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Optical Properties of Synthesis Silver Nanoparticle by Green Method and effect by Radioactivity and Apply on Bacteria

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Abstract: *Silver Nanoparticle materials had been synthesized to produce new alternate substance for reducing the rare or high cost of industrial materials. In this work, three samples of silver nitrate were prepared with different concentrations (0.04, 0.05 and 0.06) molar by chemical method, and effect with gamma ray on the all sample that mead , the add to the bacteria. The optical absorbance properties were investigated for all sample that made by used the ultraviolet-visible (UV-Vis) spectroscopies. The maximal optical absorbance equal 1.44 a.u for sample (Ag Nano 0.04 Molar +R) at 200 nm wavelength , minimal value 0.705 au for sample (Ag Nano 0.06) at the same wavelength ,but when add bacteria equal 0.812 a.u at 213 nm for the (Ag Nano 0.06 Molar +R) sample . The optical energy band gap value of were decreasing from 5.618 eV to 5.227 eV by increasing the molar and effect by gamma ray.*

Keywords*: Silver Nanoparticle, optical properties, ultraviolet-visible spectrometer (UV), optical energy band gap.*

1. Introduction

In recent days, nanotechnology has induced great scientific advancement in the field of research and technology. Nanotechnology is the study and application of small object which can be used across all fields such as chemistry, biology, physics, material science and engineering. Nanoparticle is a core particle which performs as a whole unit in terms of transport and property (Nour et al., 2010). As the name indicates nano means a billionth or 10^{-9} unit. Its size range usually from 1-100nm (Nour et al., 2010) due to small size it occupies a position in various fields of nano science and nanotechnology. Nano size particles are quite unique in nature because nano size increase surface to volume ratio and also its physical, chemical and biological properties are different from bulk material. So the main aim to study its minute size is to trigger chemical activity with distinct crystallography that increases the surface area (Osaka et al., 2006, Singh et al., 2008 & Sinha et al., 2009. "There's plenty of room at the bottom"; this statement by Richard Feynman in 1959 during a presentation to a meeting of the American Physical Society, is widely accepted as the spark that initiated the present 'nano' age Nano, "dwarf" in Greek, is defined as one billionth, it follows that the nanoscale is measured in nanometers, or 10-9 m. To put this in perspective; the average strand of a human hair is roughly 75,000 nm in diameter, or from the other extreme 1 nm is the length of 10 hydrogen atoms lined up end to end. There are two methods of synthesis of metallic nanoparticles which are chemical method and physical method. In chemical approach it include chemical reduction(Guzman et al., 2009), electrochemical technique(Rodriguez-Sanchez et al.2000), photochemical reduction (Balan et al., & Sharma et al., 2009).The chemical process is again subdivided into classical chemical method where some chemical reducing agent (such as hydrazine, sodium borohydride, hydrogen)are used, radiation chemical method generated by ionization radiation (Leff et al., 1995; Lisiecki and Pileni, 1995; Huang et al.,1997;Gutierrez and Henglein, 1993; Nour et al.2010). In the physical approach it includes condensation (Raffi et al., 2007), evaporation (Mitrakos et al.,2008) and laser ablation for metal nanoparticle synthesis (Zamiri et al.,2012). The biological synthesis of nanoparticle is a challenging concept which is very well known as green synthesis. The biological synthesis of nanomaterial can solve the environmental challenges like solar energy conservation, agricultural production, catalysis (Kumar et al., 2011), electronic, optics (Evanoff et al, .2005), and biotechnological area (Soloviev and Mikhail 2007). From the various literature studies it can be stated that the amount of accumulation of nanoparticle varies with reduction potential of ions.Nanoscience is one of the most recent attractive branch of Physics. It is concerned of with the behavior of matter of the form of small isolated non interacting particles having dimensions in the rang of (1-300)nm. The term nm stands for nono matter, where 1nano meter is equal to one part, when one meter is divided to thousand million equal parts. Nano materials being very small, can not be described by classical lows, instead it is described by quantum lows[1-7].

