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INFLUENCE OF CELLULOSE FILM THICKNESS ON OPTICAL CHARACTERISTICS

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Abstract

In this study, cellulose was precisely and scientifically extracted, allowing for the production of thin films that were made using the Spin Coating technique, well been studied Zeta analysis is a measurable physical property .A large molecule or matter's surface. It is used to improve the properties of materials such as solutions and proteins, as well as the potential interactions of solutions and surfaces and we studied discovered .influence of film thickness on the optical properties of these films, including their absorbents, Transamination's transmittance, and absorption coefficient (α), Additionally, it is important to understand the quality of the anticipated optical absorbance of these membranes in relation to the wavelengths, photon energy, and the nature of electronic transitions, such as direct or indirect transmissions, between the beams.

Keywords: Millet Husk, Zeta-Potential, Physical Measurements, Optical Properties, Influence Film Thickness.

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Introduction

As extreme weather conditions become more common, there is a greater need for new innovative, environmentally responsible materials to mitigate their negative effects. Cellulose is an easily accessible biomaterial .It is used in the food industry, has many naturally beneficial properties, and has the potential to develop optical materials for high-value-added applications. Biocompatibility, adaptability, availability, renewability, and biodegradability are all important factors to consider(1). Cellulose is a polymer with good mechanical properties, solubility, and environmental friendliness, making it an attractive material for biomass refining(2), Several studies have been conducted on cellulose and its applications, for example, cellulose was extracted from cardboard to benefit from its mechanical properties.(3_4), Cellulose films have huge potential for use in food packaging, biomedical applications, and delivery materials, Because of cellulose's chemical structure, which contains homogeneous and linear chemical bonds, it is possible to bond with many substances between the same bonds and between the molecules of the cellulosic compound. As a result, when treated with alkaline media, cellulose has a high tensile strength (5-9).

Nano cellulose is a versatile renewable biopolymer used in a wide range of packaging and technological applications. Thermal stability and changes in the properties of Nano cellulose High temperatures are required for many applications, including packaging, composites, and electronics. High temperatures (above 100 ^{o}C) can change the molecular and crystal structure of cellulose and compact the networked structure of cellulose nano-entities .Controlled thermal treatments of solid Nano cellulose materials, such as films, can also be used to improve mechanical strength and hardness (e.g., tensile strength, elongation at break, and Young's modulus). Because higher temperatures of 200-300 ^{o}C begin to degrade the cellulose polymeric structure, the maximum thermal treatment temperature of Nano celluloses is typically less than 200 ^{o}C.(11-15), effect of thickness on the optical properties of cellulose is studied.

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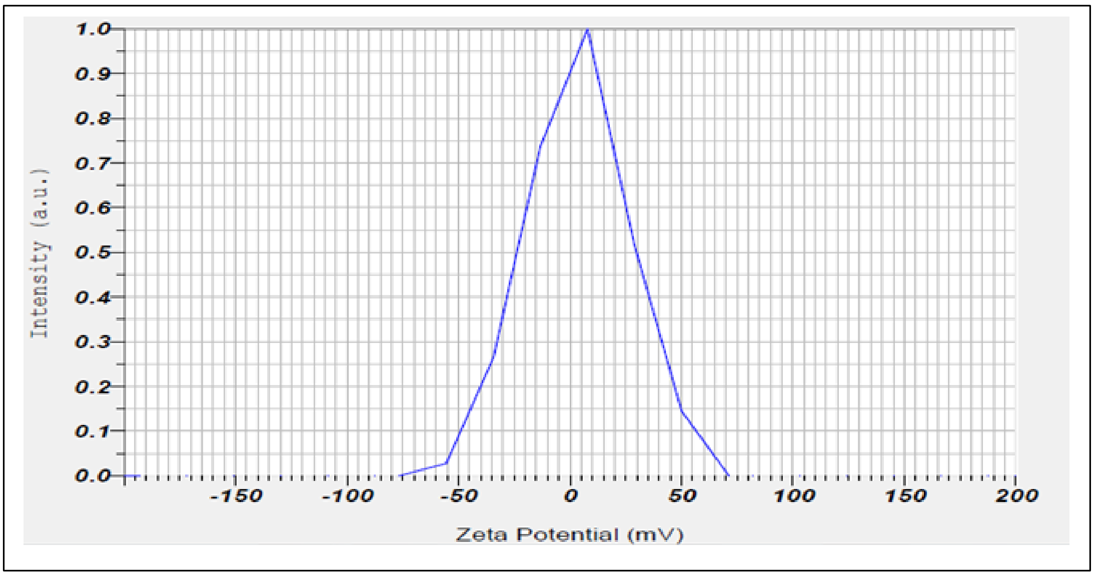
Materials and Methods

