

---

## **Graphene 2018: Focus on optimization of colorimetric assay for the detection of hydrogen peroxide using a green synthesis pathway for silver capped nanoparticles-Hamid Idriss-University of Sharjah, UAE**

---

### **Abstract**

Fascinating green and cost-effective technique for the synthesis and preparation of silver nanoparticles for an easy assay for the detection of hydrogen peroxide as reactive oxygen species is described in the present study. Silver nanoparticles were capped using an extract of an algae harvested from the Arabian sea in Al-Fujairah, UAE. Nanoparticles were obtained in an optimum time of 3h under optimum temperature of 75°C in a water bath shaker. The optimum pH was found to be the normal pH of the plant extract (pH= 7). The nanoparticles were characterized by using Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Dynamic Light Scattering (DLS) and Energy-Dispersive X-ray Spectroscopy (EDS). The nanoparticles were used for the sensing of hydrogen peroxide based on a colorimetric technique. The silver catalytic ability for the decomposition of hydrogen peroxide was assessed using different concentration of AgNPs, pH effect, temperature effect and different loads of hydrogen peroxide. The red color of the silver nanoparticles solution was found to change gradually to a transparent solution with the increase of the concentration of H<sub>2</sub>O<sub>2</sub>.

Reactive oxygen species are fashioned thru the electron switch reactions in the mitochondria and chloroplasts and swiftly converted to H<sub>2</sub>O<sub>2</sub>. Therefore, H<sub>2</sub>O<sub>2</sub> as a more steady ROS can be regarded as an indicator of cell stress and it can be used in a constant country to display intracellular stress level. In this regard, the growing use of a variety of nanoparticles, most of which are related with organic systems, are

fundamental to be studied for their viable unfavourable effects. We measured the concentration of hydrogen peroxide in samples gathered before and after the remedy with silver nanoparticles with the aid of a novel technique and optimized this approach for the residing tissue.

**Methods:** In this study, we evaluated the endogenous H<sub>2</sub>O<sub>2</sub> manufacturing from *Pyricularia oryzae* tissue under regular and stress conditions (such as after remedy with nanoparticles) with the aid of spectrophotometric assay. The approach used is primarily based on instant reaction of hydrogen peroxide with vanadium pentoxide in sulfuric acid solution, forming a peroxovanadate complicated that has a maximum absorption at 454 nm. This approach was additionally compared with different methods.

**Results:** The results of this approach compared with other methods in the same tissue showed that the approach is simple, less expensive and more efficient, and the complex is secure for numerous hours and can be used for a range of H<sub>2</sub>O<sub>2</sub> concentrations. Also, the detection range of the referred to approach equals with high-sensitivity strategies such as accessible commercial kits. Furthermore, this method can also measure greater values of H<sub>2</sub>O<sub>2</sub>.

**Conclusion:** The optimized strategies for measuring the H<sub>2</sub>O<sub>2</sub> concentration with vanadium pentoxide in sulfuric acid answer through the colorimetric technique are simple, efficient, rapid, accurate, good value and do not have problems of different methods. The measurements using this method in *Pyricularia oryzae* below oxidative stress confirmed that the

created oxidative stress caused with the aid of the use of silver nanoparticles improved H<sub>2</sub>O<sub>2</sub> in fungal tissue. H<sub>2</sub>O<sub>2</sub> is the SOD response product that is later decomposed with the aid of CAT. This approach is capable to measure H<sub>2</sub>O<sub>2</sub> in distinctive levels and beneath normal and stress prerequisites which are indicative of antioxidant defense. Therefore, we advocate it to the researchers in comparable conditions.

In the current era, distinctive types of nanomaterials are used for sensing of metallic ions and molecules the usage of colorimetric and fluorimetric techniques. Among a number of alternative methods for detection of steel ions, colorimetric method of sensing is one of the most promising methods of detection and it has received significant pastime due to its easy operation. In the area of colorimetric sensing, the use of steel nanoparticles as sensing cloth is growing unexpectedly for the detection of a number of metallic ions. This approach has attracted interest because of their extremely high visible-region extinction coefficients ( $\sim 10^9 \text{ M}^{-1} \text{ cm}^{-1}$ ), which is various orders of magnitude higher than that of natural dyes. Surface plasmon resonance (SPR) of the metallic nanoparticles well-known shows severe color, which is especially sensitive towards its size, shape, and interparticle distances. Interaction of these nanoparticles with analytes reasons aggregation and/or exchange in size, shape, interparticle networking pattern, etc., resulting in changes in SPR absorption band and colour of the solution, which is without difficulty detectable by means of the bare eye even at low concentration. Because of this unique property and also due to their easy and speedy motion with high selectivity and sensitivity, the use of nanoparticles as colorimetric sensing cloth has turn out to be a rising place of research. Among metal-based nanoparticles, each gold nanoparticles (AuNPs) and silver nanoparticles (AgNPs) are of unique habit due to the fact of their high sensitivity and wonderful shade change, which can be noted even if a minor

trade occurs in the nanoparticles' environment. Between gold and silver, the latter has been chosen in the current work to make it low-priced as silver is a great deal more cost-effective than gold and silver nanoparticles are expected to perform comparable to gold nanoparticles.

In the existing work, silver nanoparticles had been prepared with the resource of sunlight the use of newly designed thiophene-substituted calixarene by-product (ThC) as capping and stabilizing agent. It is documented in the literature that bare-surfaced nanoparticles are susceptible to aggregate, and therefore, some capping agent is required to make them discrete nanoparticles. In this case, designed calixarene by-product incorporating thiophene moiety is chosen as capping and stabilizing agent with the goal that the sulfur atom of the thiophene unit related to calixarene can make robust interplay with the surface of the silver nanoparticles making an wonderful capping, and this preorganized calixarene moiety can provide platform for interplay with incoming analytes. These calixarene-modified silver nanoparticles (ThC-AgNPs) have been used for detection of metallic ions in aqueous media, and it has been found that they detect Hg<sup>2+</sup> with high selectively, sensitivity, and sharp color trade over 17 other steel ions used in this study. They detect now not solely Hg<sup>2+</sup> in aqueous media, but additionally Hg<sup>0</sup> in vapor and liquid phases. These ThC-AgNPs have additionally been used for the detection of Hg<sup>2+</sup> electrochemically the use of amperometric technique, in which a constant possible of working electrode is maintained and trade in current is measured with incremental addition of Hg<sup>2+</sup>. This amperometric approach has also detected Hg<sup>2+</sup> in aqueous media with high sensitivity. Herein, we report small print of the synthesis of modified calixarene and the preparation of calixarene-modified silver nanoparticles and their application as colorimetric sensor for Hg<sup>2+</sup> and Hg<sup>0</sup> and amperometric sensor for Hg<sup>2+</sup> with high sensitivity.

**NOTE: This work is partly presented at 2nd International Conference and Expo on Graphene & Semiconductors on April 16-17, 2018 held at Las Vegas, Nevada, USA.**

---

Hamid Idriss  
*University of Sharjah, UAE*

---

[2nd International Conference and Expo on Graphene & Semiconductors](#)

April 16-17, 2018

Volume 8. Issue 1