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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.

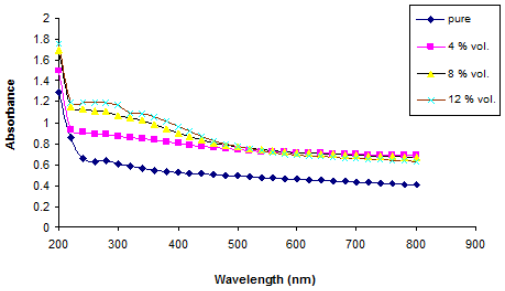

Figure.1. Variation of the absorbance of PVA-PEG- vegetarian lotion of willow bio composites with the wavelength

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.

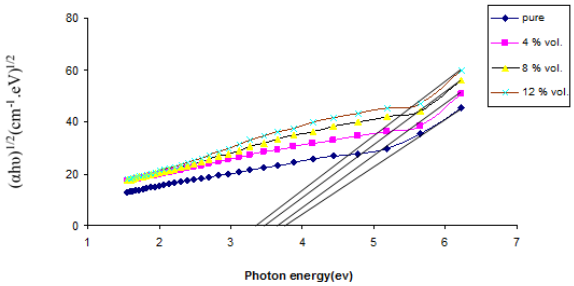

Figure.2. Relationship between $(\alpha h\nu)^{1/2}$ $(cm^{-1}.eV)^{1/2}$ and photon energy of PVA-PEG-vegetarian lotion of willow bio composites

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.

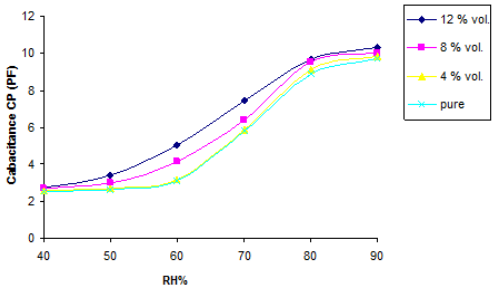

Figure.3. Variation of capacitance of (PVA-PEG-vegetarian lotion of willow) bio composites with relative humidity (RH%)

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.

REFERENCES

Abduljalil H, Hashim A, Jewad A, The effect of addition titanium dioxide on electrical properties of poly-methyl methacrylate, European Journal of Scientific Research, 63 (2), 2011.

Al-Ramadhan Z, Algidsawi A.J.K, Hashim A, The D.C electrical properties of (PVC-Al_2O_3) composites, AIP Conference Proceedings, 1400 (1), 2011.

Guravamma J, Sai Vandana C and Rudramadevi B.H, Structural and Optical analysis of Eu^{3+}, PVA polymer films, International Journal of Chem Tech Research, 7 (2), 2015.

Habeeb M.A, Hashim A, AbidAli A.R.K, The dielectric properties for (PMMA-LiF) composites, European Journal of Scientific Research, 61 (3), 2011.

Hadi S, Hashim A, Jewad A, Optical properties of (PVA-LiF) composites, Australian Journal of Basic and Applied Sciences, 5 (9), 2011.

Hashim A, Algidsawi A.J.K, Abduljalil H, Hadi S, Mechanical properties of (PVA-$CoNO_3$, $BaSO_4.5H_2O$) composites, European Journal of Scientific Research, 65 (2), 2011.

Hussien B, Hashim A, Jewad A, Electrical properties of polyvinylchloride - Zinc composite, European Journal of Social Sciences, 32 (3), 2012.

Hussien B, Kadham Algidsawi A.J, Hashim A, The A.C electrical properties of (PVC-Sn) composites, Australian Journal of Basic and Applied Sciences, 5 (7), 2011.

Ibrahim Agool R, Kadhim Kadhim J, Ahmed Hashim, Preparation of (polyvinyl alcohol–polyethylene glycol–polyvinyl pyrrolidinone–titanium oxide nanoparticles) nanocomposites, electrical properties for energy storage and release, International Journal of Plastics Technology, 20 (1), 2016, 121–127.

Jasim F.A, Hashim A, Hadi A.G, Salman R, Ahmed H, Preparation of (pomegranate peel-polystyrene) composites and study their optical properties, Research Journal of Applied Sciences, 8 (9), 2013, 439-441.

Jasim F.A, Lafta F, Hashim A, Ali M, Hadi A.G, Characterization of palm fronds-polystyrene composites, Journal of Engineering and Applied Sciences, 8 (5), 2013, 140-142.

