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Optical Parapets of Gum Arabic Syntheses by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

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Abstract: *Syntheses Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide, and used UV-VS mini 1240 spectrophotometer to study the optical parapets. The absorbance in range(410 to 555) nm for all samples ,the maximal absorbance of sol gel at 465 nm corresponding photon energy 2.667 eV, and for chemo thermos sample at 576 nm corresponding photon energy 2.605 eV. The value of absorption coefficient (α) equal 4.25 cm^{-1} for (Sol Gal) Method sample in the visible region(465 nm) , but for (chemo - thermos) Method sample equal 4.36 cm^{-1} at the (476 nm) wavelength. The energy band gap (Eg) value of (Sol Gal) Method sample equal (2.397) eV but for (chemo - thermos) Method sample equal (2.349) eV.*

Keywords: *Gum Arabic, Sol Gel, Chemo Thermos, Optical property, Absorption Coefficient and Optical Energy Band Gap.*

Introduction

The main gum Arabic producing regions of the Sudan, which covers most of Kordofan and Darfur state and Part of White Nile stat [1]. Gum Arabic is a natural polymer, play an important role in our daily life. It is one of the major exported goods from Sudan more than 67% of world product is from Sudan. Gum Arabic has many uses in foodstuffs and an adhesive material due to its high viscosity and also used as an additive to make stable suspension mixture for medical surprise, lithography, textiles, paint, inks, and cosmetic[2]. Gum Arabic is most important commercial poly- saccharine and it is probably the oldest food hydrocolloid in current use. Gum Arabic is high molecular weight polymeric compounds, composed mainly of carbon core mixed in heterogeneous manner, including some materials in tonic forms as salts of macromolecules have weak conductive properties {C+2 , Mg+2 , K+ } {FAO, 1990}[3].Gum Arabic is produced from many species of Acacia of African origin. Chemically, A. Senegal gum is an Arabian galactoy protein composed of arabinose {17-34%}, GA lactose {32- 50%}, rhamnose {n- 16%}, glue carbonic acid {3- 50%} and protein 1. 8- 16%} with an optical rotation of {28° to 32°}[4]. There are many studies, which are done in Gum Arabic on different domain concerning new research in addition to identifying new application of Gum Arabic. One of this study is Gum Arabic based solar cells with Rhodamin 6G were fabricated on indium tin oxide by a spin coater position. Microstructure and cell performance of the solar cells with ITO/ Rhodamin 6G/ Gum Arabic structures were investigated. Photovoltaic devices based on the Rhodamin 6G/Gum Arabic hetro junction structures provided photovoltaic properties under illumination [5].The other study was made Gum Arabic (Talha) as Nano-material doping by Iodine were prepared in different Concentration . Optical Properties of this material measured by using the UV- Spectroscopy min 1240, and study the effaced of Iodine different concentration on the optical parameters. The study reached to absorbance increases upon increasing the concentration, while the transmission decreases, and the value of Energy band gap (Eg) was decreased from (4.420) eV to (4.323) eV as increasing the concentration [6].The last one was used Gum Arabic doped by Cu O based Dye Sensitized Solar Cells (DSSC) with different type of dyes (Coumarin 500, Ecrchrom Black, Rhodamine B, DDTTc and Nile blue) were fabricated on ITO glass. Photovoltaic devices based on the Gum Arabic and dyes hetrojunction structures provided photovoltaic properties under illumination. The DSSC were produced and characterized. The analysis shows that the efficiency of the solar cell increases when the upper layer is that are more transparent [7].

The aim of this work is to syntheses Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide , and used UV-VS mini 1240 spectrophotometer to study the optical parapets (absorbance, transmission, reflection, absorption coefficient, extinction coefficient and optical energy band gap) are carried out.

Experimental

In this work, gum Arabic prepared by two methods (sol gel and chemo thermos), .The precursor used in the synthesis gum Arabic (GA) and Aluminum Oxide (Al_2O_3). For the sol-gel process used Gum Arabic and Aluminum nitrate monohydrate, (5g) Hashab Gum Arabic dissolved in 50 ml of distillation water then 1ml ammonia added to solution .The solution was stirred for 60 min at 80°C. Moreover (2g) aluminum nitrate monohydrate Al $(NO_3)_3.9H_2O$ was dissolving in (110 ml) Ethanol C_2H_5OH in the glass beaker. Then dropped 1ml Dimethyl 2- methyl the solution was stirred for 60 min at 80°C. After that, the two solutions are mixed

and put at room temperature for 24 hours, and we obtained the Sol ready to be used to prepare as layers by spinner (spin coating).In the second method Chemo thermos has been used to prepare Gum Arabic and Aluminum nitrate monohydrate. 17 ml acid added 34 ml ethanol (C_2H_5OH) slowly and the solution was stirred for 5 min , then added (5g) Hashab Gum Arabic , the solution was stirred for 60 min at 70°C. In addition (2g) Aluminum Nitrate monohydrate Al $(NO_3)_3.9H_2$ O dissolved in 110 ml Ethanol C_2H_5OH, and then 2 ml 2 Dimethyl methyl dropped, the solution was stirred for 60 min at 100°C. After that, two solutions were mixed in ice bath with stirred for 60 min. The mixture have been leaved in lab's temperature about one day. After syntheses Gum Arabic by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples used UV-VS mini 1240 spectrophotometer to study the optical parapets (absorbance, transmission, reflection, absorption coefficient, extinction coefficient and optical energy band gap) as showing in the results blow , the curves we found the behavior of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples studied using UV-VS min 1240 spectrophotometer

