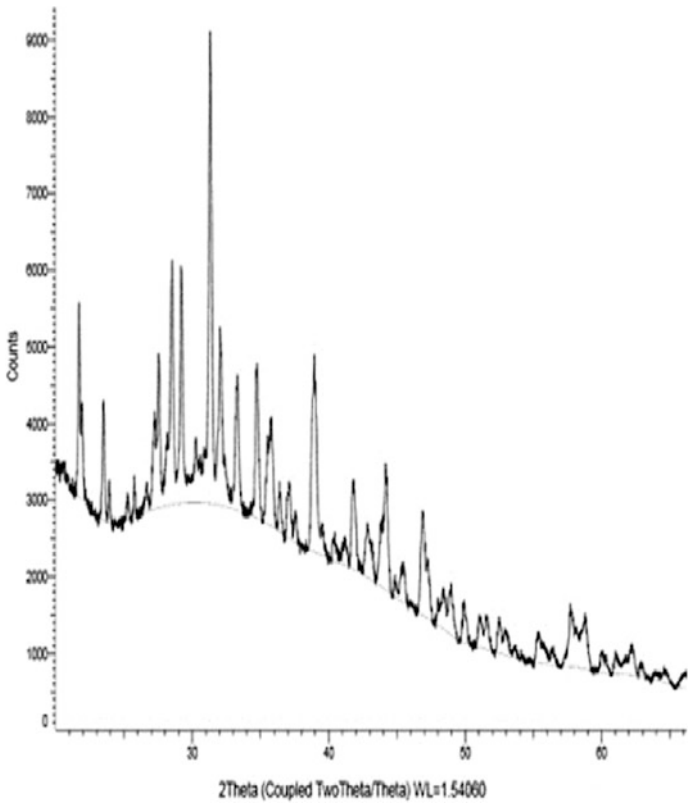

Fig. 25.2 In this X-axis determines the intensity and Y-axis the diffraction angle

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25.3 Conclusion

From above characterization process, we conclude that the analysed particle is finely ground, homonized and averaged bulk composition is determined. The result from XRD analysis is a diffract gram showing the intensity as a function of diffraction angle and the size determine was about 17–22 nm. In UV we determined the absorptivity of light passing through the sample and it will be determined by the detector present in instrument which will difference between transmitted light versus incident light. The absorbed wavelength was about 375–420 nm.

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