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The Effect of Biomaterial on Optical Properties of Polymer Blend and their Applications

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ABSTRACT

In this work, bio composites have been prepared by adding the vegetarian lotion of willow solution to (polyvinyl alcohol- polyethylene glycol) solution blend. Study of optical properties for polymer blend and with different concentrations of (VLW) have been investigated. The absorption spectra recorded at the wavelength ranges (200-800) nm. The results show that the absorbance of bio composites are increasing with the increase of the VLW concentrations. The energy band gap of bio composites decreases with the increase of the VLW concentrations. Fabrication of humidity sensors by using bio composites has been investigated.

KEY WORDS: Bio Composites, Vegetarian Lotion of Willow, Relative Humidity, Capacitance.

1. INTRODUCTION

Biopolymers can be defined as biologically derived polymers and their attractive is lead to their availability, biodegradability, biocompatibility and availability. The origin of biopolymer may from natural or synthesis sources as proteins and carbohydrates or synthetically prepared as poly (lactic acid), PVA, PEG etc. Most natural biopolymers are degradable soon after treating, to industrial use which creates a major barrier. There are two main popular synthetic options to create strong biomaterials. One is to form composites which means incorporating biopolymers into synthetic materials and called Bio composites. The other way is to rearrangement biopolymers by addition of functional groups. Poly (ethylene glycol) (PEG) is a synthetic polyether compound, is called as polyoxyethylene (POE), or polyethylene oxide (PEO), according to molecular weight of its. PEG is water soluble, neutral, non-toxic, biocompatible and non-immunogenic, PEG has several bio-applications as and protein repellent surfaces and stealth drug carriers. In physiological media, it's allow a good solubility of bioactive compounds in addition to; prevents the adsorption of plasma proteins. And PEG side chains, can be used for building superior biomaterials. In recent years, polymeric based composite materials are being used in many applications, such as automotive, sporting goods, marine, electrical, industrial, construction, household appliances, etc. Polymeric composites have high strength and stiffness, light weight, and high corrosion resistance. The development of polymer system with high ionic conductivity is one of the main objectives in polymer research which resulted in blending of polymers, cross linking, insertion of ceramic fillers, plasticization etc. The lightweight composite materials can offer the impressive mechanical properties such as a high specific strength, stiffness and the relatively good energy absorbing characteristics. PVA is a semi crystalline polymer and has various interesting physical properties which are used for different applications.

2. EXPERIMENTAL PART

PVA and PEG solution were prepared by dissolving it in water by using magnetic stirrer. Bio composites of (poly vinyl alcohol and poly ethylene glycol -vegetarian lotion of willow) films are prepared by using casting method. The VLW was added to blend with different concentrations are (0, 4, 8 and 12) Vol %. The optical properties of are measured by using UV/1800/ Shimadzu spectrophotometer in range of wavelength (200-800) nm. The optical constants are very important because they describe the optical behavior of the materials. The absorption coefficient of the material is very strong function of photon energy and band gap energy.

Absorptance (A) is defined as the ratio between absorbed light intensity (I_A) by material and the incident intensity of light (I_o):

$A = I_A / I_o$ ……..…….……..(1)

The indirect transition for amorphous materials is:

$\alpha h\nu = B(h\nu - Eg)^r$ ……..…….…(2)

Where B is a constant, hυ is the photon energy, Eg is the optical energy band gap, r=2 for allowed indirect transition.

3- Fabrication of humidity sensors: The application of humidity sensor for (PVA-PEG-vegetarian lotion of willow) bio composites were prepared by precipitated the solution of these bio composites on glass slides dimensions $(2x2)cm^2$ after cleaning by ethanol and distilled water and left to dry mix for two days. Aluminum electrodes were deposition on the surface of the samples of (PVA-PEG-vegetarian lotion of willow) bio composites by using the vacuum evaporation system (Edwars Coating System -C) type. To examine the sample place in box and the water vapor was used as a source of humidity. The control network monitored and controlled variations in humidity. The capacitance for different humidity range (40-90) % was measured by using LCR meter type (HIOKI 3532-50 LCR HI TESTER).

3. RESULTS AND DISCUSSION

The variation of absorbance of bio composites with wavelength of different concentrations of additive is shown in figure.1. The figure shows that the absorbance of polymer blend is increased with the increase the concentrations of VLW, this is due to the vegetarian lotion of willow absorb some of the incident light.

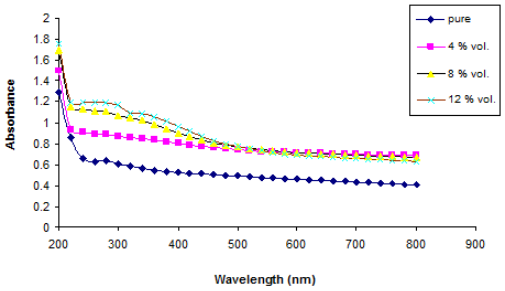

Figure.1. Variation of the absorbance of PVA-PEG- vegetarian lotion of willow bio composites with the wavelength

The bio composites have indirect energy gap as shown in figure.2, for allowed indirect transition of bio composites. The energy band gap of bio composites decreases with the increase of the concentrations for vegetarian lotion of willow, this behavior attributed to the increase of the localized level in energy band gap.

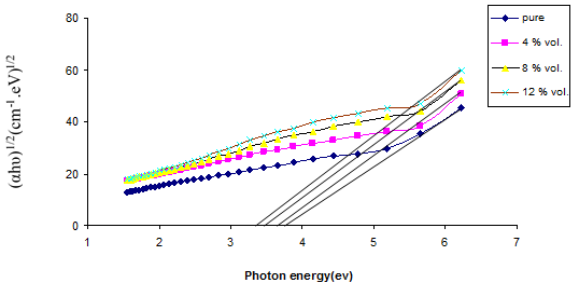

Figure.2. Relationship between $(\alpha h\nu)^{1/2}$ $(cm^{-1}.eV)^{1/2}$ and photon energy of PVA-PEG-vegetarian lotion of willow bio composites

Fig.3, shows the variation of capacitance of bio composites with the relative humidity (%RH). The capacitance increase with increase humidity, this is can be attributed to the mobility of the vegetarian lotion of willow which is binding force between it and polymer blend chains are weak in general; van der Walls forces of attraction.

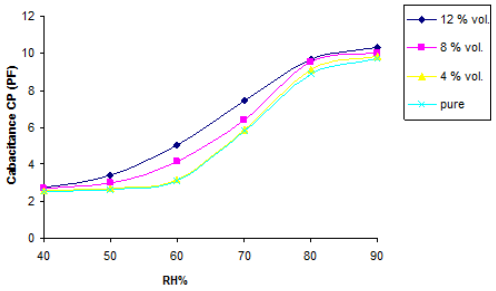

Figure.3. Variation of capacitance of (PVA-PEG-vegetarian lotion of willow) bio composites with relative humidity (RH%)

4. CONCLUSIONS

- The absorbance of bio composites increases with the increase of the concentrations of VLW.
- The energy band gap of bio composites decreases with the increase of the VLW concentrations.
- The capacitance of (PVA-PEG-VLW) bio composites increases with increase of humidity.

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