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INFLUENCE OF ALIZARIN RED DYE ON SOME OPTICAL PROPERTIES OF (PVP: ZN) FILMS

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ABSTRACT

Thin films of polyvinylpyrrolidone /zinc acetate (PVP: Zn) of 1:1 doped with various concentration of alizarin red were prepared by cast method and characterized using x-ray diffraction (XRD) technique and FT-IR spectroscopy.

Optical absorption spectra of these thin films have been recorded in the wave length range (190-900)nm using UV-visible spectrophotometer.

The values of optical band gap with the variation of composition in the blend films have been found from 3.45 to 3.1eV.

Refractive index, extinction coefficient have been calculated at 500 nm wavelength in the region where the absorbance by the film is the maximum.

KEYWORDS: Optical Properties, Polyvinylpyrrolidone & Alizarin Red Dye

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INTRODUCTION

Polymers will be the materials of great interest for their low priced, easy process ability, low weight, high quality areas and easy fabrication of solid and thin samples etc.

Perhaps one of the most valuable properties of polymers is their capacity to inhibit electric conductivity as insulator, however now they are bringing in attention as performing polymers.

The approach of mixing of polymers is just about the center of interest because you can design the materials of required properties.

As there are significant technical applications of the synthetic polymers, it's important to explore the dynamics of the polymers in a variety of conditions. Polyvinylpyrrolidone (PVP) may have an ever-growing pharmaceutical importance and possesses good electric properties [1-4]. optical gab which can be greatly changed by impregnating it with suited mixing with other polymers. PVP has attracted a particular attention between the conjugated polymers due to its good environmental stableness, easy process situation and excellent transparency, PVP is a potential materials using a good charge storage space capacity and doping-dependant electric and optical properties, chemically PVP has been found to be inert non- dangerous and interestingly.

It displays a solid tendency for complicated formation with a multitude of smaller molecules (5-7).

Many materials put into polymers to be able to increase the properties of polymers (8,9).

Among these materials are dyes. Dyes widely used as lasers as effective materials when solution with preferred solvent.

The optical exploration of thin sample of the dye constitutes an important tool to improve its applications in optical filter systems, screen device and stable condition photovoltaic cell (10).

EXPERIMENTAL

pvp (0.1)gm and Zn acetate (0.1) gm were taken in the ratio of 1:1 by weight.

PVP powder of weight (0.1) gm were dissolved in (5) vol of ionized water to obtain solution of 2%wt/vol.

The mixture was heated to 600 C and shaken well by magnetic stirrer about 1 hour to obtain homogenous solution.

2% w/vol of zinc acetate was dissolved in water and added to the mixture.

Doped flms were fabricated by dissolving Alizarin red in ionized water of concentration(1.25,2.5,3.75) wt%. The measurements of absorbance and transmittance spectra in the wavelength range (300-900)nm were carried out using UV –CE 7200 spectrophotometer.

RESULTS AND DISCUSSIONS

Structural Parameters

Figure 1 shows the X-ray diffraction patterns of PVP: Zn/dye composites. The XRD of pure PVP exhibited the amorphous[11-13] nature of the prepared film due to appearance of broad diffraction peaks located at 2Ө value 110 and 210. The noticeable changes in terms of appearance of new peaks and improvement in intensity of some peaks were observed Zn/dye related peaks in doped composites.

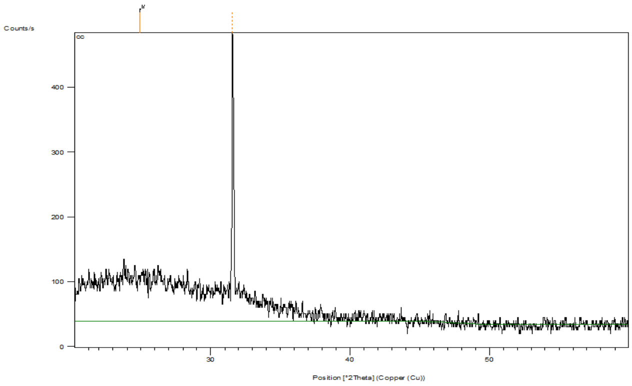

Figure 1: (1XRD Spectrum for PVP: Zn/Dye)

FT-IR Spectrum

The FT-IR spectrum was obtained with a FT-IR model 8400s spectrophotometer, under ambient condition.