All these conventional studies had concentrated on the Synthesis of silver nanoparticles by various methods and optical properties of it, one of them was indicated that the Ag NPs possessed high stability to SSF for more than 90 days, which was not previously reported in the literature and the particle size and polydispersity decreased with increasing of PVA-SH content. Other one presents an overview of silver nanoparticle preparation by physical, chemical, and biological synthesis. The aim of this review article is, therefore, to reflect on the current state and future prospects, especially the potentials and limitations of the above mentioned techniques for industries. Moreover; there is a study has a results suggest that Ag nanoparticles can be used as effective growth inhibitors in various microorganisms, making them applicable to diverse medical devices and antimicrobial control systems.

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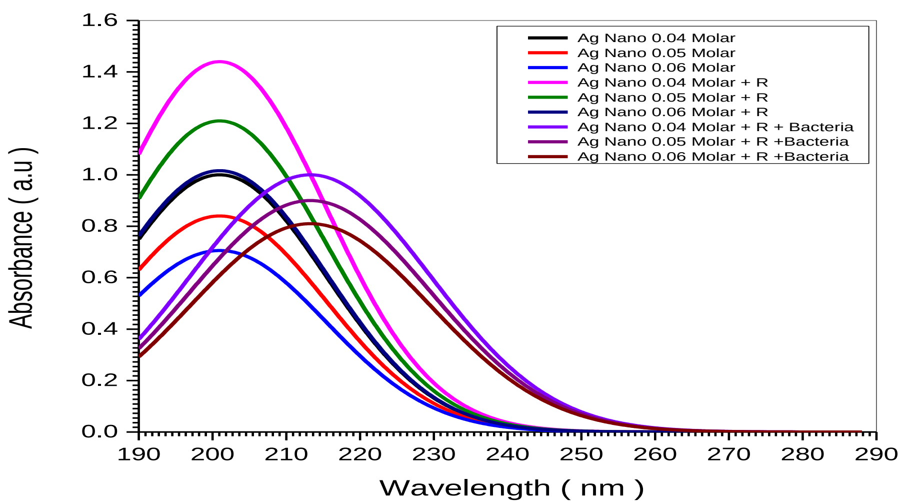
2. Methodology

Three samples of silver nitrate were prepared with different concentrations 0.04, 0.05, 0.06 and dissolved in 1.5 liters of distilled water and placed in magnetic stirring to be well dissolved. Its temperature is 80 ° C (Warmth Solution - Then a freshly prepared sodium borohydride solution of 0.01 was prepared. Sodium borohydride solution was added to the silver nitrate solution (drop wise) to mix well. The reaction, shape and color of the solution were monitored. Color change, separation and precipitation were observed. The samples were placed in the dark room for 24 hours to complete the sediment formation, after which the water was separated from the sediments and distilled water was added to them again and they were placed in a Centrifuge for 5 minutes to completely separate the sediment, after which the water was withdrawn from the sediment and ethanol was added to completely withdraw the sediment. Then, samples were placed on a bridresh and placed in a preheating oven at 85 ° C for drying. Moreover, effect with gamma ray on some sample and then add to the bacteria.

All sample were divided as three groups , the first group without effect of gamma ray and bacteria, the second group effect by gamma ray , the last group effect by gamma ray and add bacteria , the used UV-Vis spectrometer min 1240 to study the optical properties (absorbance , transmission , reflection ,absorption coefficient , exaction coefficient and optical energy band gap)

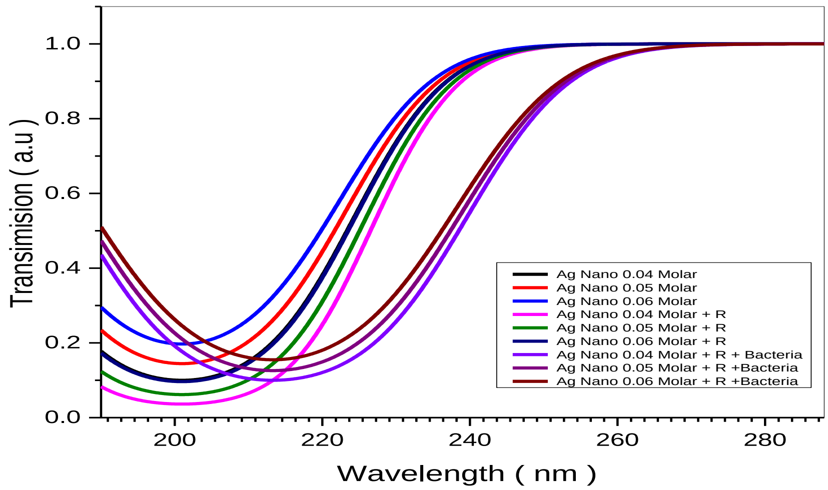
3. Result and Discussion

After preparing, the samples the optical properties were investigated for all sample that made by used the ultraviolet-visible (UV-Vis) spectroscopies as showing before

