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Analysis and Synthesis of Gold Nanoparticles.

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Abstarct : *In Nanotechnology, a particle is defined as a small object that behaves as a whole unit with respect to its transport and properties. This paper deals with an approach to synthesize gold nanoparticles. Gold nanoparticles have been used widely in Industrial as well as Academic fields which includes biomedical and catalytic applications. Gold Nanoparticles have a very wide application in tribology as it reduces frication and wear by forming a soft and low shear strength tribofilms when mixed with the Lubricating oil. Gold Nanoparticles are having higher hardness and Elastic Modulus then the bulk material. Various methods are being developed for synthesizing nanoparticles. The Gold nanoparticle was synthesized from HAuCl4 and firstly observed by Tyndall Effect the further characterized by U-3900 Spectrophotometer.*

Keywords: Gold Nanoparticles, Synthesis, Analysis,

I. INTRODUCTION

In recent years the Gold Nanoparticles have been in center of center of attraction for the researchers due to its mechanical and chemical properties. At first the colloidal gold nanoparticles were utilized for centuries due to the vibrant colors produced by their interaction with visible light. The optical-electronics properties of the Gold Nanoparticles can be utilized in high technology applications such as organic photovoltaics, sensory probes, therapeutic agents, drug delivery in biological and medical applications, electronic conductors and catalysis. The Mechanical properties of the Gold nanoparticles enabled it for use in the Tribology industry and electronic Industry. Gold Nanoparticles have very unique physical and biochemical properties that enables it for the use in the field of biosensors drug vector and gene therapy.[5] Gold Nanoparticles can be synthesized by reducing the high concentration Au(III) ion.[1] The colloidal Gold Nanoparticles can be obtained in a pseudo-template system using a specific polyhydrosilane copolymeric structure and it can be characterized by SEM-EXD.[2,3]. The Gold Nanoparticles metallocarbonyl conjugates can be determined on the basis of UV–vis and IR spectroscopy, transmission electron microscopy (TEM) or dynamic light scattering (DLS),.[9] The solubility of Gold Nanoparticles are better in Acetone as compared with water.[6]. The microreactor system can be used for controlling and reducing the size of the Gold Nanoparticles. Glucose can be used as reducing agent for synthesis of Gold Nanoparticles its chloride.[10]. Gold nanoparticles having size 10–50 nm can be synthesized by γCo-60 irradiation using water soluble chitosan (WSC) as stabilizer.[12]. The shape and size of the Gold Nanoparticles can be controlled by Photochemical process or by microwaves.[18,19] Gold nanostars can be synthesized by the reducing the Gold precursor using hydroxylamine as a reducing agent. The pH value of the colloidal solution goes upto 12.5.[14] Gold Nanoparticle mixed with polyethylene glycol and it can be used as a novel drug. The mean size of Gold Nanoparticles can be controlled by controlling the mixing rate.[11]. Gold Nanoparticles can also enhance the quality of the signals when used as coating for the electronic sensors.[20] The synthesis of Gold Nanoparticles can be done by various methods. The method discussed in this paper is the Ruby Red colloidal Gold Nanoparticles synthesis.

II. EXPERIMENTAL SETUP

20 ml of very dilute (0.001 M) solution of $HAuCl_4$ (pale yellow colour, Sigma Aldrich) was taken in a beaker. Then 180 ml of distilled water at room temperature was added into the same beaker in order to decrease the molarity to 0.00001 M. (Figure 1). Then beaker was put onto a heating plate and heated to 355 K. At around 359 K 2ml of Sodium Citrate solution was added into the beaker. (Figure 2). The solution was sintered occasionally and gently until the colour of the solution in the beaker turned deep purple. (Figure 3) However the heating was done until the solution turned ruby red in colour. At this stage of solution turning into ruby red, gold nanoparticles were formed in the beaker.(Figure 4).

The color of the solution changes from light purple to dark purple and the light red at last the solution became Ruby Red this change in color of the solution is due the scattering of light through the solution as the particle size decreases to Nanoscale the solution turns deep Ruby Red in color.

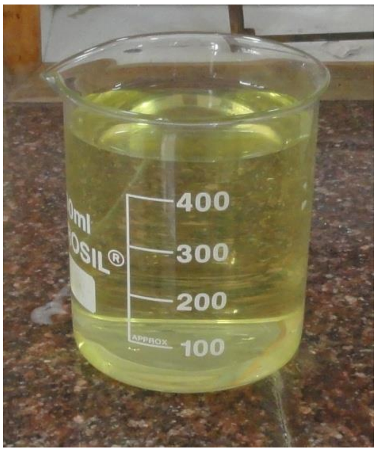

Figure 1: 0.00001 M solution of $HAuCl_4$

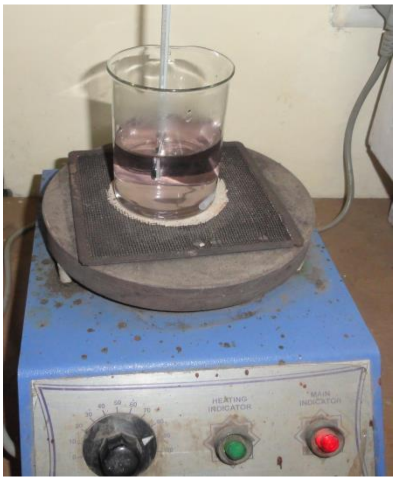

Figure 2: Heating of solution on the heating plate

Figure 3: Deep Purple solution

Figure 4: Ruby Red solution

III OBSERVATIONS AND ANALYSIS

U-3900 Spectrophotometer had been used for the analysis of the sample. The starting wavelength of the U-Spectrophotometer was 900.00 nm the end wave length was 190 nm. The scanning speed for the sample was 600 nm/min. the pitch length was 10.0 nm. Integration method selected was rectangular with sensitivity 1 and threshold 0.010.

