

Evaluation of Mechanical Properties in Hemp Fiber Reinforced with Polymer Composites

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Abstract— The study is mainly concentrated on the reinforcement of the epoxy with natural hemp fabric. The hemp fabrics were obtained from the hemp plant by various methods by the textile industry to get fine quality of fabric. Than the density of hemp fabric is calculated by the water displacement method. The composite laminates are prepared for 60% of fiber and 40% of matrix by using Hand layup technique by varying thickness of 2.5mm and 6.5mm. After fabrication specimens were prepared according to the ASTM standards. The mechanical properties are determined as per the ASTM standards.

Key words: Composites, Hand Lay-Up, Epoxy, Hemp

I. INTRODUCTION

A composite material is composed of a combination of two or more micro or macro constituents that differ in chemical composition and which are essentially insoluble in each other. Natural fibre reinforced composites are eco-friendly to environment mostly natural fibre are biodegradable, renewable. Now a day’s natural fiber reinforced composites exhibits the higher mechanical properties than the man made synthetic fibre reinforced composites. The mechanical properties such as tensile strength, flexural strength and impact strength of the hemp fibre reinforced with epoxy composites can be determined.

II. PREPARATION OF THE COMPOSITE



Fig. 1: Mould design

Hand layup process is used for developing E-glass and Jute fiber reinforced polyester composites. The schematic form of hand layup technique is as shown in Fig.1. Initially Mould is cleaned using acetone, allowed it to dry and a thin layer of releasing agent (Polyvinyl acetylene) is applied on the mould. The same time woven fabric was cut to the required size (300×300 mm²). Polyester resin has been prepared by mixing accelerator (Cobalt) and catalyst (MEKP) of 2% each. Once a layer of resin was applied on the mould using bristle brush, woven roving placed on it and it was continued until all layers. The layers are consolidated and air bubbles are removed by squeezing using the hand roller and the mould was closed, allowed to cure for 24 hours. After laminate preparation, test specimens are cut into required dimensions. Results and Discussion

The use of composite materials in different field is increasing rapidly due to their improved properties scholars and engineers are working together to come out with higher purpose materials. In the present research natural fibres are reinforced with epoxy composites. The test specimens are prepared as per ASTM standards and the tensile test conducted by using computerized universal testing machine.

Samples	Tensile Strength (MPa)
2.5mm	22.29
6.5mm	30.27

Table 1: Tensile Strength of the specimens

The different composite specimen samples are tested in the universal testing machine (UTM) as per the ASTM standard D-3039. The samples are allowed to ultimate tensile strength. From tensile test data the stress-strain plot is generated to determine the ultimate tensile strength and elastic modulus of the composite material. The stress strain curve for different thickness of the composite specimen is shown in below figure 2 and 3. The result shows that 6.5mm thickness hemp epoxy composite specimen gives better tensile strength than the 2.5mm thickness.

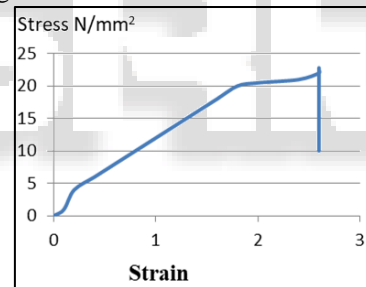


Fig. 2: Tensile strength of the 2.5mm thickness

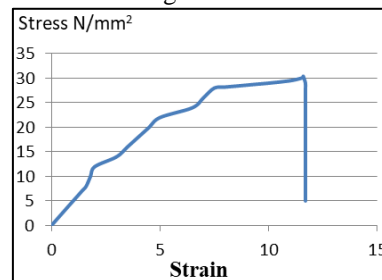


Fig. 3: Tensile strength of the 6.5mm thickness

III. CONCLUSION

The Hemp fabric reinforced with epoxy composite characteristics has been studied. The fibers were reinforced using epoxy resin by hand layup method. For different samples the laminates are obtained and the better mechanical properties are obtained in 2.5mm thickness compared to 6.5mm thickness.

It is observed that the tensile strength of hemp fabric for 2.5mm thickness and 6.5 thickness are 22.79MPa and 30.27MPa for volume fraction 60% fiber and 40% matrix.

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