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Determination of the Optical Parameter from Chitosan Doping With Nicotine

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Abstract The aim of this work is recycling. where the natural polymers were extraction (Chitosan) from Shrimp Waste (soluble in acetic acid), and Nicotine extraction from in cigarettes. measurement FT-IR (400-4000) of Chitosan and Nicotine(CN) and analysis of active group were taken to ensure the purity of extracted materials. The chitosan/Nicotine as also revealed by scanning electron microscopy (SEM). Measurement UV –Spectroscopy rang (300-900) nm and The UV-IS optical properties related to, refractive index (n), extinction coefficient (K) and was the real dielectric constant (εr), and fixed fantasy insulation (εi).

INTRODUCTION

Not only physicists but scientists and engineers of various disciplines have directed to study the optical properties of many materials, to correctly understand optical properties, and many natural materials (polymer, dyes), characterized by good optical, lignin study with a good electrical properties when it doped with synthetic dye (Rhodamine–B[1]. Natural polymers are safe non-toxic as well as readily available, entered into many applications. In our research, this emphasis was placed on chitosan Figure (1), chitosan material recently found in many applications in industry, agriculture and medical science [2], Chitosan is a natural polymer found in marine crusts and is a non-toxic polymer used in many medical fields [3]. Chitosan has a good ability to interact with many substances and improves its optical properties. Chitosan was also used in water purification, the degree of turbidity decreased with the concentration of chitosan and the bacteria decreased in water [4, 5], As a result, of the chitosan properties of biodegradation and non-toxicity and resistance to bacteria, they were used in the manufacture of food envelopes [6, 7]. Dyes are important compounds because they play a "significant" role in our daily lives and have a wide range of industrial applications such as textiles, chemical reagents, and others. So it is very important to "distinguish clearly between dyes and dyes colorant." colorants are a comprehensive term for pigments, that are in the form of granules or crystals that do not dissolve in the material they form. There is no electron between them and the simplest example is when mixing polymers with hemoglobin to form pigments used in coatings [8, 9]. The dyes are defined as organic materials that can absorb the visible light of the electromagnetic spectrum. Natural pigments are derived from leaves, roots, bark, flowers and even fruits. These were the only dyes available to many kinds until 1856 when the first synthetic dye was discovered during the search for a cure for malaria by the world William Perkin [10]. Many researchers have tended to study natural dye. Nicotine is a semi-alkaline organic compound Fig(2), Nicotine is found in eggplant (Solanaceae), and most commonly found in tobacco, and in a few amounts in tomatoes, eggplant and green pepper. Nicotine penetrates the skin easily, The use of nicotine-derived nicotine from tobacco in several medical fields has been used to determine the effect of this alkaloids on human body cells as well as in the treatment of smoking (quit smoking)[11,12]. The optical properties of the printers are important for their practical applications such as type (DSSC) solar cells, light sensors, and other industrial applications. Dark color absorption is high within the spectrum of visible light and is therefore used in solar cells. [13, 14].

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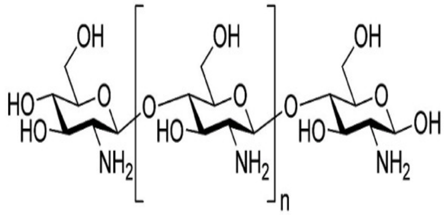

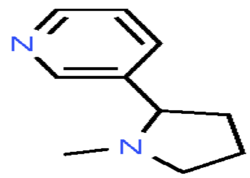

FIGURE 1. Structure of Chitosan [1]. **FIGURE 2**. Structure of Nicotine [10].

MATERIALS AND METHODS

Hydrochloric acid HCl, sodium hydroxide, potassium hydroxide, and ethyl alcohol were purchased from Merck and used as received. Chitosan extract of the Shrimp shells and Nicotine was extracted from the tobacco leaves. The FTIR spectra were recorded IR spectra (KBr discs) on a JASCO FT/IR 4200, with a wavenumber range of 400-4000cm^{-1}. The absorption spectra were measured in the range of 200- 1100 nm for 10^{-3} by using UV-Visible spectrophotometer type Shimadzu UV-160A. Available at Polymer Research Center, Basrah University-Iraq, The FESEM images, and EXD analysis were obtained using Leo-Supra 50VP (Carl Zeiss, Germany) equipped with EXD system.

