Chapter – 6

CONCLUSIONS AND FUTURE SCOPE
Chapter – 6. Conclusions and Future Scope

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The blends of Polystyrene and Exudated resin of Ailanthus Malabaricum tree with were prepared and subjected to rigorous and
comprehensive testing and characterizations. All the properties have been studied as a function of blend ratio. Polystyrene was successfully blended with Exudated resin of Ailanthus Malabaricum tree by solution casting method. The solvent transport behavior of Exudated Resin/Polystyrene blends has been studied. Benzene was used as the solvent for the entire swelling studies. The blend with 30 % of resin allows more amount of benzene to penetrate at different temperatures studied. The parameters of solvent sorption obtained for benzene in the blend with 40 % of resin exhibited a least dependence on the sorption temperature. For the 70/30 PS/ER blend, these parameters are found to decrease with temperature. At temperatures 35 °C and 55 °C the transport of benzene through the blend with 40 % of resin is found to be Fickian. For the other blends at various temperatures it is anomalous. Positive values of activation energies of diffusion and permeation are obtained in all the blend compositions. The calculated value of heat of sorption for the blends is also positive, and its variation among the different blends is within ± 2.0 kJ/mol. From the study of swelling properties, it can be concluded that there is a good compatibility between the two polymer phases in the blend 60/40 PS/ER which leads to a better resistance to solvent transport.

The thermal degradation of PS/ER blends was investigated using thermogravimetric method. The incorporation of elastomeric resin into polystyrene improved the thermal properties of polystyrene. All blend
systems show improved initial decomposition temperature upon the addition of resin to polystyrene phase and the effect of cross-linking on the thermal degradation of PS/ER blend was also investigated. The thermal stability of the blends is improved by increasing the interfacial interaction between elastomeric and polystyrene phases. The activation energies of degradation decreased with increase in elastomer content in polystyrene. An increase in activation energy was observed for the cross-linked PS/ER blend. Therefore more energy should be supplied to decompose the blend. The improved interfacial adhesion by the formation of strong interface upon cross-linking increases the thermal stability. X-ray diffraction studies show the reduction in crystallinity of the crystalline polystyrene as a result of resin addition. The formation of cross-links increased the amorphous nature of the material and hence decreased its crystallinity.

By the incorporation of elastomeric phase into polystyrene reduces the porosity of polystyrene as seen in figure. A better surface morphology is attained for the blend with 40 percent of elastomer. The amount of hard phase decides the tensile properties of the blend. In the present system the elastomeric phase is interpenetrated into the thermoplastic phase by blending. Consequently the morphology of the blend shows a better non porous manner. A fine dispersion of elastomeric phase in to hard polystyrene is seen in the blend with 40 % resin.
Blends of PS/ER with 40 % or more amount of polystyrene exhibited a higher mechanical property. This drastic change in mechanical properties is associated with the fully continuous nature of the polystyrene matrix in the blend. Tensile strength, Young’s modulus and hardness are higher for blends containing higher proportions of polystyrene. The modulus is also found to be higher for the blend with higher thermoplastic content. Due to the reduction in crystallinity of polystyrene by the addition of elastomer reduces the mechanical strength of the blend. From the various theoretical models is found that the Halpin-Tsai model fits better than other models studied with the experimental results.

To conclude, the prepared thermoplastic elastomeric blend is found to be immiscible with good mechanical and thermal properties. In essence, extensive investigation has been done on blending of ER with PS and on interaction between the phases of the blends in terms of their mechanical properties, thermal properties, morphology, solvent interaction etc. Based on these studies, it is found that the preparation of ER/PS thermoplastic elastomeric blend is beneficial for the development of cost effective polymeric materials for specific applications. By reinforcing nano-fillers, namely, carbon black and clay nano particles into this blend system, it can be used to prepare high performance thermoplastic elastomers for engineering and industrial applications.