Infrared spectroscopic studies were conducted to investigated the type of chemical bonding of PVP: Zn/dye.

The band observed at 3390 cm-1 is due to OH band, also the band at 2954 cm-1 is due to bending of aromatic C-H, and 1640 cm-1 is due to C=O band. The band at (1496,1423) cm-1 is due to symmetrical stretching of C=C armonic bands, 2139 cm-1 is due to Co2.

Figure 2 Shows the FT-IR Spectrum of PVP: Zn/dye

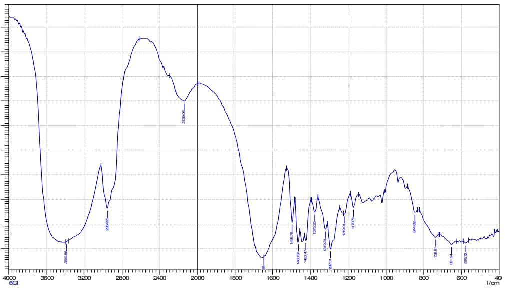

Figure 2: FT-IR Spectrum of PVP: Zn/dye

Optical Properties

However, in this paper we investigate the effect of incorporating additives or dyes, on the optical properties of PVP films. The purposes of this paper are reporting some of our results about the effect on optical constant of pure PVP as well as the doped PVP/Zn films with different concentrations Figure (3) shows the uv -visible spectra of undoped PVP and PVP: Zn doped with dye blend thin films.

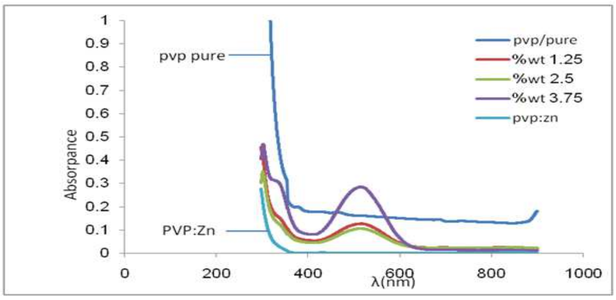

Figure 3: The Absorption Spectrum of PVP: Zn/dye

It is clearly increasing the concentration of dye in the polymer matrix leads to increasing the peak intensity and the beast ratio of the added dye to the polymer is 3.75 wt%.

The absorption coefficient α was determined near the absorption edge at different photon energies for all investigated thin films using the relation[14] :

$$\alpha=2.303\ A/t \qquad (1)$$

where A: is the absorbance of the filmt: the thickness of the film. Figure 4 shows the absorption coefficient as a function of photon energy of PVP:Zn/dye.

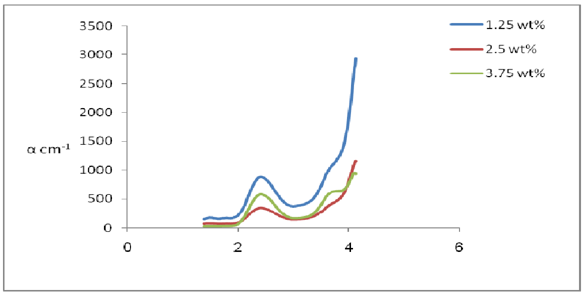

Figure 4: Absorption Coefficient Versus Photon Energy

The relationship between absorption coefficient and indirect energy gap can be written as [15-17].

$\alpha = \alpha o *[h\nu\text{-}Eg \pm Ep]r / h\nu$ for $h\nu > Eg$

$\alpha = 0$ for $h\nu \leq Eg$ (2)

were Eg and EP are respectively indirect energy gap, and the energy of the absorbed (+) or emitted (-) phonons. r has 2 values; 2 for allowed indirect transition and 3 for forbidden indirect transition.