Results and Discussion

After prepared gum Arabic by two methods (sol gel and chemo thermos), used UV-VS min 1240 spectrophotometer to study the Optical properties (absorbance, transmission, reflection, absorption coefficient, extinction coefficient and optical energy band gap) as showing in the results blow.

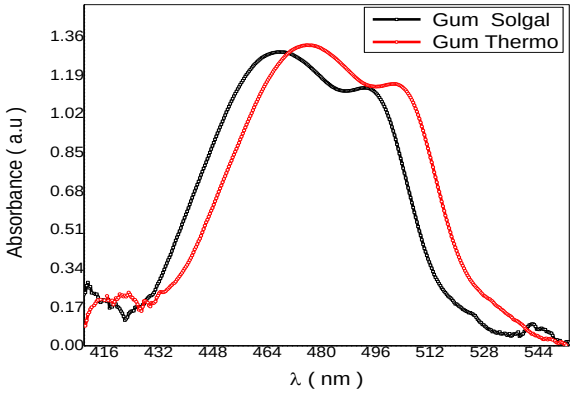

Fig (1) the relation between absorbance and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

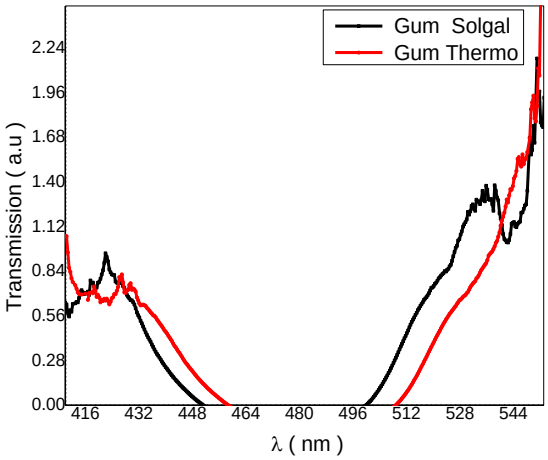

Fig (2) the relation between transmission and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

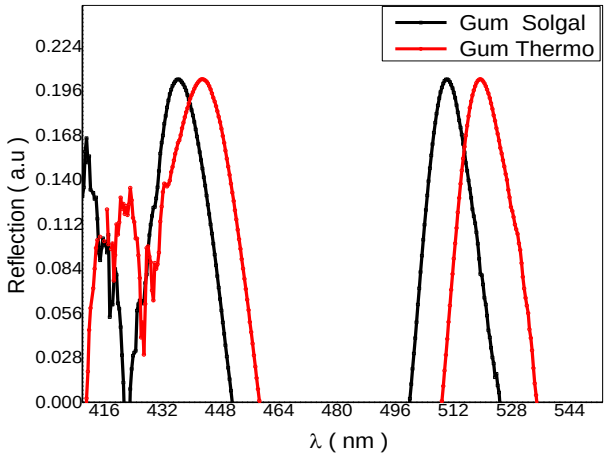

Fig (3) the relation between reflection and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

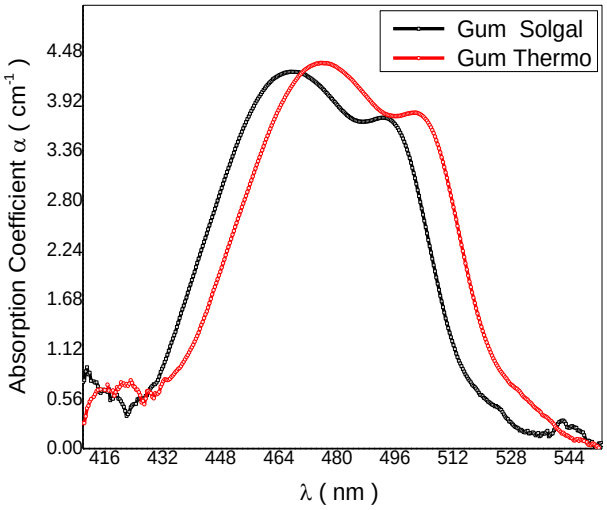

Fig (4) the relation between absorption coefficient and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

