CHAPTER-2

MATERIALS AND METHODS
2.1 **INTRODUCTION**

Increased environment awareness and the interest in long term sustainability of construction materials have led to the development of environmentally friendlier alternatives to synthetic oil based FRP composites. In this regard, significant efforts have been directed to investigate the use of natural fibres as reinforcement in thermoplastics. Natural fibres such as wood fibres, wheat fibres, straw fibres, jute fibres and bagasses fibres have several benefits viz., low cost, low density, high toughness, acceptable specific strength properties, enhanced energy, recovery and biodegradability [1-5].

The use of natural fibres in plastic matrix leads to many benefits such as low volumetric cost, increase of heat deflection temperature, increase of stiffness of thermoplastics and improvement of fibre surface appearance. However, the main drawback of natural fibres may be their hydrophilic nature when compared to hydrophobic polymeric matrix. If no modification of fibre or compatibilization of the two materials is made, the weak interfacial adhesion between fibre and matrix usually results in poor mechanical properties of the composites. In the composite field, therefore, most of research has been focused on improving interfacial properties between the polymer matrices and natural fibres in order to enhance the physical and mechanical properties of the end products [6-7].

There are various methods of promoting interfacial adhesion in systems where fabric materials are used as reinforcements, such as graft co-
polymerization, plasma treatment, coating, surface modification and chemical treatment [8].

In the present work, the author modified the naturally occurring uniaxial fabric *Hildegardia Populifolia* by coating it with some polymers and polymer blends. The materials used and the methods followed in carrying out the present work are described in the present chapter.

### 2.2 MATERIALS

#### 2.2.1 FABRIC REINFORCEMENT

In the present work, the naturally occurring *Hildegardia Populifolia* fabric, which belongs to the family of Streculicaceae, was used as reinforcement. This fabric was procured from Bukkapatnam village of Anantapur dist, A.P, India. This fabric exists under the bark of the trunk and branches of the tree. The fabric is removed from the branches part of the tree so that the tree is protected. The tree grows to the height of 700 cm. The extracted fabric, which exists in naturally woven form, was washed and dried in the sun for a long time until the moisture was completely removed. The photograph of the *Hildegardia Populifolia* tree and fabric are presented in Fig.2.1.
Fig. 2.1 (a) The photographs of *Hildegardia Populifolia* tree and
(b) The photographs of Fabric
2.2.2 MATRIX

In the present work, PC and PS were used as the matrix components and PMMA is used with PC in the blend matrix. The PC was supplied by M/s Viral Rasayan Baroda. It is having a number average molecular weight of 25,000. The PS was supplied by M/s GSFC India, and it has a number average molecular weight of 90,000. The PMMA was supplied by M/s GSFC India, and it has a number average molecular weight of 98,000. The analytical grade common solvent Dichloromethane was used without purification. However, they were dried in vacuum to remove traces of moisture if any.

2.3 METHODS

2.3.1 SAMPLE PREPARATION

The performance of the matrix materials was studied by coating them on the fibres. As the natural fibres are made up of mainly crystalline α-cellulose and amorphous hemi-cellulose, it is customary to remove the hemi-cellulose component from the fabrics. For this, some of the fabrics were treated with 2% aquaex NaOH solution for 30 min. These fabrics were then washed thoroughly with distilled water and dried under the sun. As, *Hildegardia Populifolia* is available in fabric form, individual long fibres could not be separated from it. So, the fabrics were directly coated with polymer solutions using a TLC spreader and later the solvent was allowed to evaporate. The gap in the spreader was adjusted by trial and error method to ensure uniform thickness of the polymer coating on the fabric.
2.3.2 TENSILE STRENGTH

The tensile load at break of the coated and uncoated fabrics was determined using INSTRON 3369 Universal Testing Machine. The test was performed according to ASTMD 638 method at a crosshead speed of 5mm/min using a 50kg load cell. In each case, ten samples were used and the average values are reported. Using this instrument, the other tensile parameters - maximum stress, modulus and % of elongation at break were determined. A photograph of the UTM is presented in Fig.2.2.

2.3.3 MORPHOLOGY

The micrograms of the untreated and alkali treated fabrics were recorded by using JEOL JSM 820 scanning electron microscope at the Institute of Chemistry, Beijing, China. The samples were gold-coated by an electro-deposition technique to impart electrical conduction before recording the SEM. The optical micrograms of the fabrics were recorded using a Leica DMLP polarized optical microscope at Polymer Division, Central Leather Research Institute (CLRI), Chennai, Thamilnadu. Using this instrument, both bright field and Polarized Optical Micrograms were recorded.

2.3.4 CHEMICAL RESISTANCE

To study the chemical resistance of the composites, the test method ASTMD 543-87 was employed [9]. This method covers the testing of the resistance of all plastic materials including cast, hot molded, cold molded and laminates and describes the
Fig. 2.2. Photograph of Universal Testing Machine
procedure for reporting changes in weight, dimensions, appearance and strength properties by the action of chemical reagents. Standard reagents are specified to establish the results on a comparable basis and exposed to reagents at elevated temperature.

The author in the present work conducted chemical resistance tests on natural fabric *Hildagardia Populijolia* coated with some polymers and a polymer blend. The author judiciously selected three acids, three bases, and three solvents for this purpose. Glacial Acetic acid (8%), con Nitric acid (40%), con Hydrochloric acid (10%), con Ammoniumhydroxide (10%), aq Sodium carbonate (20%), aq Sodium hydroxide (10%), Toluene (250ml), Benzene (250ml), and Carbon tetrachloride (250ml) were used after purification. The water absorption by these composites was also studied.

In each case, the samples were pre-weighed in a precision electronic balance and dipped in the respective chemicals for 24 hours. They were removed and immediately washed in distilled water and dried by pressing them on both sides with the filter paper at room temperature. The treated samples were then re-weighed and the % of weight loss/gain was determined using the following formula. In each case, ten samples were tested and their average values are reported.

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\text{% of weight loss/gain of samples} = \left\{ \frac{\text{Original weight} - \text{Final weight}}{\text{Original weight}} \right\} \times 100
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The complete details of the experimental procedure adapted by the author were presented in each chapter.
REFERENCES