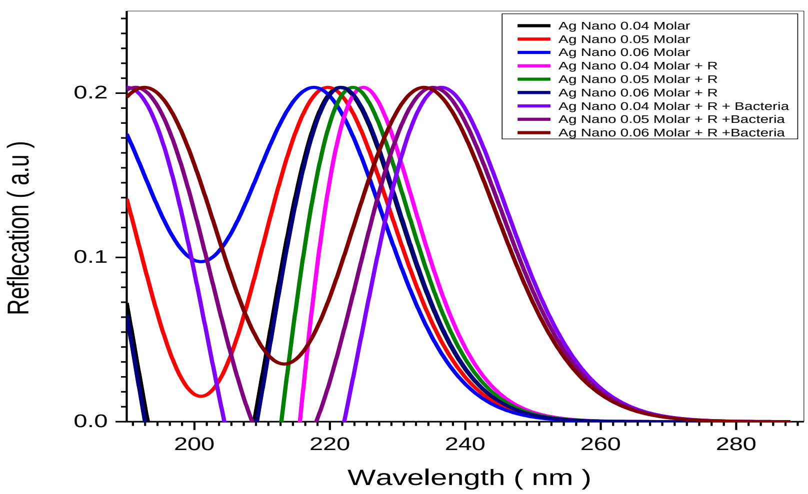


Fig(1) relation between absorbance and wavelengths of Silver

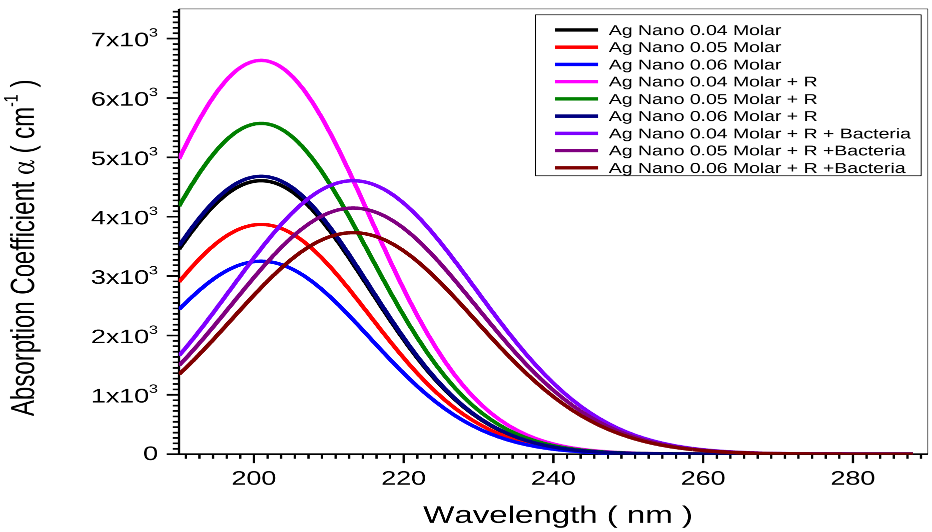
Nanoparticle (Ag Nano samples)