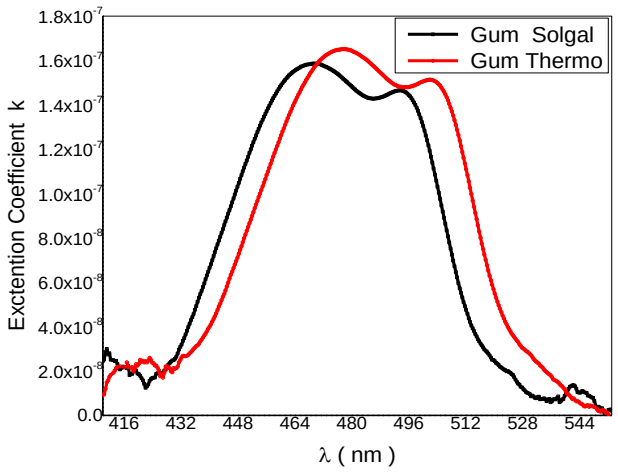

Fig (5) the relation between extinction coefficient and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

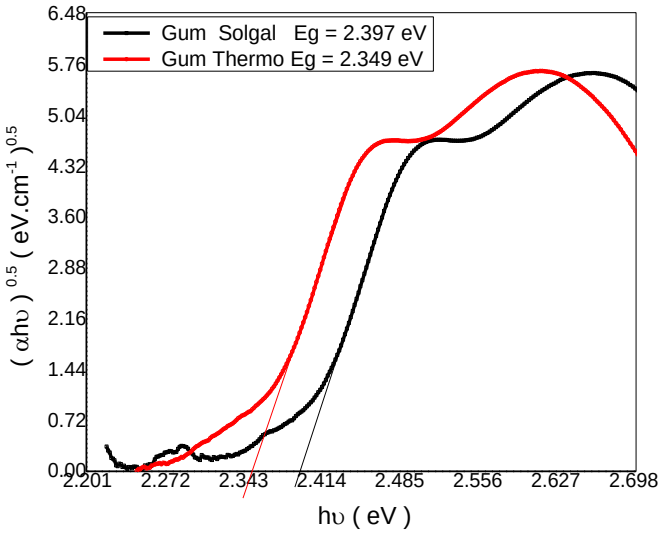

Fig (6) optical energy band gap of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples

Discussion

For figure (1)Shows the relation between absorbance and wavelengths for Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples at range(410 to 555) nm for all samples , for sol gel sample the maximal absorption at wavelengths 465 nm corresponding photon energy 2.667 eV, and for chemo thermos sample the maximal absorption at wavelengths 576 nm corresponding photon energy 2.605 eV .The absorption coefficient (α) of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples were found from the following relation $\alpha = \frac{2.303xA}{t}$ where (A) is the absorbance and (t) is the optical length in the samples. In fig (2) showing the relation between transmission and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples**,** and in fig (3) showing the relation between reflection and wavelengths of Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples**.** In fig (4) shows the plot of (α) with wavelength (λ) of Gum Arabic

Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples , which obtained that the value of α = 4.25 cm^{-1} for Gum Arabic Made by (Sol Gal) Method and doping with Aluminum Oxide sample in the visible region(465 nm) but for Gum Arabic Made by (chemo - thermos) Method and doping with Aluminum Oxide sample equal 4.36 cm^{-1} at the (476 nm) wavelength , this absorption coefficient value means that the transition must corresponding to indirect electronic transition, and the properties of this state are important since they are responsible for electrical conduction. Extinction coefficient (K) was calculated using the relation $= \frac{\alpha\lambda}{4\pi}$. The variation of the extinction coefficient (K) values as a function of (λ) are shown in fig (5) for (Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples and it is observed that the spectrum shape of (K) as the same shape of (α). The extinction coefficient (K) for Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples in fig (5) obtained the value of (K) for the Gum Arabic Made by (Sol Gal) Method and doping with Aluminum Oxide at the (465 nm) wavelength was depend on the samples treatment method equal $1.578x10^{-7}$, where the value of (K) at 476 nm for Gum Arabic Made by (chemo - thermos) Method and doping with Aluminum Oxide sample equal $1.65x10^{-7}$ .The effects of method that treatment for the sample on the Extinction coefficient (k) is the mean of wavelength shift . The optical energy gap (Eg) has been calculated by the relation $(\alpha h\upsilon)^2 = C(h\upsilon - Eg)$ where (C) is constant. By plotting $(\alpha h\upsilon)^2$ vs photon energy (hυ) as shown in fig.(6) for the (Gum Arabic Made by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide 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 (4) the energy band gap (Eg)value of Gum Arabic Made by (Sol Gal) Method and doping with Aluminum Oxide equal (2.397) eV but for Gum Arabic Made by (chemo - thermos) Method and doping with Aluminum Oxide equal (2.349) eV .The value of(Eg) was decreased from (2.397) eV to (2.349) eV . The decreasing of (Eg) related to the method that treatment of samples; it was observed that chemo thermos annealing the samples, this reason confirmed the reason for the band gap shifts.

Conclusion

Syntheses Gum Arabic by (Sol Gal and chemo - thermos) Method and doping with Aluminum Oxide samples, and study the optical parapets. The energy band gap of all samples was decreased from (2.397) eV to (2.349) eV related to the method that treatment of samples. Due to energy band gap value, the sample s can be used in the following application optoelectronic devices such as solar cell, light emitting diodes, and electrochemical sensors.

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