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# Synthesis of The gold Nanoparticles with Novel Shape via Chemical Process and Evaluating The structural, Morphological and Optical Properties

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**Abstract**

In this work, the gold nanoparticles have been prepared via chemical method by using Gold TetraChloride $HAuCl_4H_2O$ as starting material. The reduction and stabilization material have been employed to get more stable gold nanoparticles (Au NPs).
The structural properties, the determination of the size of the GNPS and the novel shape of the GNPs have been studied by using the scanning electron microscopy (SEM) and particle size analyzer (DLS). Electrical properties and the stability of the gold nanoparticles colloid have been investigated by Zeta Potential. As, well as demonstrated the optical properties by UV-Visible Spectrophotometer at room temperature.
The results of this research have been indicated by Particle Size Analyzer analysis and the Scanning Electron Microscope show the size and the shape of the colloid of gold nanoparticles which find in the range of nanoscale about (20-40) nm. Zeta Potential measurements show the excellent stability of gold nanoparticles colloid at value (-33 mV). Optical properties studied the absorbance peak of gold nanoparticles colloid at (λ= 537.2) nm.


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***Keywords:*** Gold nanoparticles (GNPs), Chemical method, Scanning Electron Microscope AUNPs.

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## 1. Introduction

Synthesis of grand metal nanoparticles has attracted a raising attention due to their novel and distinct characteristics as compared with those of the macroscopic condensed phase. Gold nanoparticles (AUNPs) are being seen as essential structure blocks of nanotechnology [1, 2]. As a result, nanoparticles materials are applied in a numerous of applications in different fields, such as: biotechnology, optics, medicine, microelectronics, catalysis, information storage, and energy conversions [3, 4]

Gold does not change, burn and oxidize in air, even if heated, and has been indicate to be passive to intensive alkalis and acids thereby making it one of the minimal chemically interactive metals known to people, also gold nanoparticles exhibit as antioxidant activity [5]. Gold NPs suspended in a solution have attracted much concern on account of they have abundant applications due to their individual physical and chemical attitude, which are different from those of bulk materials [6, 7]. The suspension stability depends on size, shape and liquid medium [8]. The nanoparticles suspension can effect on the charge of surface for nanoparticles [9]. The surface charge gonna to the forces of repulsion between the NPs and preserves them far from each other, which produces a suspension with standard stability [10, 11].

GNPs can be synthesized into a miscellaneous of forms included gold nano spheres, nano rods, nano belts, nano cages, nano prisms, and nano stars [12]. The optical, chemical, and electromagnetic characteristics of gold nanoparticles are robustly affected by their size and shape [13]. For instance, as compared with metallic gold which is golden yellow, globular gold NPs have an apparent red wine color while gold [14].

Nano rods are blue (aspect ratio 2-3) or black (aspect ratio 3) in a solution. Manufacturing of nanoparticles in liquids does not vacuum system [15]. As well as, nanoparticles can preparation in water without impurities or in any arbitrary solution [16, 17]. Gold nanoparticles have many concern and important applications in biological field e.g. anti-fungi and anti-microbial [18, 19]. In addition to the medical applications in diagnosis of the cancer tumors and treatment [20]. In general nanoparticles can prepared by many processes such as sol- gel method, sol method, laser ablation method and chemical method [21, 22, 23, 24]. Finally in this research, we focus concern on the preparation the gold NPs by special chemical method and studying the morphological, optical and structural characteristics of the synthesized gold Nanoparticles.

## 2. Experimental Methods:

### *2.1. Materials and Methods:*

The raw materials used in this work to prepare gold nanoparticles by chemical reduction method are Gold TetraChloride HAuCl4H2O.Trisodium Citrate Dehydrate Na3C6H5O72H2O. De- ionized water.

### *2.2. Preparation of Gold Nanoparticles colloid:*

A magnetic stirrer has been installed on it ring stand and clamped on it (10 ml) of (0.5 mM) HAuCl4 to a (25 ml) conical flask. Magnetic bar has been added to the flask. The magnetic stirrer was turn on; the function of stirring and hot plate gets the solution to the boiling. The working of stirrer put between a medium to fast setting at intensive stirring. When boiling complete there is appropriate volume of liquid left in the flask. Drop by drop from 1ml of 1% Trisodium citrate dehydrate Na3C6H5O72H2O added to the (25 ml) flask. The colloid solution has been permanent for stirring and boiling on a magnetic stirrer hot plate until a deep red color arises. Firstly a dark purple color will appear, but with the passage of time will take on a deeply red hue that is a bit dark more the beets color.

When the color of colloid solution is obtained, cautiously put the flask far from the hot plate and puts on wire gauze. When it becomes cool enough to get it, cast contents of flask into a 25ml beaker. Then measure the pH value of gold colloid is in the range of (6-7).