SYNTHESIS OF SILVER NANO-PARTICLES USING CO-PRECIPITATION METHOD

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ABSTRACT
Silver (Ag) nanoparticles of ~ 20 nm size were prepared by co-precipitation method. NaBH4 was used as a reduction reagent to perform the reaction. The reduction reaction was confirmed by change in solution color. The prepared nanoparticles size and particle distribution was confirmed using transmission electron microscopy. The process is easy to make and size can be controlled using reduction reagent.
Keywords: Silver nanoparticle, transmission electron microscopy, nanoparticles, co-precipitaion synthesis

I. INTRODUCTION

When the diameters of the prepared particles are in the range of nanometer, then the particle is called as nanoparticle. The nanoparticles are mainly interested in these are due to their unique chemical and physical properties and these properties are different from those for the bulk materials[1]. The change in properties are due to their nano-size and large surface area. Due to change in properties with size for metallic nanoparticles, the nanoparticles have found large verities of applications in field of chemistry as catalyst[2; 3], medicine[4], and in quantum confinement system as electronic devices[5]. These metallic nanoparticles can be prepared using different techniques such as chemical synthesis – salt reduction, solvothermal synthesis, electrochemical synthesis etc. and physical synthesis – microwave dielectric heating reduction, evaporation method etc.[6; 7]
Recently it is observed that the noble or inert metal like silver (Ag) and Gold can be used in cancer treatments. Recent study showed that [8] PEGylated amino pyrimidines surface on the gold and silver nanoparticles can be designed and used for anticancer activity against three human cancer cell lines U2OS osteosarcoma, MB231 breast cancer and SW480 colon carcinoma. Further, it is showed that the silver and gold nanoparticles are able to target PEGylation to cancer cells, and are profound apoptotic induction effect to those cells.[8; 9]
In this paper, we are going to focus on preparation and characterization of silver nanoparticle using co-precipitation method. The samples were characterized using transmission electron microscopy.

II. SAMPLE PREPARATION

In the presented work, we have used silver nitrate ($AgNO_3$), triply distilled water (H_2O), 1 % tri-sodium citrate and $NaBH_4$. All used chemicals were of synthesis grade and all the solvents are distilled prior to use. Silver nanoparticles were prepared by the reduction of silver nitrate using co-precipitation process. 1 % tri-sodium citrate and $NaBH_4$ are acts like a reducing agents for this process.
In a 1L flask, a solution of 90 mg $AgNO_3$ in 500mL of triply distilled H_2O was brought to boiling with rapid stirring. To this solution was added 10mL of 1% sodium citrate. The reaction mixture was boiled for 30min, and then it was diluted up to 420mL. A series of reduction reactions were characterized by changes in the color. The AgNPs were concentrated by centrifugation of the reaction mixture at 10,000 rpm for 10min twice, and then were collected. All nanoparticles were stored at room temperature in dark bottles and were generally used within 1-2 months after preparation. A series of reduction reactions were characterized

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III. RESULT AND DISCUSSION

As mentioned in the articles [10-12] series of reduction reactions characterized by changes in the color is depicted. Our prepared samples also showed the change in color as our reaction progressed – the solution first were transparent liquid and then the color of the solution changed to yellow. Atlast colloidal solution was formed; this colloidal solution was then centrifuged for 10000 rpm and then the nanoparticles were stored in dark bottles.

With comparison with references[8; 11; 12] one expects the change in color in the reaction we can conclude that the reaction were successfully carried out and the expected product is formed.

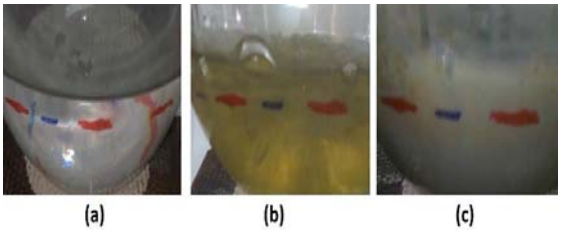

Figure 1 The figure showed the change in sequence of the color of the reduction reaction. (a) At initial state the mixture is transparent. (b) After some time during boiling the liquid changed to pale yellow color. (c) At the end of the reaction we have observed the colloidal solution.

Transmission is used as a primary tool to determine physical characteristics and the size of the nanoparticles. The samples were scan at various scan sizes from 20 nm – 200 nm as shown in Figure 2.

From the images it can be concluded that particles are formed with a fairly even size. Hence the distribution is fairly even size distribution. Many particles fell within in ~ 20 nm. Some silver nanoparticles aggregated and formed a comparative bigger size particle as shown in Figure 2 (c). It is observed that the normal size nanoparticles were coagulating around the large particle in a circular order.

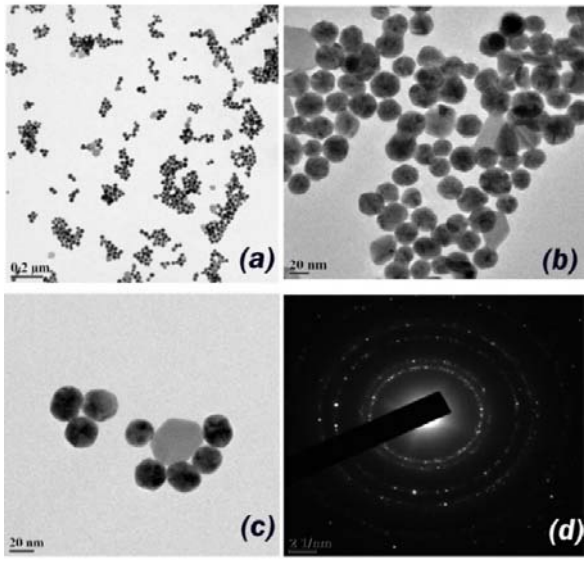

Figure 2 High-resolution TEM images of silver nanoparticle at various scan. (a) 0.2 µm scanned Ag-nanoparticles. (b) 20 nm scanned Ag-nanoparticles to show that the distribution is nearly uniform. (c) 20 nm scanned Ag-nanoparticles to show the formation of aggregated nanoparticle.

Thus from the above observation, it confirmed that Ag nanoparticles were successfully synthesized using co-precipitation method and $NaBH_4$ as a reduction agent.

IV. CONCLUSION

The study shows that the Ag-nanoparticles prepared using co-precipitation method. The distribution of particles was uniformly distributed and the nanoparticles size was ~ 20 nm.

Acknowledgements

I would like to thank Dr. B. M. Bahirwar, Department of Physics, G. N. College of Science, Ballarpur, for his guidance over synthesis and characterization. I also like to thank you Prof. Niley and Dr. R. G. Weginwar for allowing to perform experiments in chemistry laboratory.

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