Isolation and Purification of Chitosan

Shrimp shells were used in this study. The crusts were removed and washed then prepared to Shrimp crusts were collected and dried with an electric oven at a temperature of 100 ° C, then grinded for fine powder. (100 g) of powder and treated with 1 liter of 5% hydrochloric acid (HCl) solution with continuous stirring for 24 hours at room temperature for demineralization. Then precipitate wash several times with distilled water to get rid of acid residue. Then add to the precipitate (1 liter) of 10% sodium hydroxide, then heat the mixture with continuous stirring at 90 ° C for three hours to get rid of the protein (Deproteinization), leave the mixture to cool down, and then spray and wash the precipitate several times with distilled water to get on Chitin with 35% of the amount used. The mixture is heated with continuous stirring at 90 ° C for 6 hours. This step is repeated three times. Take 20 g of Chitin isolated from the first phase and add 250 mL of potassium hydroxide solution (50%). The residue is washed with distilled water and dried [15]. The result of the product is 75% of the quantity used and taking the spectrum (FTIR) of the resulting chitosan Figure (3).

Extraction of Nicotine

The tobacco leaves were taken in the local sacks and left to dry for three days at room temperature. They were then well grinded, and placed in a Soxhlet device (is a laboratory device invented by Franz von Soxhlet in 1879. Soxhlet is usually required only when the desired compound is soluble in solvent and impurities are not soluble in this solvent. If the required compound has high solubility in the solvent). 200 mL of ethyl alcohol was added and extracted at 40 ° C for six hours [16].

Sample Preparation

The pigmented solutions were present using the physical mixing method by placing a volume ratio of the polymer solution (V = 0.19ml) and add a volume ratio of the dye solution (V = 0.01ml) to obtain a 5% dilution ratio. Place the solution in a glass container and leave for 24 hours to ensure homogeneity, the material is then poured into the glass slide using a disposable syringe and several cycles (1000 cycles/min). The model is then raised from the rotary base to be placed on a hot plate for 10 minutes at a temperature of $120C^0$ to ensure evaporation of liquids and solvents. The model is then ready to measure the optical properties [17].

RESULTS AND DISCUSSION

FT-IR analysis

The analysis FTIR showed the effective groups of pure Chitosan and Chitosan with nicotine in 5%, the spectral region between 4000 and 400 cm^{-1}. The spectra were showed band at 3422.06 cm^{-1} was attributed to the O-H stretching, 2927 cm^{-1} Symmetric amid a(C–H),1631.48 cm^{-1} corresponds to C=O stretching vibration of –

CH$_2$– groups in 1419.35cm^{-1}, 1318.11cm^{-1} was C-N Vibration,1078.01cm^{-1} C-O group , this result agrees with [18], Figure (3). Figure (4) and, Figure (5) Show that the values of the active groups started to change. This indicates an interaction between the pigment and the polymer. This is due to the possession of Chitosan, many bonds that can interact with the added dye. The spectra were showed a band at 3435. 65 cm^{-1} was attributed to the O-H stretching,2928 cm^{-1} Symmetric amid a(C–H),1656.55 cm^{-1} corresponds to C=O stretching vibration of –CH$_2$– groups in 1439.6cm^{-1} ,1318.11cm^{-1}, 1158.04cm^{-1} vibration band C-N ,1078.01cm^{-1} C-O.

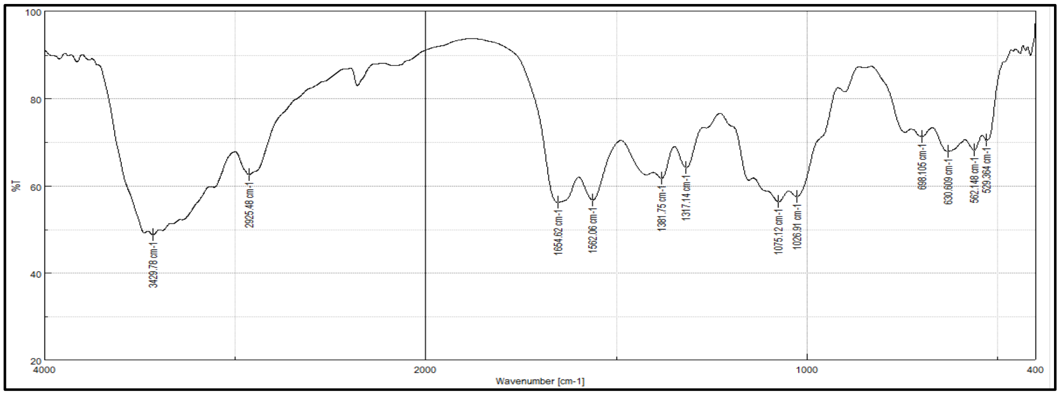

FIGURE 3. FTIR of Nicotine.