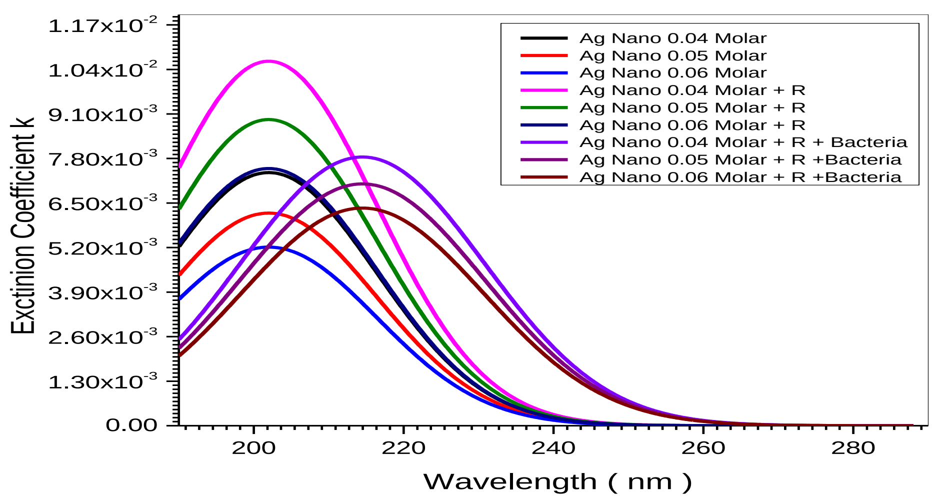
Fig(2) relation between transisimission and wavelengths of Silver Nanoparticle (Ag Nano samples)



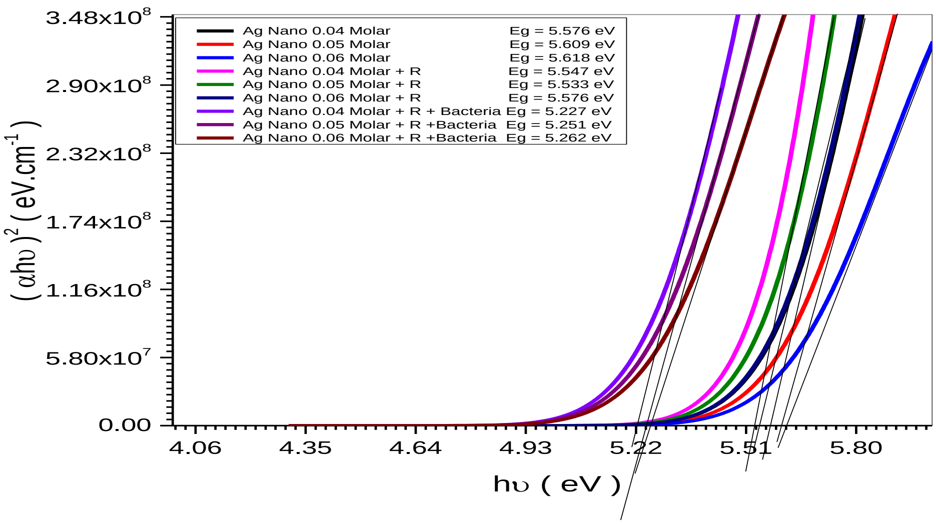
Fig(3) relation between reflection and wavelengths of Silver Nanoparticle (Ag Nano samples)



Fig(4) relation between absorption coefficient and wavelengths of Silver Nanoparticle (Ag Nano samples)



Fig(5) relation between exctintion coefficient and wavelengths of Silver Nanoparticle (Ag Nano samples)



Fig(9) optical energy band gap of Silver Nanoparticle (Ag Nano samples)

