Analysis the Mechanical Properties of Natural Fiber Reinforced Epoxy Composites

P. Ramesh
Assistant Professor
Department of Mechanical Engineering
Muthayammal Engineering College, Rasipuram, Tamil Nadu, India

S. Manikandan
U.G. Student
Department of Mechanical Engineering
Muthayammal Engineering College, Rasipuram, Tamil Nadu, India

S. Manivasagam
U.G. Student
Department of Mechanical Engineering
Muthayammal Engineering College, Rasipuram, Tamil Nadu, India

N. Manoj
U.G. Student
Department of Mechanical Engineering
Muthayammal Engineering College, Rasipuram, Tamil Nadu, India

S. Muthumani
U.G. Student
Department of Mechanical Engineering
Muthayammal Engineering College, Rasipuram, Tamil Nadu, India

Abstract

The natural fiber composites in India based on a two pronged strategy of preventing depletion of forest resource as well as ensuring good economic returns for natural fibers. Kenaf & Abaca based composite developed as substitutes for plywood & medium density fiber boards. In this project natural fiber composites fabricated, by combining materials of Kenaf & Abaca in chopped form by hand lay method. In this composite, Epoxy resin used as a matrix material. The NFR composite made in different fiber volume fraction such as 17.5% of Kenaf and 17.5% Abaca, 35% of Kenaf, 35% Abaca. The mechanical properties of this sample investigated according to the ASTM standards. From the result it observed that the 35% of Kenaf and 35% of Abaca fiber reinforcement showed the highest tensile strength and impact strength respectively among the other fiber volume fraction.

Keywords: Mechanical Properties, Kenaf/Abaca Fiber, Epoxy

I. INTRODUCTION

Fiber-reinforced polymer composites have played a dominant role a long-time in a variety of applications for their high specific strength and modulus. The manufacture, use and removal of traditional fiber–reinforced plastic, usually made of glass, carbon or aramid fibers–reinforced thermoplastic and thermosets resins are considered critically because of environmental problems. By natural fiber composites we mean a composite material that is reinforced with fibers, particles or platelets from natural or renewable resources, in contrast to for example carbon or aramid fibers that have to be synthesized. Natural fibers include those made from plant, animal and mineral sources. Natural fibers can be classified according to their origin.

Kenaf (etymology: Persian), hibiscus cannabin's a plant in themalvaceae family. Kenaf fibers are reinforced with epoxy resin to form fiber reinforced polymeric composites which improve the strength of the composites. Sisal fiber is fully biodegradable, green composites were fabricated with soy protein resin modified with gelatin. Abaca fiber were selected for their cheap rate and widely available.

II. COMPOSITES PREPARATION

Initially the pattern placed on the ground or table, paraffin (or) wax applied on the surface of the mold. Apply a coating of general epoxy resin on the surface and allow adequate time. ABACA fiber placed properly after it as the first layer. Then after adequate time the mixture of general EPOXY resin, araldite as a hardener and applied as a binding agents on the surface of the Abaca fiber. Again pour same mixture. Place the KENAF as the next layer over the resin. Again pours same mixture as required quantity. Abaca fiber placed after it as the last layer. Again pour same mixture as required quantity. Apply force to this arrangement using hydraulic press.

III. EXPERIMENTAL RESULT

Testing result of composite material the various test performed in mechanical testing are

- Tensile test
- Bending test
- Impact test

A. Tensile Test Result

Tensile testing of specimen prepared according to ASTM D 3039, using electronic tensile testing machine with cross head speed of 2 mm/min and a gauge length of 250 mm. The tensile modulus and elongation at the break of the composites calculated from the stress strain curve. Three specimens tested for each set of samples and the mean values reported. The kenaf sample gave good results when compared with the other samples.