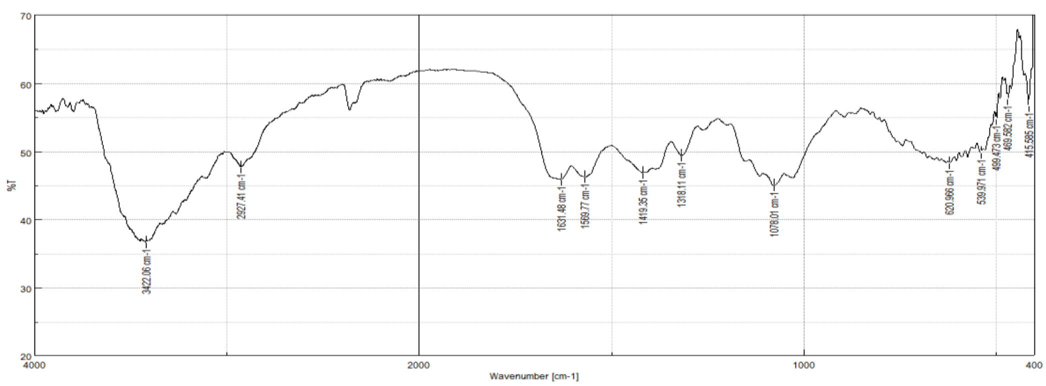

FIGURE 4. FTIR of Chitosan.

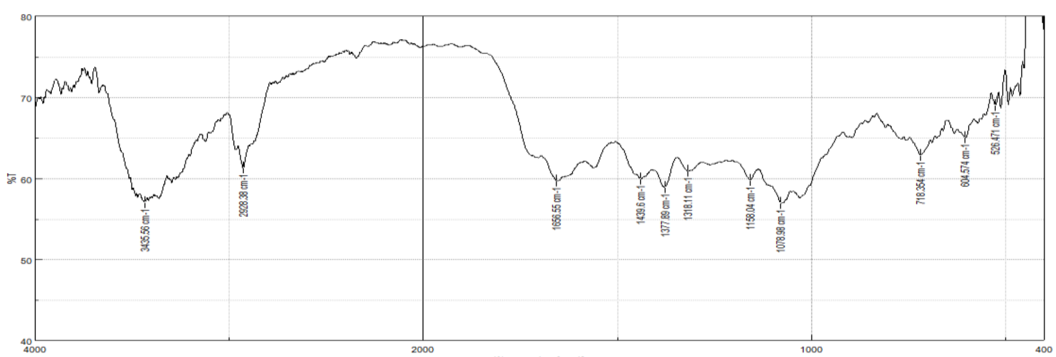

FIGURE 5. FTIR of Chitosan with Nicotine.

Scanning Electron Microscopy (SEM)

The SEM micrograph details of the pure chitosan and chitosan with Nicotine with (10 Kx,1Kx) magnification of composite**,** SEM micrographs showed that there was a significant difference in the surface of the chitosan before and after doping, Analysis shows that the surface of the pure chitosan is heterogeneous and after the addition of nicotine by 5% the surface becomes homogenous, shown Figure (6).