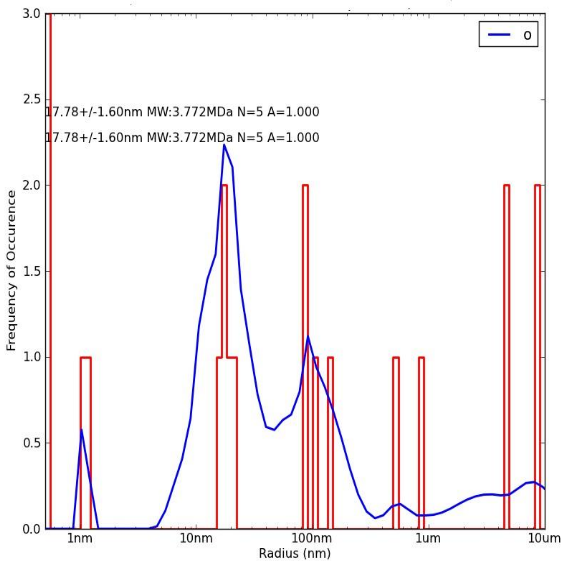

Figure 5: Histogram of the Gold Nanoparticles

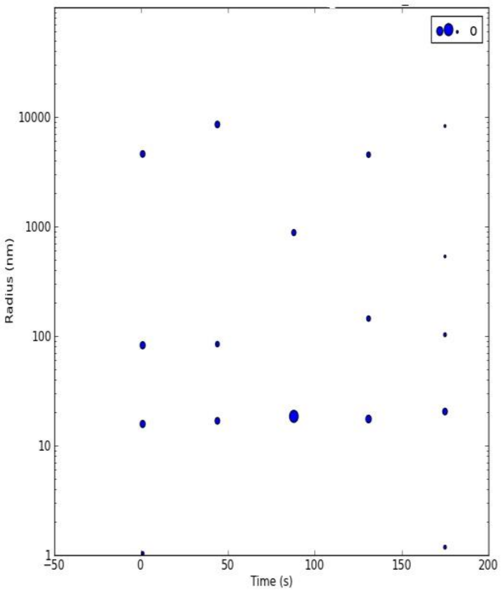

Figure 6: Radius Plot of the Gold Nanoparticles

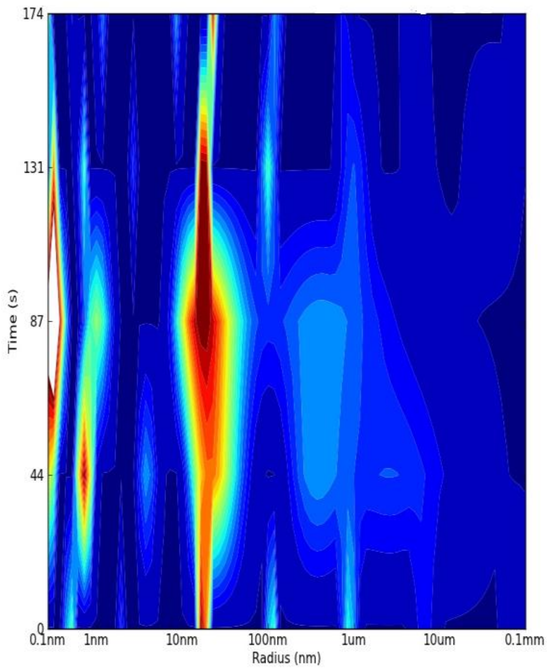

Figure 7: Radius Distribution of the Gold Nanoparticles

The Histogram of the Gold Nanoparticles (Figure 5) is a plot between Radius of Nanoparticles and Frequency of Occurrence shows that the range of Nanoparticles is from 1 nm to 1000 nm the frequency of occurrence is maximum in the range of 10 nm to 100 nm. The Radius Plot and the Radius Distribution are the plots time v/s radius and radius v/s time. These plots also conform that the maximum particles were having size between 10 nm to 100 nm.

III. CONCLUSIONS

The Gold Nanoparticle obtained from HAuCl4 were in the form of colloidal solution. The light gets scattered through the colloidal solution and color of the solution show an observable change due to the variation in size of the Nanoparticles. The Nanoparticles produced by this method are further investigated by the Spectrophotometer which shows that the particles produced are having a range of size with maximum intensity in the range of 10 nm to 100 nm. The Nanoparticles produced by this method are having a range of size i.e. there is no control on the size of the Nanoparticles moreover the Nanoparticles produced by this method are in the form of colloidal solution. But this method for producing the Gold Nanoparticles is very easy and economical.

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