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# Optical Properties of (Polystyrene-Wood Buckthorn Peel) Composites

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**Abstract:** In this research, samples of pure polystyrene and Polystyrene (PS) doped with Wood Buckthorn Peel (WBP) were prepared using casting method. The effect of addition of Wood Buckthorn Peel (WBP) concentration on optical properties of poly styrene have been studied in the wavelength range 200-800 nm. The absorption coefficient, energy gap, refractive index and extinction coefficient have been determined. The results show that the optical constants change with increase of WBP concentration.

**Key words:** Polymer, PS, Wood Buckthorn Peel (WBP), optical properties, absorbance, Iraq

## INTRODUCTION

Nature, as a best engineer and most ingenious designer, gives us a mysterious and economical world. Learning from the nature to solve the problem in our life has aroused more and more interests and bionics has become one of the frontier field of science in the 21st century (Tan *et al*., 2008; Geim *et al*., 2003; Gu *et al*., 2003; Blossey, 2003; Feng *et al*., 2002; Callies and Quere, 2005). As well known, amorphous Polystyrene (PS) is one of the most common plastics in modern chemical industry. A polymer of a particular group is characterized by the molecular weight of the monomer unit. To study the interactions in the solid state of the polymers of few models have been suggested. One such model treats a polymer as an aggregate of fairly stiff tubes held together in approximately parallel bundles of forces arising from particle-particle potentials. The structure of polymers has been related to internal pressure and the same study has been extended to polystyrene solutions. Some of the interesting properties of polystyrene like the Gruneissen parameter, specific heat and bulk modulus have also been reported (Durai and Ramadoss, 2004). Polystyrene (PS) is amorphous polymer with bulky side groups. General purposes PS are hard, rigid and transparent at room temperature and glass like thermoplastic material which can be soften and distort under heat. It is soluble in aromatic hydrocarbon solvents, cyclohexane and chlorinated hydrocarbons (Saeed, 2000). Many researchers succeeded to prepare PS as films deposited on various substrates such as glass or silicon wafer (Al-Ramadhann, 1996; Maebayashi *et al*., 2004; BaoLi and DuXin, 2007).

The aim of this research was prepared samples of Polystyrene (PS) and Polystyrene (PS) doped with WBP by using casting method and studied the optical properties of them.

## MATERIALS AND METHODS

The polymer was dissolved in distill water by using magnetic stirrer in mixing process to get homogeneous solution. The weight percentages of Wood Buckthorn Peel (WBP) are 2, 4, 6 (weight, %) were added and mixed for 10 min to get more homogenous solution, after which solution was transferred to clean glass petri dish of (5.5 cm) in diameter placed on plate form. The dried film was then removed easily by using tweezers clamp. The polymer systems were evaluated spectra photo metrically by using UV/160/Shimadzu spectrophotometer.

## RESULTS AND DISCUSSION

**The absorbance of composites:** Figure 1 shows the relationship between absorbance of PS-WBP composite with wave length from Fig. 1, it was appeared that the absorbance tends to decrease with the wavelength increasing.

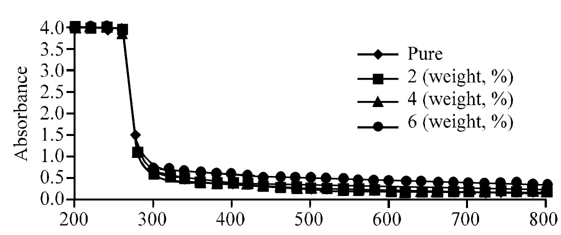


Fig. 1: The relationship between absorbance and the wave length of PS-WBP

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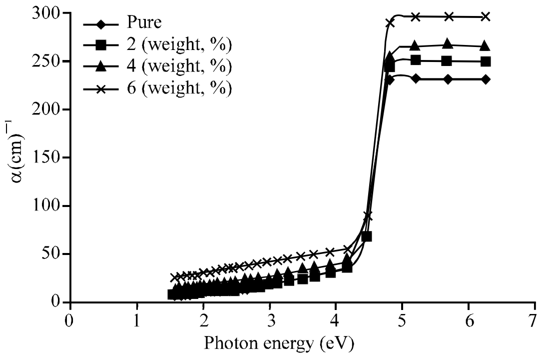


Fig. 2: The absorption coeffient of PS-WBP composite with photon energy

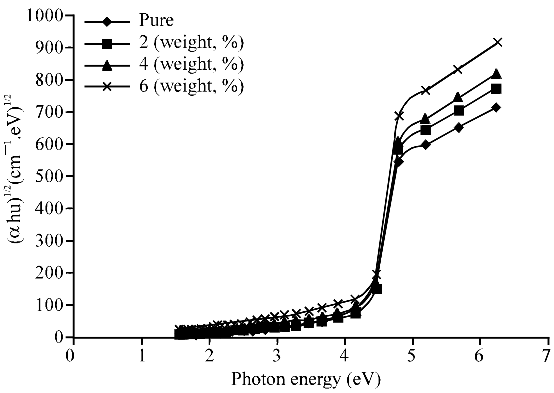


Fig. 3: Relationship between $(\alpha hu)^{1/2}$ (cm BaoLi$^{-1}$.eV)$^{½}$ and photon energy of PS-WBP composites

