Refractive Indices Studies on PVA and PVP Blends

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Abstract— The present work explores the synthesis and optical properties of biodegradable solid polymer blends of Poly (vinylalcohol), PVA and Poly(vinylpyrrolidone), PVP blend films. The blend samples with different weight percentage were prepared by using the solution cast technique. The optical properties of pure PVA incorporated PVA and PVP blend has been determined by Refractive Index technique. The Refractive Indices decreases with increase in Wavelength and increasing concentration of PVP.
Key words: PVA, PVP, Refractive Index

I. INTRODUCTION

Polymers are playing significant role in all branches of science and industry today. Many notable advances in technology are taking place with new polymeric materials like blends, composites, etc. Polymer blends are plying important role in the technology development [1]. Polymer blending is one of the most important ways for the synthesizing &improving properties of new polymeric materials and it is a Useful technique for designing materials with a wide variety of properties. The manifestation of advanced properties depends up on the miscibility of blend [2]. Polymer blends are prepared by various techniques and among them solution blending technique is very simple [3]. Polymer blends are physical mixture of structurally different polymers [4].

The polyvinyl alcohol (PVA) and polyvinyl pyrrolidone (PVP) polymers were selected for the present work. Among the polymers, PVA has excellent physical properties such as mechanical strength, electrochemical stability, non-toxicity, good film-forming capability, and biocompatibility. It contains hydroxyl group attached to methanecarbons. These hydroxyl groups can be a source of hydrogen bonding. PVP is a vinyl polymer possessing planar and highly polar side groups due to the peptide bond in the lactam ring [4]. In this work, we spot light on the synthesis of polymeric blend and their optical characterization using Refractive indices measurement techniques.

II. MATERIALS AND METHODS

The PVA and PVP that has been used in this work has been procured in powder form from HIMEDIA Chemical, Mumbai and used without further purification. The solution cast technique used for the synthesis of pure polymeric films and their blends in various concentrations. Distilled water was used as a solvent for the preparation process. The solution was stirred at Room temperature to obtain homogeneous gel of polymeric materials. The gel so obtained was poured on glass plate over mercury pool. So that films with uniform thickness is obtained. The films were heated or cured for 24 hours at 60^{o}C, The films were then removed from the glass plate and stored in desiccators for further characterizations. .

The thickness of the prepared samples is measured using micrometer screw gauge, it is found in the range 200-410 micrometer.

III. CHARACTERIZATION TECHNIQUES

The developed biodegradable blends were characterized by using Refractive Index Measurement Technique as discussed below-

A. Refractive Index

Refractive index varies with wavelength (is occasionally called dispersion) which explains the optical behavior when electromagnetic waves passing through or propagate in the material. The refractive index is the most common optical property for an optical material as it plays a very important role in optical communication and designing of the optical devices. As it relates to the electronic polarization of ions and also the local field inside that optical material [5]. The refractive indices of films of pure PVA and composite films incorporated with PVP in different concentrations were carried out.

For measuring the refractive indices of Blends the Abbe's Refractometer has been used. The Abbe's Refractometer was first calibrated by measuring the refractive index of distilled water by using a monochromatic light source whose wavelength is589 nm .After calibration we measure the refractive index of pure PVA and composite films incorporated with PVP by using filters of different wavelength.

The refractive index 'μ(λ)' of optical transparent media varies with wavelength and its spectral behavior can be described by Sellmeier dispersion formula. The general form of the Sellmeier equation for the dispersion behavior of refractive index is given by[6]-

$$\mu^2 - 1 = \sum_i [A_i \lambda / (\lambda^2 - \lambda_i^2)] \qquad (1)$$

Where A_i is the strength of absorption resonance at correspondence wavelength λ_i.

IV. RESULT & DISCUSSION

A. Refractive Index

The current paper explores the refractive indices of pure PVA and PVA blend films incorporated with PVP were measured by spectroscopic measurements. The effect of doping PVP in various concentrations on the refractive index was seen. The refractive index of PVA film was increased after doping and it is decreased as the wavelength was increased which is represented in Fig. 1.and Fig. 2.

As we seen in above Fig.1 that the refractive index of PVA and PVP is decreases with increase in wave length the reason is explained by Sellmeier equation. According to this equation refractive index decreases with wavelength.

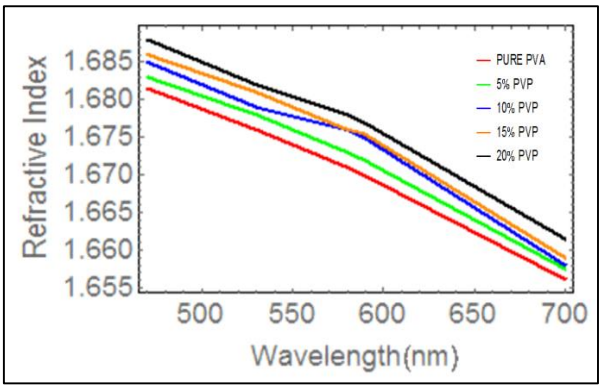

Fig. 1: Variation in Refractive index with wavelength for Pure PVA, and other PVP incorporated blends

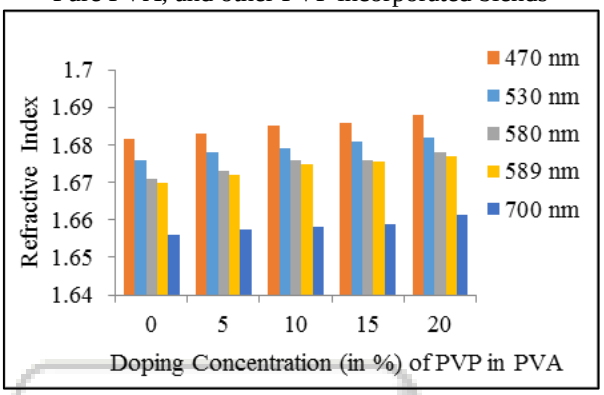

Fig. 2: Variation in Refractive index with Doping Concentration as a function of Wavelength.

V. CONCLUSION

In summary, we have prepared a biodegradable composite film of PVA and PVP. It is found that the refractive index in increasing with the concentration of PVP and it is maximum for 20wt% PVP concentration blend, while the refractive index is decreases with increase in wavelength which confirms the Sellmeier dispersion relation [6]. Finally, it is concluded that the incorporation of PVP in to the PVA matrix greatly enhances the optical properties of developed blend.

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