Fig. 1: Tensile Test Specimen before Testing

Fig. 2: Tensile Test Specimen after Testing

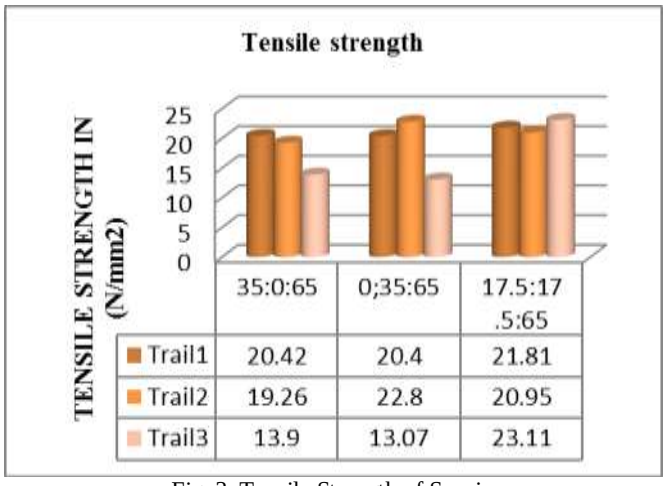

Fig. 3: Tensile Strength of Specimens

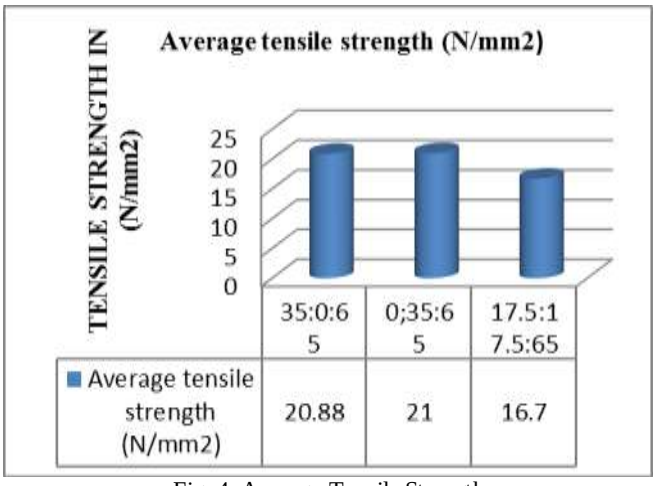

Fig. 4: Average Tensile Strength

B. Bending Test Result

Bending (also known as flexure) characterizes the behavior of a slender structural element subjected to an external load applied perpendicularly to a longitudinal axis of the element. The bending test performed according to ASTM D 790. 35% abaca sample gave a good result when compared with the other samples. The tested results are given below.