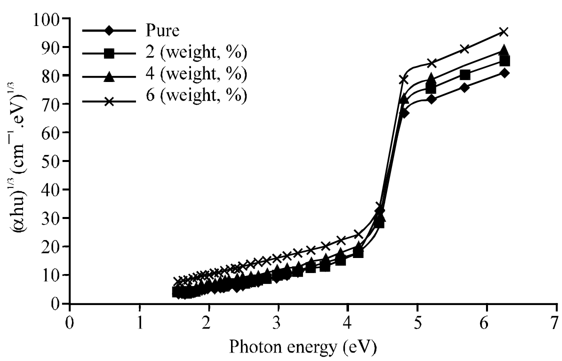


Fig. 4: The relationship between $(\alpha hu)^{1/3}$ (cm$^{-1}$.eV)$^{1/3}$ and photon energy of PS-WBP composites

Figure 2 shows the optical absorption spectrum of composite for different impurities quantities, it was found that the composite have a low absorption coefficient at a small photon energy then increase at different rates dependence on the composite structure. The pure sample had low absorption coefficient this may be as a result of low crystalinity.

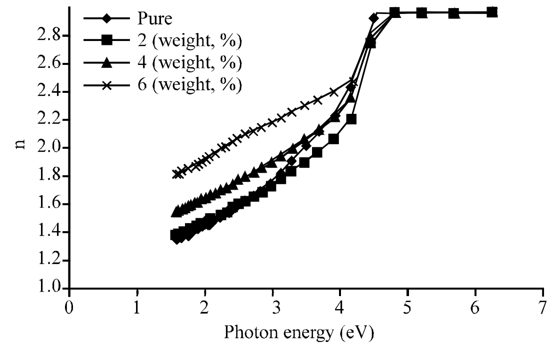


Fig. 5: The relationship between refractive index for (PS-WBP) composite with photonenergy

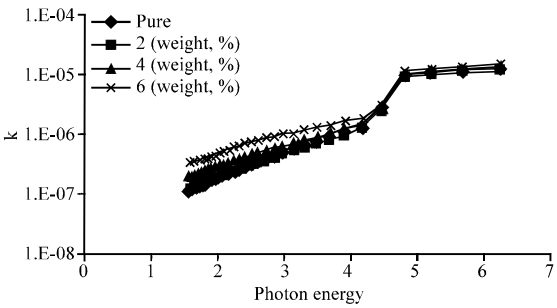


Fig. 6: The extinction coefficient of PS-WBP composites with various photon energy

Figure 3 and 4 represented the direct transition, the energy gab values dependence in general on the crystal structure of the composites and on the 6 arrangement and distribution way of atoms in the crystal lattice.

**Refractive index and extinction coefficient:** Figure 5 shows the variation of refractive index (n) with of the composite with a given photon energy the values increase exponentially with increasing photon energy. This increase indicates that the electromagnetic radiation passing through the material is faster in the low photon energy.

Figure 6 represent the variation of the extinction coefficient (k) with the incident photon energy in the Fig. 6 the variation is simple in the low energy region while the variation increased in the high photon energy region this behavior may be as a result to the variation of the absorption coefficient which leads to spectral deviation in the location of the charge polarization at the attenuation coefficient due to the loses in the energy of the electron transition between the energy bands.

**Dielectric constant:** Figure 7 and 8 represent the real and imaginary parts of the dielectric constant, respectively in the real part the variation is very clear spatially in the high

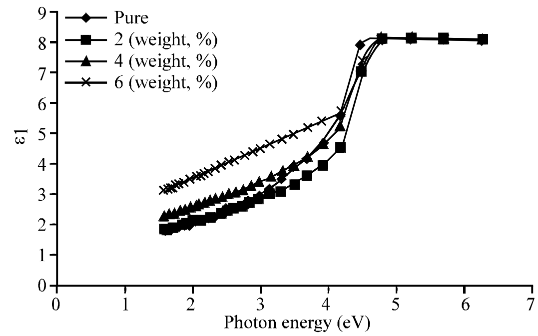


Fig.7: The variation of real part of dielectric constant PS-WBP with photon energy

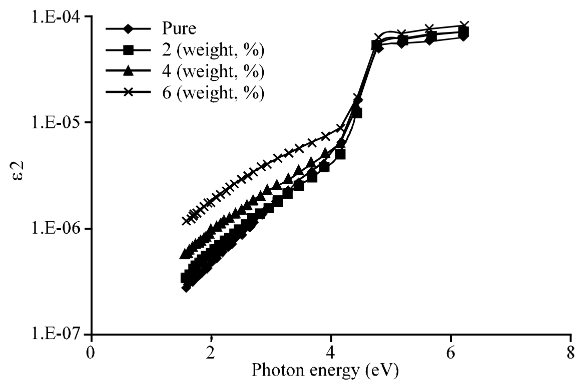


Fig. 8: The variation of imaginary part of dielectric constant of PS-WBP composite with photon energy

impurities concentration this may be due to the no resonance between the frequencies of the incident photon energy (electromagnetic and the induced dipoles in the composite) while in the imaginary part there is an absorption to the energy of the incident photon energy so the variation nearly constant until it reaches to the high photon energy. The pure composite shows the smaller variation

## CONCLUSION

Prepared films samples of pure and doped PS with WBP with different concentrations have been investigated for their optical properties, such as optical band gap, refractive index and extinction coefficient through transmittance and reflectane spectra. The optical constants such as the real (n) and imaginary (k) are parts of the complex refractive index, the real and imaginary parts of the dielectric constant were also determined.

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