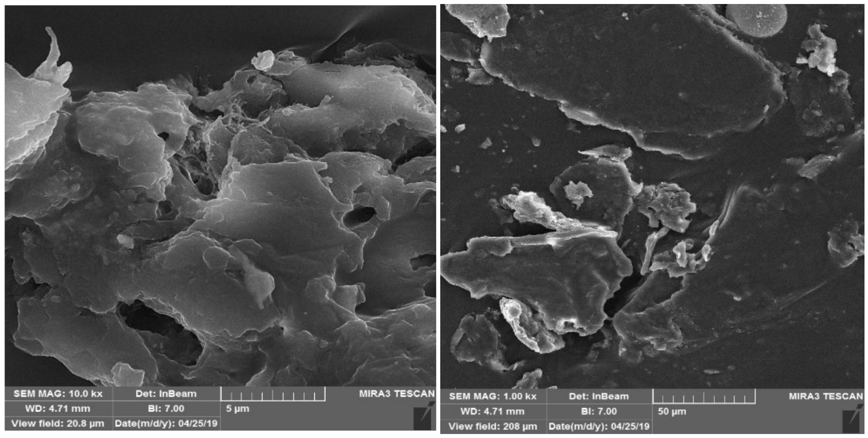

FIGURE 6. SEM (A) Chitosan pure. (B) SEM Chitosan with Nicotine.

UV-Spectroscopy

The optical properties of the materials are typically determined by showing the results of the reliability of the refractive index n, the attenuation coefficient K, or the relative permutation of their real and imaginary parts as a frequency function, the refractive index n, the attenuation coefficient K, or the absorption coefficient α. Commonly referred to as Optical Constant.

The refractive index is defined as the ratio between the speed of light in vacuum C and its velocity in the center v, the true part of the complex refractive index N. The refractive index can be set from the following relationship [19].

$$n = \frac{1+\sqrt{R}}{1-\sqrt{R}} \dots\dots\dots\dots\dots \quad (1)$$

Figure(7): shows that the refractive index values settle at approximately (1.5) for wavelengths of 400-800 nm while the refractive index values of nicotine-coated nicotine are different at the same wavelengths.

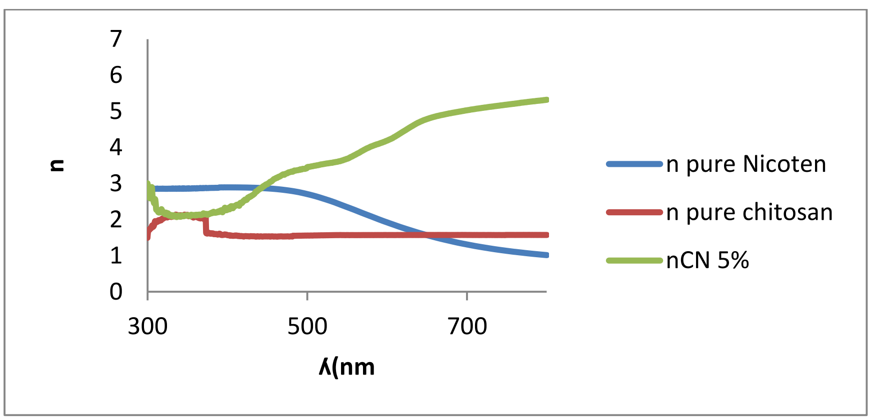

FIGURE 7. Refractive index is a function of Wavelength of Chitosan with 5% Nicotine.

Extinction Coefficient K is a measure of the fraction of light lost as a result of the dispersion and absorption of the unit of distance from the penetration of the center and can be estimated from the values of the α and λ wavelength using the following relationship by [19]:

$$k = \frac{\alpha ʎ}{4\pi} \dots\dots. \quad .(2)$$

Figure (8): shows that the values of the coefficient of inactivity are negligible, indicating that the lost energy values are also low.

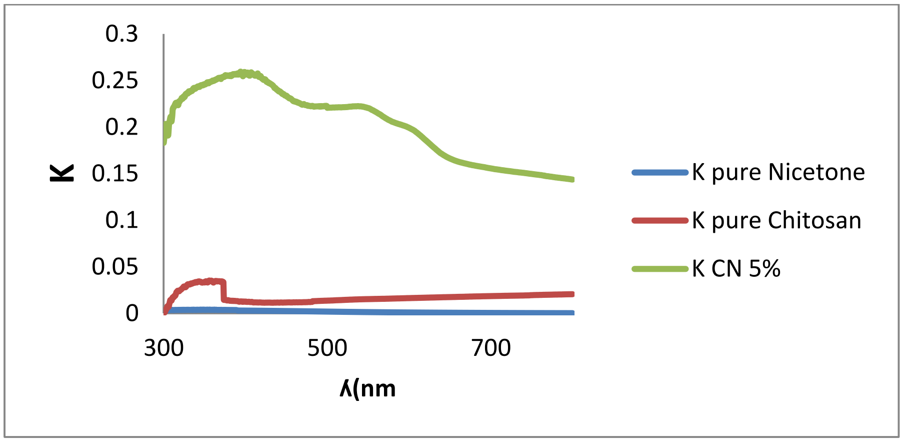

FIGURE 8. Extinction Coefficient function of the wavelength of Chitosan with 5% Nicotine.