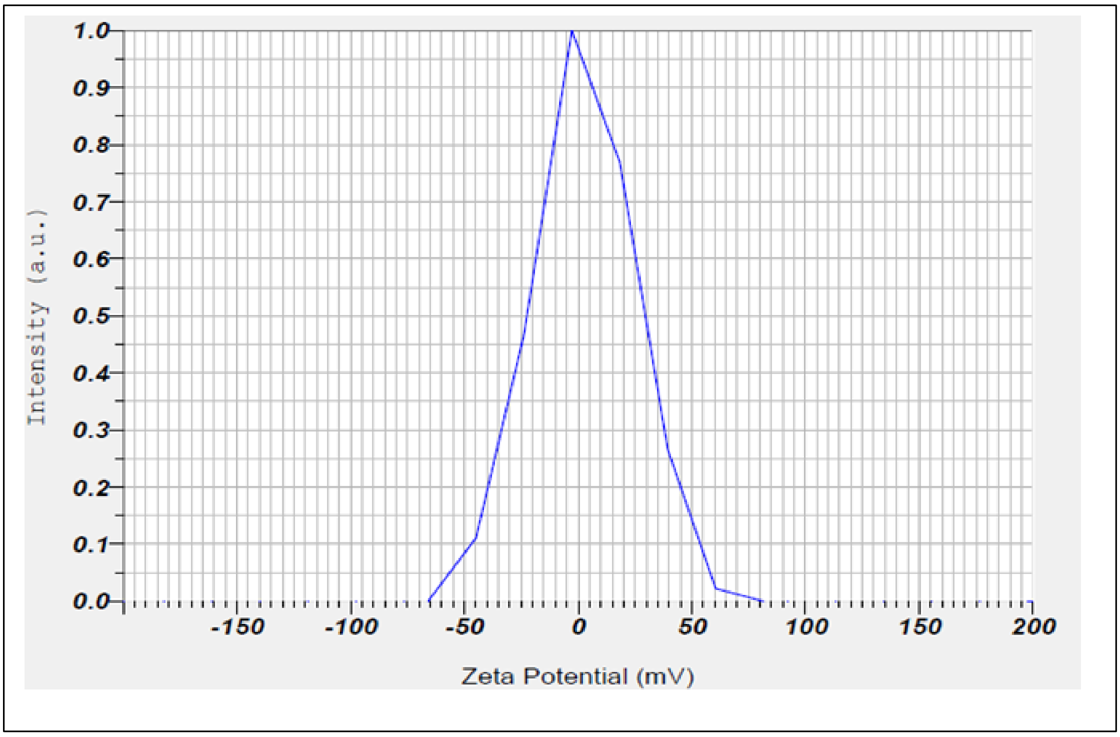
Millet husks were gathered from poultry farms in the province of Basra. They were then placed in bags Oil extracted from the ground crust by solvent extraction with ethanol at 60 °C for six hours. Before use, the sample was dried free of extracts in an oven at 60°C for 18 hours and refrigerated. 3.3gm of the sample was mixed with 100ml of aqueous NaOH solution. In degrees, the mixture was stirred for an hour, To remove the base, the pre-treated peels were filtered at room temperature and repeatedly washed with 95% ethanol. The sample was dried in a 60°C oven for 24 hours. 100 ml of distilled water, 15 ml of glacial acetic acid, and 0.2 g of sodium chlorite were mixed with 0.2 g of the sample, The extracted cellulose is then dissolved in 1% acetic acid. Following that, thin films are formed by pouring the solution onto glass bases with dimensions of 2cm * 2cm, after being cleaned with acetone and distilled water and dried) for 1000 rd/sec cycles (15).

Results and discussion

1- Zeta potential.

Zeta analysis is a measurable physical property .A large molecule or matter's surface. It is used to improve the properties of materials such as solutions and proteins, as well as the potential interactions of solutions and surfaces. Zeta potential can be discovered. Cutting the time it takes to create experimental formulations(15). It can also function as an adjuvant. The measurements were taken at 25°C room temperature. Figure 1 depicts the temperature values for sample 1, which has a thickness of 100 nm, and Figure :2 depicts the temperature values for sample 2, which has a thickness of 300 nm and tablet 1 Zeta Potential and Electrophoretic Mobility are demonstrated.