4. Discussion Optical Results of ($Ni_X Co_{1-X} O_2$) samples

The absorbance we found the behavior of curves is the same for Silver Nanoparticle (Ag Nano samples) Molarstudied using UV-VS min 1240 spectrophotometer. Show all results of absorbance in fig (1). In fig. (1) shows the relation between absorbance and wavelengths for Silver Nanoparticle (Ag Nano samples) the rapid increase of the a absorption at wavelengths 200 nm crosponding photon energy 6.5 eV by exposure to gamma ray , and decrease when add the bacteria at 213 nm wavelength crosponding photon energy 5.8 eV . Transission we found the behavior of curves is the same for Silver Nanoparticle (Ag Nano samples) that showing in fig (2). In fig. (2) shows the relation between transission and wavelengths for Silver Nanoparticle (Ag Nano samples), the efficet of irradition on the transission was decrease transission value at 200 nm , and whenn add bacteria also decrease at 213 nm . The reflection with Silver Nanoparticle (Ag Nano samples) that showing in fig (3). In fig. (3) shows that the reflection for Silver Nanoparticle (Ag Nano samples) value in tow area the first one in-ranged (216 to 226) nm for the samples that effect by gamma ray, and the second (232 to 237) nm when to add the Bactria, in this tow point the samples become mirrors. The efficet of add Bactira on the refelection was red sheft (decrease the energy of Silver Nanoparticle (Ag Nano samples)) . The absorption coefficient (α) of the Silver Nanoparticle (Ag Nano samples) were found from the following relation $\alpha = \frac{2.303xA}{t}$ where (A) is the absorbance and (t) is the optical legth in the samples[8] . In fig (4) shows the plot of (α) with wavelength (λ) of Silver Nanoparticle (Ag Nano samples) , which obtained that the value of $\alpha = 3.23x10^3$ cm^{-1} for Silver Nanoparticle (Ag Nano 0.06 molar) sample in the UV region200 nm ,and t for Silver Nanoparticle (Ag Nano 0.04 + R)sample equal $6.64x10^3$ cm^{-1} at the same wavelength , but for Silver Nanoparticle (Ag Nano 0.04 +R+ Bactria) equal $4.46x10^3$ cm^{-1} at the 213 nm wavelength , this means that the transition must corresponding to direct electronic transition, and the properties of this state are important since they are responsible for electrical conduction. Also, fig.(4) shows that the value of (α) for the Silver Nanoparticle (Ag Nano samples) increase by irradition and decreased when add Bactira . Extinction coefficient (K) was calculated using the related $k = \frac{\alpha\lambda}{4\pi}$ [9]. The variation at the (K) values as a function of (λ) are shown in fig. (5) for Silver Nanoparticle (Ag Nano samples) and it is observed that the spectrum shape of (K) as the same shape of (α). The Extinction coefficient (K) for Silver Nanoparticle (Ag Nano samples) in fig.(5) obtained the value of (K) at the 574 nm wavelength was depend on the samples treatment method , where the value of (K) at 200 nm for Silver Nanoparticle (Ag Nano 0.06 molar) sample equal $5.16x10^{-3}$, and for the Silver Nanoparticle (Ag Nano 0.04 molar+R) equal $1.06x10^{-2}$ at the same wavelength , while for other sample Silver Nanoparticle (Ag Nano 0.04 molar +R+Bactira) at 213 nm wavelength equal $7.87x10^{-3}$ .The effects of irradaition was increased on the Extinction coefficient (k) ,but efficat of Bactira was decrease and red sheft on the wavelength .The optical energy gap (Eg) has been calculated by the relation $(\alpha h\upsilon)^2 = C(h\upsilon - Eg)$ where (C) is constant[10] . By plotting $(\alpha h\upsilon)^2$ vs photon energy (hυ) as shown in fig.(6) for Silver Nanoparticle (Ag Nano) samples . And by extrapolating the straight thin portion of the curve to intercept the energy axis , the value of the energy gap has been calculated .In fig (6) the value of (Eg) of Silver Nanoparticle (Ag Nano 0.06 molar)sample obtained was 5.618 eV, and equal 5.547 eV for Silver Nanoparticle (Ag Nano 0.04 molar +R) sample, while for Silver Nanoparticle (Ag Nano 0.04 molar +R+Bactira) sample obtained was 5.227 eV.The value of(Eg) was decreased from 5.618 eV to 5.227 eV. The decreasing of (Eg) related to irradaition and add the Bactira on the samples. It was observed that the Silver Nanoparticle (Ag Nano samples) confirmed the reason for the band gap shifts .

5. Conclusion

Silver Nanoparticle (Ag Nano samples) were successfully synthesized through the green method. The absorption coefficient maximum value is $6.64x10^3$ cm^{-1} for Silver Nanoparticle (Ag Nano 0.06 molar + R) sample in the UV region200 nm ,and t for Silver Nanoparticle (Ag Nano 0.06) sample equal $3.23x10^3$ cm^{-1} at the same wavelength , but for Silver Nanoparticle (Ag Nano 0.04 +R+ Bactria) equal $4.46x10^3$ cm^{-1} at the 213 nm wavelength. The value of Optical energy band gap (Eg) Silver Nanoparticle (Ag Nano samples) was decreased from 5.618 eV to 5.227 eV.

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