Figure (9,10): Shown dielectric constant (real and imaginary part), we can calculate this in used equal (3,4) [17].that the values of the imaginary part settle at 1.1 at the wavelengths of 300-800 nm, while the values of the real part begin to increase at the same wavelengths.

$$n^2 - k^2 = \epsilon_r \dots \quad .(3)$$
$$2nk = \epsilon_i \dots \quad \dots..(4)$$

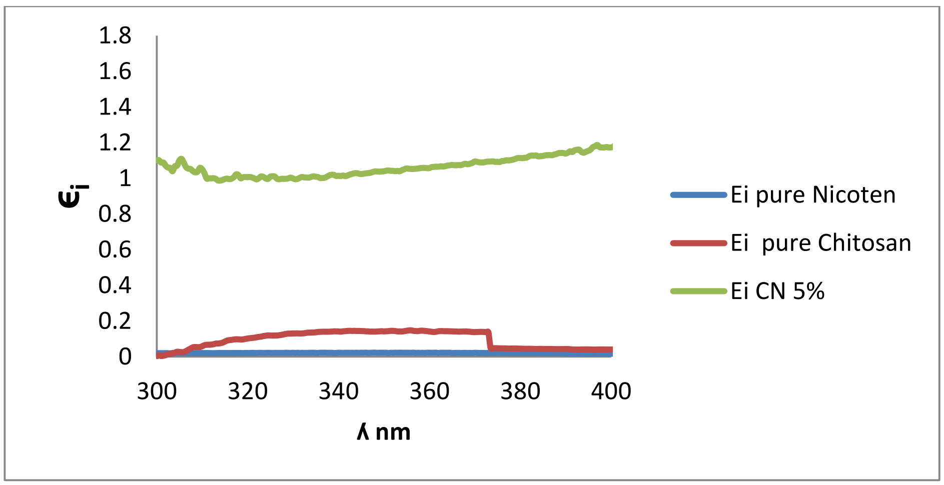

FIGURE 9. The imaginary part of the dialectical constant function of the wavelength of Chitosan with 5% Nicotine.

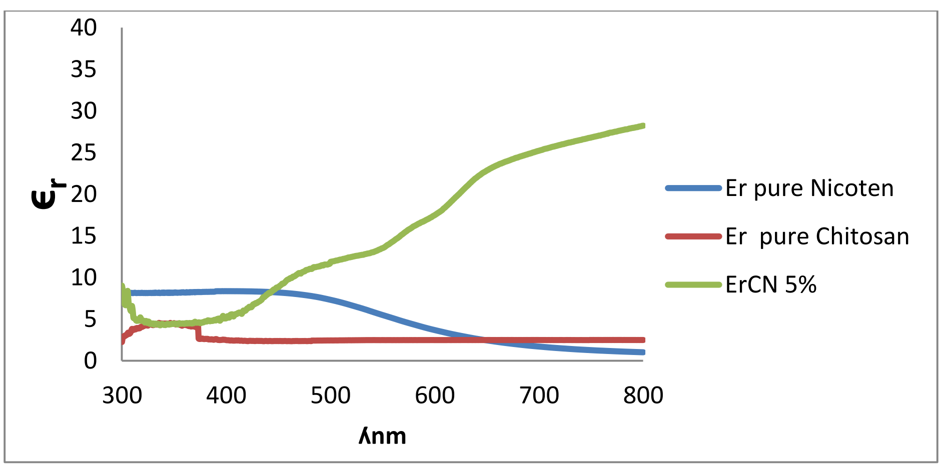

FIGURE 10. The real part dialectical constant function of wavelength thin filmsof Chitosan with5% Nicotine.

CONCLUSION

In this study, we shown that the value of doping had an effect on the values of optical parameters. This study can be used to fabrication of solar cell, which is very cheap and not harm the environment. The doping of nicotine dye from chitosan has an effect on the optical parameter, the refractive index values are greater than 1.5, and this indicates that the material is not transparent. In addition, the amount of light lost due to dispersion is low

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