Tablet 1 show of Zeta Potential and Electrophoretic Mobility

Sample	**Thicknes s (nm)**	**Zeta Potential mV**	**Electrophoretic Mobility(cm2/Vs)**
1	100	2.9	0.000022
2	300	3.6	0.000028

2- Optical properties .

study of the optical properties of thin films provides us with information about the films prepared, such as the energy gap and magazines that are used, we Use an ultraviolet spectrophotometer, of English origin (6800 UV/VIS) Jenway Double Beam Spectrophotometer -

for the purpose of studying the absorbance and transmittance from 200-1000 nm to nm, with a wavelength of as a function of wavelength of samples prepared at laboratory temperature. Figure 3 depicts the optical absorbance of the films tested at thicknesses ranging from 100 to 300 nm. As can be seen, absorbance values of 300 nm thickness are more visible in the visible spectrum, whereas absorbance values of 100 nm thickness are nearly stable for all measured wavelengths, providing an explanation for the effect of thickness on optical absorption As can be seen in Figure 4 the opposite behavior of the absorbance (17).

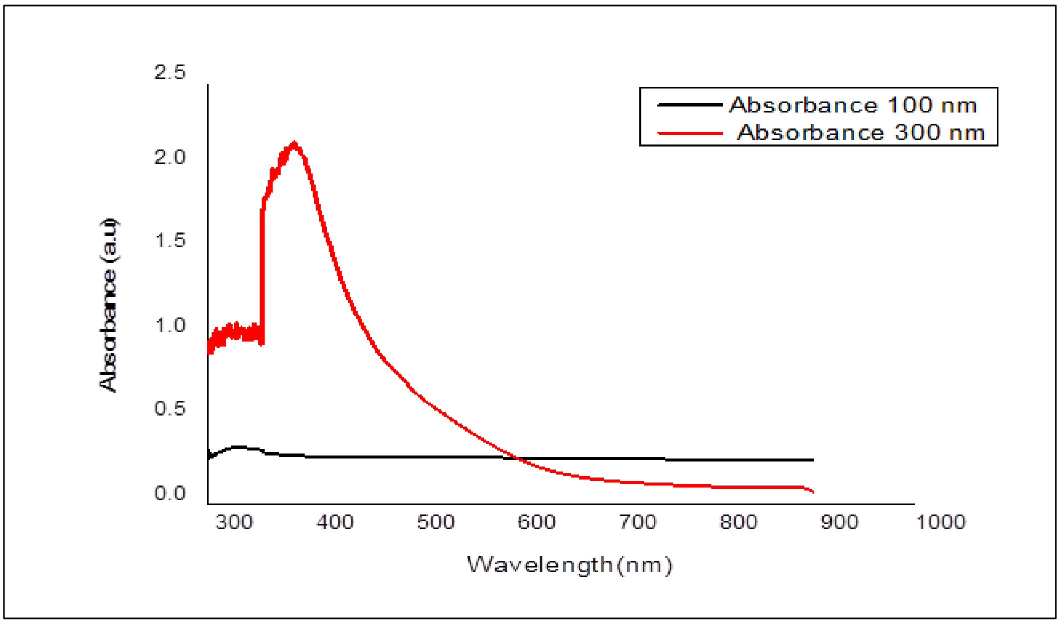


Figure 3: shows the optical absorbance of the films used at thicknesses .

