# SYNTHESIS, SIZE CHARACTERIZATION AND PHOTOCATALYTIC STUDIES ON THE DEGRADATION OF DRUGS BY SILVER NANOPARTICLES

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**ABSTRACT:**

Metal nanoparticles show enhanced physical and chemical properties when compared to bulk materials. Particularly Silver nanoparticles (Ag Np) show wonderful catalytic, optical and spectroscopic properties. We report here synthesis, size characterization and photocatalytic behavior of Ag Np. Silver nanoparticles are investigated on the degradation of potential drugs like Isoxsuprine and Amoxcillin. In recent years it was deducted that environmental water resources have been loaded in exceeding levels by these drugs. The kinetics of degradation of these drugs in the presence of Ag Np are carried out and the results are put forth.

**Keywords**: Silver nanoparticles, degradation, Isoxsuprine, Amoxcillin

## INTRODUCTION:

Metallic silver and its components exhibit photo catalytic activity in the form of bulk materials as well as in the nano size particles. Silver nanoparticles are well known to show unique optical, spectroscopic and catalytic properties. In this work the synthesis,size characterization and photo catalytic behavior of silver nanoparticles are investigated.synthetic polymers like poly N-vinyl pyrollidine which is water soluble was used as capping agent for preparing silver nanoparticles from silver nitrate precursor using freshly prepared sodium borohydride aqueous solution as the reductant

Silver nanoparticles are prepared at three different temperatures at 25*C,35*C and 45*C.So that the reaction temperature effects on the nanoparticle size can be investigated. The size characterization are carried out by using PXRD and HRTEM data. Using Sherer formula on the FWHM of the XRD pattern the mean size values of silver nanoparticles are determined at three different temperatures. The mean size values are found to be 12±1nm,15±1nm,and 22±1nm respectively.

**Size Characterizations of Silver Nanoparticles**

In figure.1 the UV-SPR spectra of silver nanoparticles synthesized at 200°C is given. The presence of SPR spectra at 408nm confirms the presence of AgNPs and the XRD pattern of solvent dried AgNPs are shown in figure.1. On comparing [JCPD file card no. 65-2871], the presence of nano crystalline silver nanoparticles are observed. Applying Scherrer formula on the FWHM of XRD pattern the mean size values are found to be 10±1nm. The TEM photographs of AgNPs synthesized at 200C are shown in figure-2. The mean size values of the AgNPs is found to be 11±1 nm. These values are found agreeable. The spherical morphology was found for AgNPs in TEM.

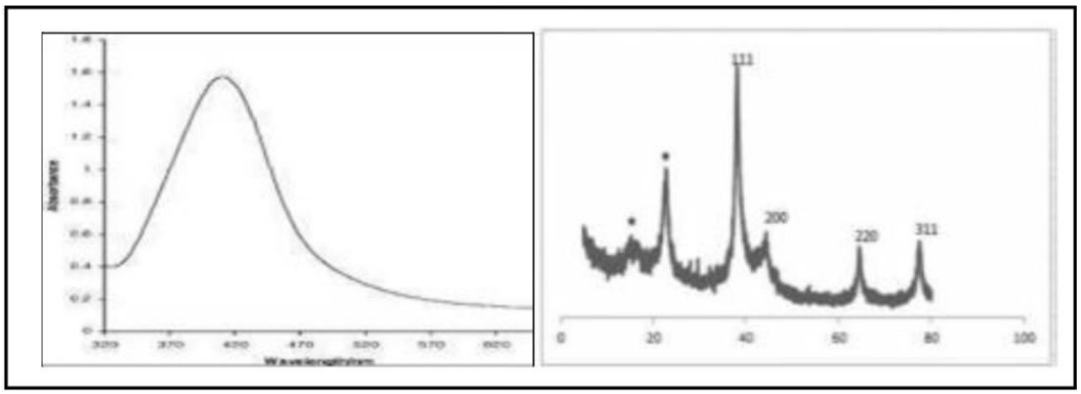



Figure 1. UV-SPR and XRD pattern of Silver nanoparticles

**EFFECT OF TEMPERATURE**

The effect of temperature on the synthesized silver nanoparticles can be studied from the TEM Photographs of silver nanoparticles collected from the sample maintained at three different temperatures.During synthesis of silver nanoparticles increase in temperature increase the mean size values of silver nanoparticles.