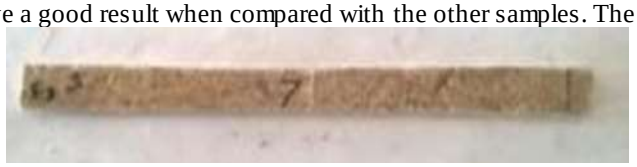

Fig. 5: Water Absorption Test Specimen Before Testing

Fig. 6: Water Absorption Test Specimen After Testing

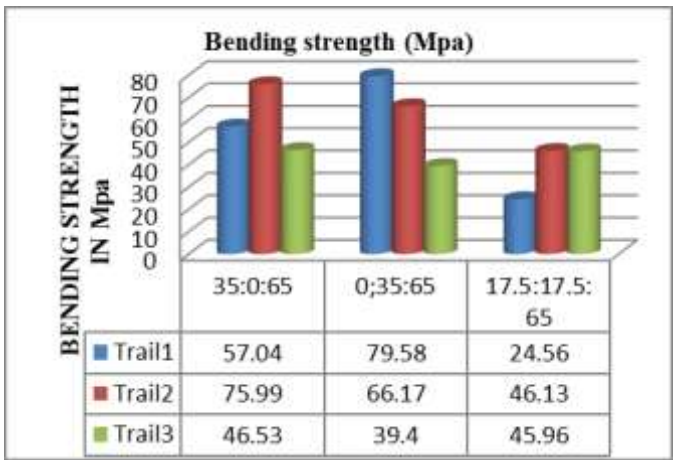

Fig. 7: Water Absorption of Specimens

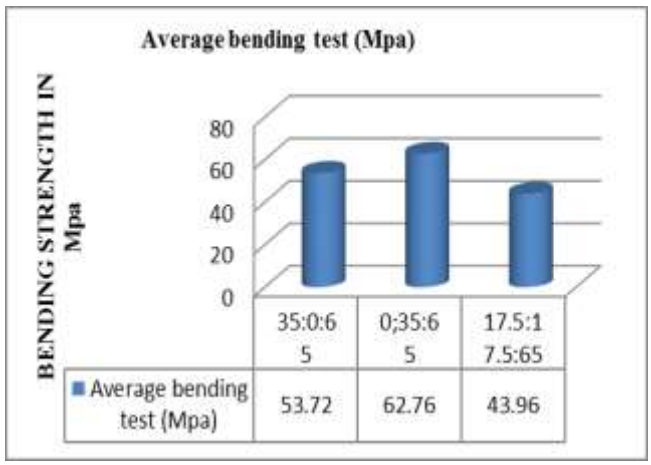

Fig. 8: Averages Water Absorption Strength

C. Impact Test Result

For analyzing the sudden load carrying capacity of the kenaf &sisal fiber reinforced composite samples an impact test carried out. The impact test performed according to ASTM D 256.The specimen clamped into the pendulum impact test fixture with the notched side facing the striking edge of the pendulum. The pendulum released and allowed to strike through the specimen. The tested results are given below.

Fig. 9: Impact Test Specimen before Testing

Fig. 10: Impact Test Specimen after Testing

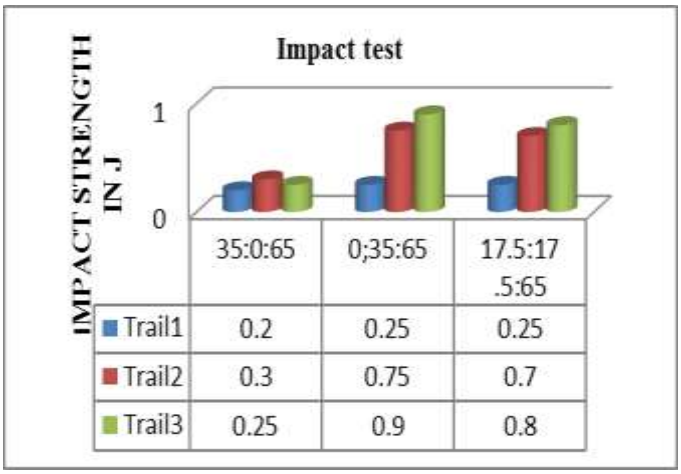

Fig. 11: Impact Strength of Specimens

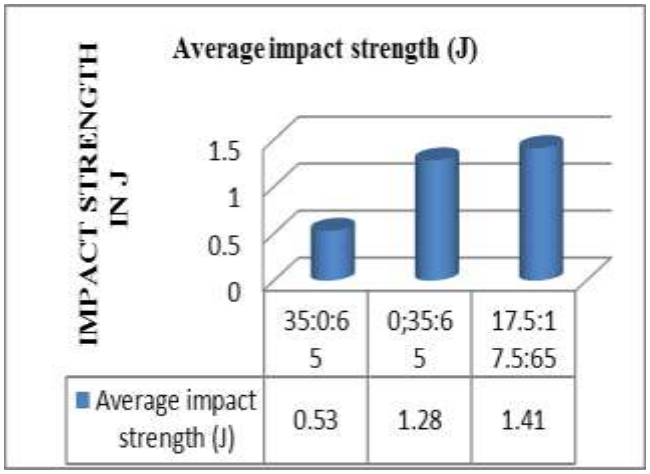

Fig. 12: Averages Impact Strength

IV. CONCLUSION

The Natural Fiber Reinforced Composites tested for its tensile strength, water absorption, impact strength as per ASTM D standard (tensile test-ASTM D3039, bending test-ASTM D 790, impact test-ASTM D256).The flexural strength found that highest 35% abaca fiber epoxy composite. The impact strength was found that highest 17.5% kenaf fiber and 17.5% of abaca epoxy composite. The tensile strength was found that highest 35% kenaf epoxy composite.

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