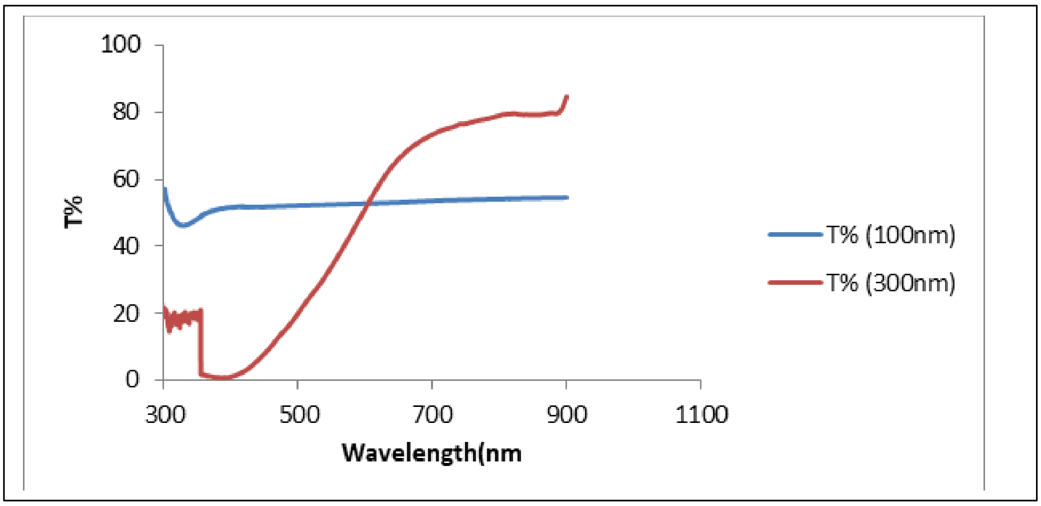


Figure 4: Show Transaction of films used at thicknesses.

Figure 5 depicts the optical absorbance and its relationship to photon energy. These absorbance's help to explain why there is light dispersion as well as the different types of absorption, Restastrahlen lattice absorption: The crystal's ions' vibrations absorb radiation, Free carriers are absorbed due to the presence of free electrons and free holes; impact of this process decreases as photon energy rises, Impurity absorption packages (re-layer) resulting from different doping grafts, Excision absorption peaks, which are typically visible at low temperatures and are close to the main absorption edge. The initial photon absorption from a bundle, This leads to an electron to be excited from the valence bundle to the conduction bundle (18,19).

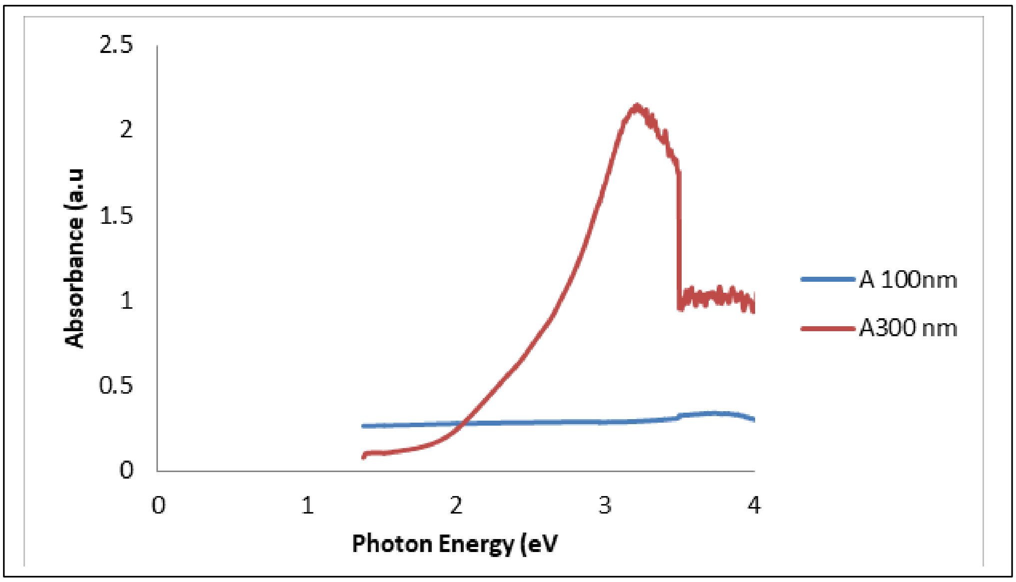


Figure 5: shows the absorbance with photon energy.

Absorption coefficient and film thickness.

following relation describes the incident light intensity (I) for a distance (X) from a surface:

$$I(X) = I_O \exp(-\alpha x) \ldots\ldots(*)$$

When I_O :- the radiation's intensity at impact

absorption coefficient is a unique property of materials, and it depends on of energy gap (Eg), or it depends on the wavelength. According to the relationship between the thickness of the membrane and the absorption of the incident light, the absorption coefficient can be calculated** , Swanpoal equation is used to determine the membrane's thickness***(20).::

