Summary

The introduction of new polymer needs many efforts in terms of production cost and marketing. So now a days improved polymer can be produced by blending and alloying the existing polymers. Combining polymers by blending or alloying can reduce the cost as well as development time. Blending and alloying of polymer is a powerful way to produce materials with desirable combination of properties which is not available with single polymer.

Mixing of two or more miscible polymers at their matrix level is termed as *Polymer Blends*, while composite can be defined as the combination of two or more different materials. A subclass of the composites consists of a polymer matrix and inorganic filler with dimension either micro or nano scale which is known as *Polymer composite*.

Benefits from blending and alloying include improvement in mechanical, electrical and thermal properties. Because the creation of blends and composites relies upon the use of existing polymers with well known characteristics, their development is considerably less costly than new-polymer synthesis. Applications of polymer blends are myriad, including automotive, aerospace, electronics, medical equipments, etc. Furthermore, thermoplastic polymer types and a range of composites based on them continue to replace metals, wood and ceramics. Polymer composites are used in a wide variety of products. Polymer composites have also been used for different kind of sensing applications.

Once the polymer blends and composites have been made, several analytical techniques are used to identify various characteristics like optical, thermal, mechanical, structural etc. of polymer blends and composites. The most important of these techniques include the common

spectroscopic methods such as Infrared, Raman, UV-Vis spectroscopy and others like Mechanical testing, Thermo gravimetric analysis (TGA).

The motivation behind this work is to study the influence of different blend and composite concentration on different properties of pure, blend and composite polymer films. And also study the spectroscopic correlation of different properties with spectroscopic results.

In the present work, we have made three different blends system and a composites system in different weight percentage as shown below.

- Polyvinyl Chloride (PVC) and Polymethyl methacrylate (PMMA) blends
- Poly Acrylamide (PAM) and Polyvinyl Alcohol (PVA) blends
- Poly Acrylamide (PAM) and Polyethylene Oxide (PEO) blends
- Polymethyl methacrylate (PMMA) and Titanium Dioxide (TiO_2) composites

Polyvinyl chloride (PVC) is one of the most important and widely used thermoplastic due to its valuable properties. But its main drawback is low thermal stability. Several polymers are mixed with PVC to overcome this deficiency. We here add poly methyl methacrylate (PMMA) as processing aids for PVC. Many researchers have been worked and reported on PVC/PMMA blend system. The present study involves the blending of PVC with amorphous and a rigid polymer, PMMA. PMMA might be expected to counter balance the fall in mechanical properties of PVC is attributed to the disruption in molecular packing of stiff and rigid chains of PVC. PMMA influences the matrix structure of PVC which in turn affects properties of PVC. We have studied here the change in different properties due to the intermolecular interaction between PVC

and PMMA polymers. We have correlated the change in the properties by different spectroscopic techniques results.

Poly acrylamide (PAM) is well-known hydrophilic polymer and has been greatly used in the field of agriculture and biomedical. Poly vinyl alcohol (PVA) is widely used as a basic material for a variety of biomedical applications. Blends of polyvinyl alcohol (PVA) with other polymers have been mechanically characterized by many researchers. Preparing Semi-interpenetrating polymer networks (semi-IPNs) of PAM and cross linked PVA to achieve strong and desired mechanical property are also studied. Thus, realizing the vital role of PAM and PVA in biomedical engineering, the present investigation aims to study the intermolecular interaction between two polymer networks and its effect on other properties of blends.

In recent years, studies on the electrical and optical properties of polymers have attracted much attention due to their applications in optical devices. The optical properties of polymers can be suitably modified by addition of dopants or other polymer with the host matrix. Polyacrylamide (PAM) is highly water-absorbent, forming a soft gel when hydrated. It is used in manufacturing of soft contact lenses, in potable water treatment industry etc. Polyethylene oxide (PEO) is becoming increasingly important in a variety of fields as the most suitable material for optical and electrical applications, because of its advantages such as water solubility, low glass transition temperature, large dipole moment, low cost, easy processability. Blend of PAM and PEO may be utilized in many applications established industrially due to their useful physical properties.

In recent years, studies on optical and electrical characteristics of polymers have fascinated much consideration in their application in optical and electronic devices. The optical properties of the

polymers can be correctly customized by the addition of dopant depending on their reactivity with host matrix. Incorporating inorganic particles into polymer matrix is a practicable way to obtain advanced materials of composites. Organic/inorganic composites materials have great consideration, because of their attractive potential application of traditional polymeric materials. Optical parameters (e.g. optical band gap, etc.) of poly methyl methacrylate (PMMA) depend on its molecular structure and they can be modified. Titanium dioxide or Titania (TiO_2) is a harmless white material widely used as an inorganic material, in photo electrochemical solar energy conversion and environmental photo catalysis (treatment of polluted water and air) including self cleaning and anti fogging surfaces. It is also commonly used as a high refractive index material in optical filter applications and sensors. In order to improve the performance of PMMA, TiO_2 particle was used to enhance different PMMA properties.

All blends and composite films were prepared by solution cast techniques. Mechanical, optical, structural, thermal properties and surface morphology of pure, blends and composites were studied. Effects of different concentrations on properties of blend and composites polymer films were also studied. Blend and composite films were characterized by TGA, SEM, FTIR, UV- Vis, Raman spectroscopy.

To identify the chemical nature of the polymer or to determine its composition, IR is a highly useful specific tool. For quantitative analysis of microstructure, stereo regularity, branching, or crosslinking, IR analysis is the simplest and most sensitive method. FT-IR spectroscopy is a powerful and potentially very widely applicable method for obtaining the dominance of the chemical functional groups, miscibility of the two polymers in the blend specimens. It helps in understanding the structure – property relationship in variety of polymers and gives quantitative approach, which can interpret the resulting data.

Raman spectroscopy of polymers also measures the vibrational energy levels. Raman spectroscopy has become the most important tool for the characterization of polymers. It may provide evidence of molecular interactions among polymer/ polymer or polymer/filler in addition to the functional groups.

UV- Vis Spectrophotometer studies will provide detailed information about the optical properties of polymer and polymer blends. Various optical parameters like optical band energy gap, absorption coefficient, absorption edge etc were calculated.

TGA is considered as the most important method for studying thermal stability of polymers. Moreover, the kinetics of the accompanied decomposition reaction has been reviewed. The weight of the sample decreases slowly as the reaction begins, then decreases rapidly over a comparatively narrow temperature range and finally levels off as the reactants are used up.

SEM is an important tool for polymer analysis, since it is extensively used to study fracture and failure mechanics, particles size and shape, filler orientation and dispersion in polymer matrices.

Mechanical properties of polymer blends and composites were carried out to study the Young's modulus (YM), Ultimate Tensile Strength (UTS), Stress at Peak load and Elongation at Break (EB).

The spectroscopic investigations on polymer and polymer blends using FTIR , Raman, UV- Vis and DSC studies enables us to understand the issues related to the processing and structure-property relationship for pure polymer and polymer blends/composites.