

Synthesis of Metallic Element [Silver] Nanoparticles in a Continuous Micro Flow Reactor using Surfactant

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Abstract—Synthesis of metal silver nanoparticles was prepared in a continuous microreactor from reduction process. By using silver nitrate as a precursor, Glucose as a reducing agent, Sodium hydroxide used to increase the rate of reaction and PVP as capping agent. The amount of time that the reaction is carried out was studied. Characterization was done to know the presence of silver nanoparticles formation. The absorbance observed from the UV Spectrophotometer graph remains same from 400-600nm wavelength. During the process, PVP acts as surfactant for not forming the agglomeration.

Keywords: Nanoparticles, Microreactor, Reducing agent, absorbance, agglomeration, reduction process, Precursor.

1. INTRODUCTION

In recent years production of colloidal nanoparticles proved to be very important as they have more applications[1-5].As silver is transition metal it can be used in conductive applications.[6-8]. In the application of micro electronics silver nanoparticles found to be great use[9-12]. Due to small size, these nanoparticles exhibit material properties that varies from Bulk properties.[13]. Used in the field of photochemistry, optical properties and also due to the metallic properties [14-20].

2. SYNTHESIS OF SILVER NANOPARTICLES IN A CONTINUOUS PROCESS

2.1. Materials

Chemicals used for the preparation of solutions during the experiment were analytical grade. The silver nitrate was purchased from Merck (99%), Glucose and polyvinyl pyrrolidone and sodium hydroxide.

Silver nitrate (AgNO_3 , 99%; MolyChem) of analytical grade, Analytical grade sodium Hydroxide (NaOH ; 99%; Sisco research laboratory) and Dextrose ($\text{C}_6\text{H}_{12}\text{O}_6$; 99% ; Sisco research laboratory). Millipore deionised water was used for preparation of all solutions used in the preparation for the

experimental procedure. The reactor size is 173 cm length and 1.2 mm diameter.

2.2. Experimental Procedure

Silver nanoparticles were prepared from silver nitrate by reduction when in it reacted with PVP, Glucose and sodium hydroxide. The process flow is represented in a flow chart of **figure4**.Two solutions were made. Solution 1 was prepared by adding 0.101g of silver nitrate (0.001M) into 60ml demineralized water in a 250ml beaker. Solution 2 was prepared by addition of 5.08g of polyvinyl pyrrolidone (PVP), 3.84g of sodium hydroxide and 23.76g of glucose in 60ml demineralized water.

Both the solutions were passed through Y-Junction into the microflow channel. During the experiments 1mL/Min of flow rate for 1hour was maintained at a reactor temperature 60°C .A brown color solution was obtained and collected in sample bottle the obtained solid product was washed several times with demineralized water until no NO_3^- traces are retained. Later it was characterized to confirm silver nano particles with UV-Vis Spectrometer by observing the color change and the absorbance.

3. RESULTS AND DISCUSSIONS

The UV-Vis graph shows that absorbance remains same in between the wavelength of 400nm-600nm.The concentration of the particles remained unaltered due to the presence of Surfactant. In the continuous microflow reactor the residence time of the reagents in the reactor (i.e., the amount of time that the reaction is carried out), is calculated from the Total reactor volume and Volumetric flowrate of the fluid. Thus the amount of time the fluid spent in the reactor is 0.23min in a continuous microreactor. The obtained graph is shown in figure1 with an absorbance rate 4.00.

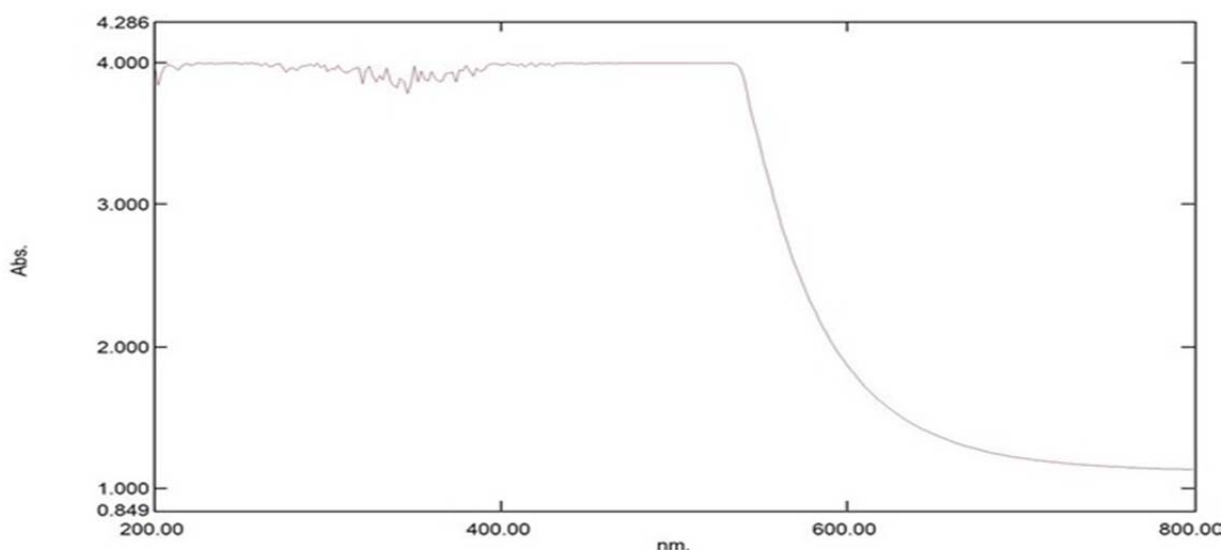


Fig1: UV Spectrophotometer for silver nanoparticles from microreactor

4. CONCLUSIONS

The metal nanoparticles were prepared with less residence time. Surfactant and reducing agents played a greater role to make the process fast. The reaction between the glucose and silver ions was accelerated due to surfactant. The time taken to finish the process is less due to the presence of reacting agent sodium hydroxide.

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