

CHAPTER IV

CONCLUSIONS

The polybenzoxazine paper composites, based on both B-a and B-m polymers, show higher densities than the pure polymers. Comparing B-a and B-m polymers, the factor which affects density differences most are due to the molecular structure of the polymer main chains. In the case of paper composites, the interface between the paper and polymer is mainly responsible for the differences in density.

Water absorption mechanism can be explained in terms of two states, i.e. an initial state and an equilibrium state. In the initial state, the B-m polymer shows more water absorption than the B-a polymer due to the greater hydrophilicity of the B-m polymer, while at the equilibrium state the higher free volume of B-a is the main factor affecting water absorption.

The paper composites reveal higher water absorption than the pure polymer due to the hydrophilicity of the paper fiber used in the composites. However, the water absorption of paper fiber in the composites were far less than that of paper fiber only, owing to the protection offered by the polymer in the composites. At optimum soaking time and soaking temperature, the water absorption of the composites can be reduced.

The mechanical properties of benzoxazine paper composites show higher flexural modulus, stress and strain than that of the pure polymer system. The fiber used in the composites was found to play an important role

in the stress transfer mechanism and gave an improvement in mechanical properties over the pure resins.

Dynamic mechanical analysis reveals that benzoxazine paper composites have higher storage modulus and glass transition temperature than pure resin, due to the restriction imposed by the fiber, and the reduced mobility of resin in the composites. In the case of loss modulus, the paper composites exhibited more energy dissipation, which can be explained as the fiber/matrix interface acting as an additional source for energy dissipate.

SEM images of both dry and wet paper composites reveal the interfaces of the composites very well. In the wet composites, the fiber phase is found to swell significantly due to water. It can be concluded that the fiber is involved with the mechanical properties of the composites.