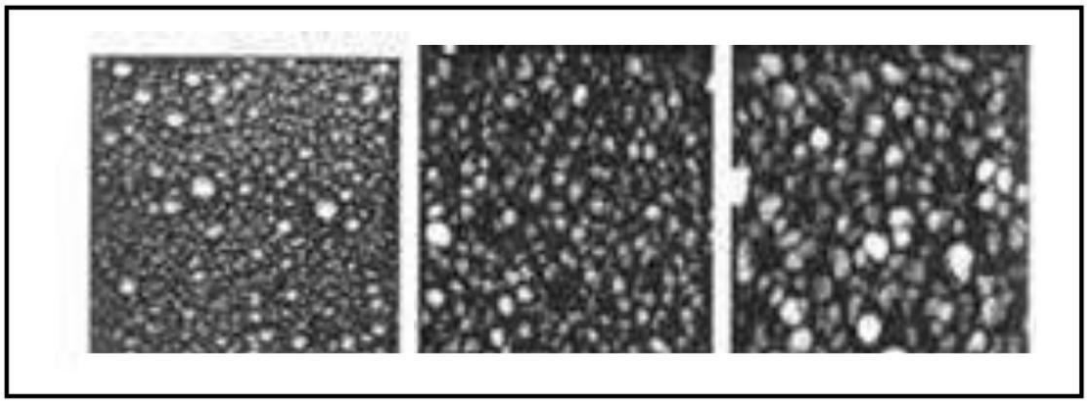


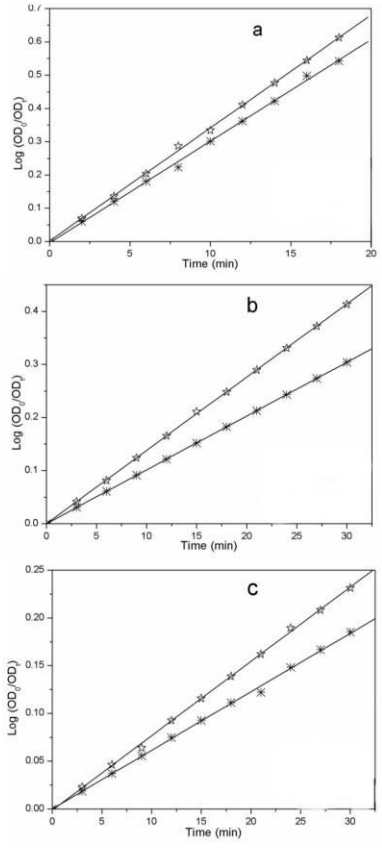
Figure 2. Silver nanoparticles size values at 25*C, 35*C and 45*C and the size values are found to be 12±1nm,15±1nm,and 22±1nm respectively.

**KINETIC STUDIES:**

The photocatalyst loading amount was optimized to be 1 mg/20 ML of the 1MM drug solution. At a regular interval of time, the absorbance of the aliquots drawn out is measured in a UV spectrometer. Absorbance Vs Time plots are for the drug separately carried out in the UV irradiation.

Apply the pseudo first order kinetics expression on plots of log ($OD_0/OD_t$) VS Time are made in order to ascertain complete degradation of the drugs, effect of hydrogen peroxide addition to the Photo degradation mixture was adopted at 25°C and at constant catalyst loading with one ML of 5% by weight hydrogen peroxide was incorporated absorbance was made for this photo catalytic mixture. The rate coefficient values are known from the slopes of the kinetic plots. It was found that in the presence of Photo catalyst, silver nano particles the drug degradation in the presence of hydrogen peroxide is greater than in the absence of hydrogen peroxide, hydrogen peroxide induces, the drug oxidation independently, and also silver nano particles combine with hydrogen peroxide produces higher extent of drug degradation

The reason attributed to this behavior is due to the formation of active free radicals in the presence of hydrogen peroxide and UV radiation on silver nano particles.



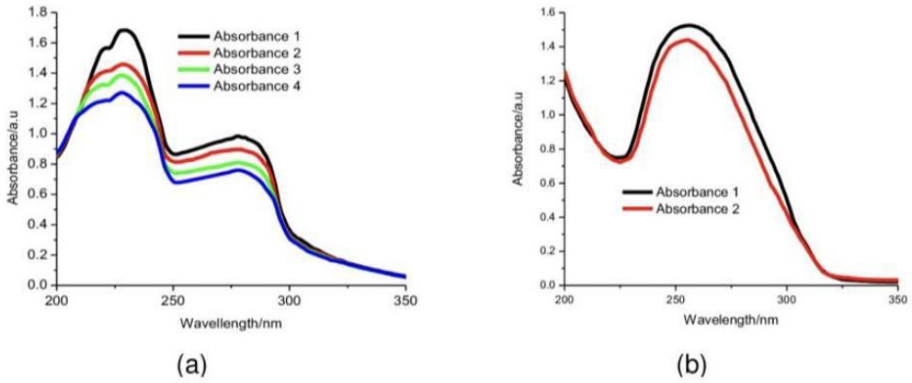

Kinetic plots for the rate coefficient determination of degradation of drugs with hydrogen peroxide catalyst by silver nano particles.

**PHOTOCATALYTIC MECHANISM:**

The work function of element silver lies around 4.26eV with Schottky barrier. On photolysis, photo generated electrons are transferred between surfaces of AgNPs, through electron tunneling process. The conductive bridge of AgNPs arising due to electrons moving between inter AgNPs could be transferred to surface absorbed oxygen rapidly, thus forming activated superoxide anion radical $O_2$* , OH*,and $HO_2$* in aqueous medium. Simultaneously, the remaining photogenerated holes and electrons react with water giving rise to OH* radic

$$Ag + h\Upsilon \longrightarrow Ag^{+} + e^{-} \xrightarrow[H_2O]{2O_2} {}^{*}OH + HO_2{}^{*} + O_2{}^{-*}$$

In the aqueous environment the stabilized drug molecules are easily attacked by hydroxyl (OH*) hydroperoxide (*$O_2$H) and superoxide anion ($O_2$-)* radicals, resulting in degradation of the drug molecule [5-6].




UV-Vis absorption spectrum of (a) Amoxicillin and (b) Isoxsuprine in distilled water for different concentrations.

**CONCLUSION**:

The Silver nano particles synthesized in different sizes, adopting various reaction temperature with PVP as stabilizing agent upon size characterization by XRD and TEM the measurements, the sizes of silver nano particles are synthesized at 25°C 35°C and 45°C are. Derivatives of amoxicillin drugs, are photo catalytically degraded. Losing 1 mg/20 ML of catalyst loading for the different size catalyst. The Photo catalytic variations for synthesis. Silver nano particles are found to be.25*C >35*C>45*C Due to agglomeration of the particles, the size of silver nano particles increases with increase in reaction, temperature compared to large sized, silver nano particles, smaller size silver particles has greater total surface area, and the number density of the particles produced for constant composition thus PVP capped silver nanoparticles prepared through efficient photo catalysis for drug degradation at 25°C.

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