The plot of αhν versus photon energy are shown in Figure 5. There are 2 straight line portions that are clearly seen in this curve. The lower energy line corresponds to the phonon absorption processes, and photon energy intercept at Eg+EP. The other line corresponds to the phonon emission processes and photon energy intercept at Eg-EP.

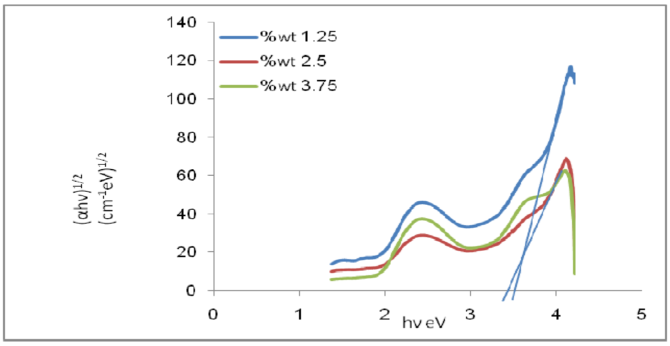

Figure 5: The Plots of(αhν)1/2 versus hν for PVP: Zn/dye

The values of E_{opt} so determined are listed in Table 1. The value of E_{opt} is 4.77 eV for pure PVP which is comparable with the reported value[18]. The E_{opt} value for the PVP: Zn/dye blends lie within the range(3.45-3.1) eV.

The extinction coefficient can be calculated by the relation[19]

$k = (\propto \lambda)/(4\pi)$ (3)

Where λ :is the wave length, α : is the absorption coefficient. Figure(6) shows the plots of extinction coefficient as a function of wavelength of PVP: Zn/dye.

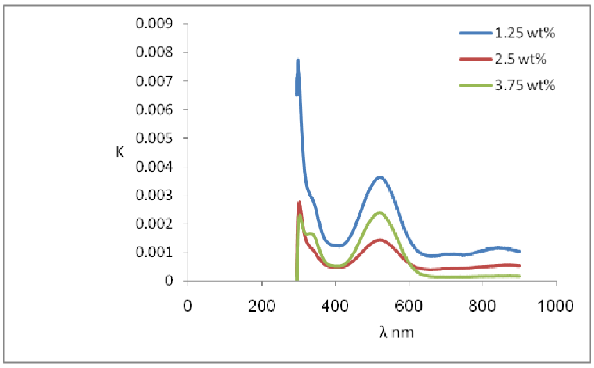

Figure 6: Dependence of the Mean Value of K on the Wavelength for PVP: Zn/dye

The refractive index of the films was calculated by the following equation for different concentration [20]

$$n = \frac{1+\sqrt{R}}{1-\sqrt{R}} \qquad (4)$$

where R:the reflectance and k:the extinction coefficient.

Figure (7) shows the variation index as a function of wavelength.

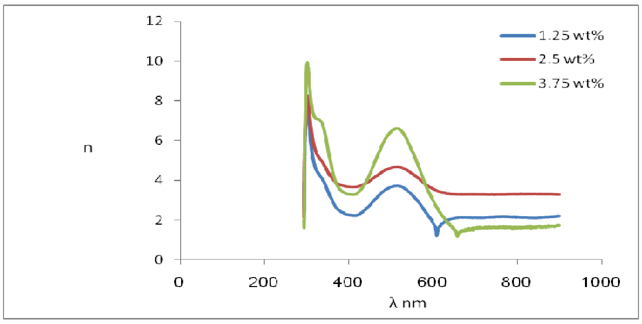

Figure 7: Dependence of the Mean Value of n on the Wavelength for PVP: Zn/dye

CONCLUSIONS

The observed variation in the optical parameters such as Eopt, extinction coefficient k, and refractive index n of PVP: Zn and their blend films, the optical absorption spectra showed that the absorption mechanism is indirect transition. The change in the optical band gap from 3.45 eV to 3.1eV makes this new blend PVP: Zn/dye used in optical devices. The XRD study reveals the crystalline nature of PVP: Zn/dye and their blend.

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