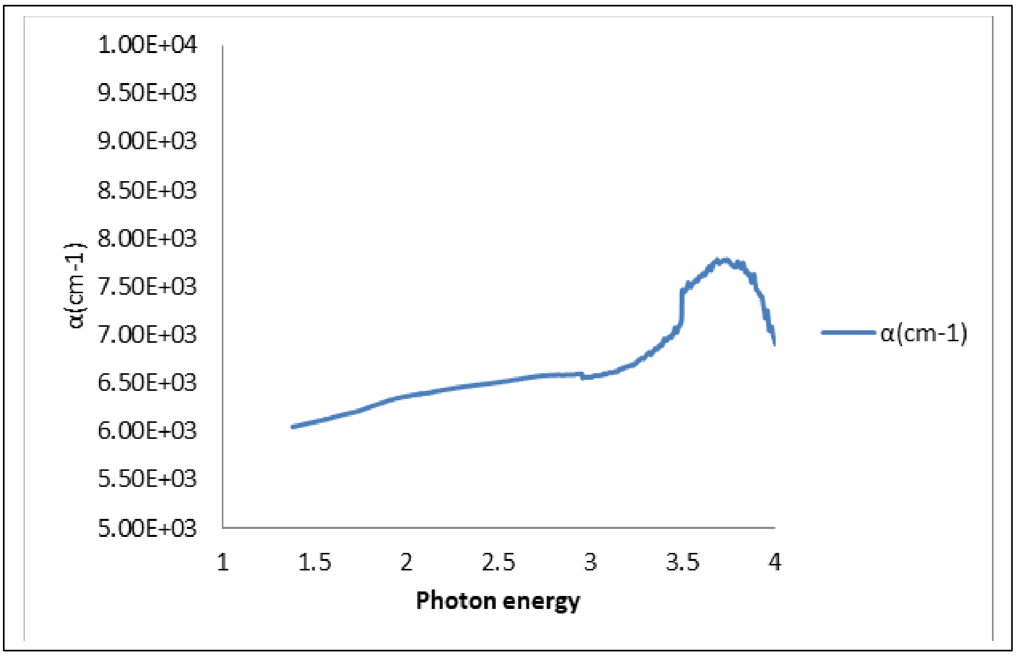
α =2.303(A/D)........(**).

$$\mathbf{d} = \frac{1}{2} * \frac{\lambda_1 * \lambda_2}{\lambda_2 n_1 - \lambda_1 n_2} \ldots\ldots(***)$$

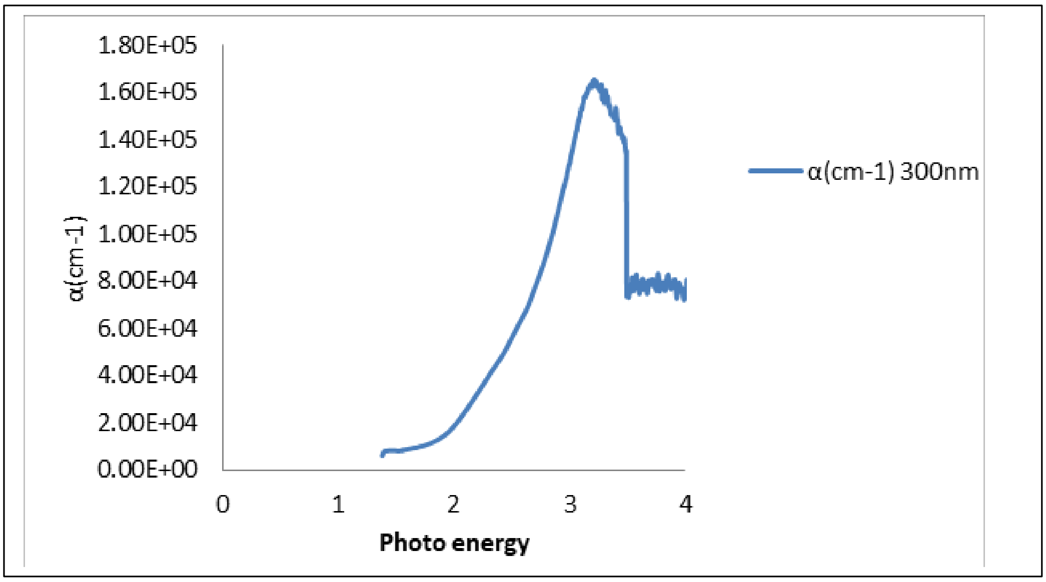
When: A: absorbance.

D: thickness of thin film.

Figures 6 and 7 show absorption coefficient versus photon energy. The curve values show that the absorption coefficient shifts with film thickens,



Figures 6 show absorption coefficient versus photon energy



Figures 7 show absorption coefficient versus photon energy

Conclusion

In this study, the results can be concluded or analyzed on the basis that the extracted cellulose can improve its properties and be used in a variety of fields. Because cellulose is a natural material that is not harmful to the environment, it is also possible to benefit from changing the thickness of the membrane when describing the location of using it. It can be used without fear or protection methods, giving researchers the opportunity to work in a safe environment..

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