Ji Chen Scott K. Spear, Jonathan G. Huddleston and Robin D. Rogers, Polyethylene glycol and solutions of polyethylene glycol as green reaction media, Journal of green. chem, 2005.

Kadham Algidsawi A.J, Hashim A, Kadham Algidsawi H.J, The effect of (LiF, $CuCl_2.2H_2O$) on mechanical properties of poly-vinyl alcohol, European Journal of Scientific Research, 65 (1), 2011.

Kadham Algidsawi A.J, Kadham H.J, Hashim A, Ali G.A.A.W, The dielectric properties of (PVC-Zn) composites, Australian Journal of Basic and Applied Sciences, 5 (11), 2011.

Kelley Britton Keys, Fotios Andreopoulos M and Nikolaos Peppas A, Poly(ethylene glycol) Star Polymer Hydrogels, Journal of Macromolecules, 31 (23), 1998.

Khatuaa C, Chinya I, Saha D, Das S, Sen R and Dhar A, Modified Clad Optical Fibre Coated With PVA/TiO_2 Nanocomposite For Humidity Sensing Application, International Journal on Smart Sensing and Intelligent systems, 8 (3), 2015.

Mayank Pandey, Girish Joshi M, Effect of DC-bias on electrical properties of polymer/Nafion composites, International Journal of ChemTech Research, 8 (10), 2015.

Mohanapriya M.K, Kalim Deshmukh, Basheer Ahamed M, Chidambaram K and Khadheer Pasha SK, Structural, Morphological and Dielectric Properties of Multiphase Nanocomposites Consisting of Polycarbonate, Barium titanate and Carbon Black Nanoparticles, International Journal of Chem Tech Research, 8 (5), 2015.

Muthuraj R, Misra M and Mohanty A.K, Studies on mechanical, thermal, and morphological characteristics of bio composites from biodegradable polymer blends and natural fibers, Journal of Bio composites, Design and Mechanical Performance, 2015.

Naveen Kumar SK, Gayithri KC, Kiran S, Fabrication and Characterization of High Performance Resistive Type Humidity Sensor based on ZnO/Pyrrole composite materials, International Journal of ChemTech Research, 7 (2), 2015.

Obed A, Paul M.W, Azzam A and Wei Li, Xiao H, Review of the Applications of Bio composites in the Automotive Industry, Journal of Polymer Composites, 2016.

Pradeepa P, Ramesh Prabhu M, Investigations on the Addition of Different Plasticizers in poly (ethylmethacrylate)/poly (vinylidene fluoride-co-hexa fluro propylene) Based Polymer Blend Electrolyte System, International Journal of Chem Tech Research, 7 (4), 2015.

Rabee B.H, Hashim A, Dielectric properties of (PS-BaSO4.5H2O) composites, European Journal of Social Sciences, 32 (3), 2012.

Rabee B.H, Hashim A, Synthesis and characterization of carbon nanotubes -polystyrene composites, European Journal of Scientific Research, 60 (2), 2011.

Rajeshwari P, Atomic Force Microscopy and Thermal Decomposition Behavior of Inorganic nanoparticle filled HDPE Nanocomposites, International Journal of Chem Tech Research, 7 (3), 2015.

Rashid F.L, Hashim A, Habeeb M.A, Salman S.R, Ahmed H, Preparation of PS-PMMA copolymer and study the effect of sodium fluoride on its optical properties, Journal of Engineering and Applied Sciences, 8 (5), 2013, 137-139.

Shahenoor Basha SK, Sunita Sundari G, Vijay Kumar K, Electrical conductivity, Transport and Discharge characteristics of a sodium acetate trihydrate Complexed with polyvinyl alcohol for Electrochemical cell, International Journal of ChemTech Research, 8 (2), 2015.

Shahenoor Basha SK, Sunita Sundari G, Vijay Kumar K, Optical, Thermal and Electrical studies of PVP based solid Polymer electrolyte For Solid state battery applications, International Journal of Chem Tech Research, 9 (2), 2016.

Sornakumar T, Ravindran D And Seshanandan G, Studies on Effect of Nano TiO_2 Ceramic Fillers of Polymer Matrix Composites, International Journal of ChemTech Research, 7 (2), 2015.

Usha Rani M, Ravishanker Babu, Rajendran S, Conductivity Study On PVDF-HFP / PMMA Electrolytes For Lithium Battery Applications, International Journal of Chem Tech Research, 5 (4), 2013.