Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

TESTING AND ANALYSIS OF KENAF FIBRE REINFORCED POLYMER

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ABSTRACT

In recent days the nature fiber are plays vital role in replacement of Metallic Metals to decrease the weight of components. One of the applications of natural fiber is marine field. I have been selected the Kenaf fiber to analyze the water absorption behaviour. Kenaf fiber reinforced polymer composites is prepared and conducted the water immersion tests. A water absorption test has been conducted by immersing specimens in a de-ionized water bath at different conditions. Also the flexural and tensile test is also planned to conduct on prepared specimen. After the testing are completed the tensile and flexural properties of water immersed specimens are compare alongside dry composite specimens. The material is also analysed on the ANSYS software with the properties found from the experimental work. From this analysis I have been found that the kenaf fiber is an one of the best option for the purpose of wet condition field.

Keywords: Kenaf fiber, FRP, tensile strength, flexural strength, water absorption test.

INTRODUCTION

Fibers are a class of hair-like materials that are continuous filaments or are in discrete elongated pieces, similar to pieces of thread. They can be used as a component of composite materials.They can also be matted into sheets to make products such as paper or felt. Fibers are of two types: natural fiber which consists of animal and plant fibers, and man-made fiber which consists of synthetic fibers and regenerated fibers. The earliest evidence for humans using fibers is the discovery of wool and dyed flax fibers.

The most used plant fibers are cotton, flax and hemp, although sisal, jute, kenaf, bamboo and coconut are also widely used.Kenaf fibers are mainly used for ropes and aerofoils because of their high suppleness and resistance within an aggressive environment. For example, currently used as a seal within the heating and sanitary industries.

After World War II, the build-up of synthetic fibers significantly decreased the use of natural fibers. Now, with the increase of oil prices and environmental considerations, there has been a revival of natural fiber use within the textile, building, plastic and automotive industries.

Composite Material: Composite materials also called composition materials and that is shortened to composites. They are materials made from two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components. The individual components remain separate and distinct within the finished structure. The new material may be preferred for many reasons: common examples include materials which are stronger, lighter or less expensive when compared to traditional materials.

Typical engineered composite materials include:

- Composite building materials such as cements, concrete
- Reinforced plastics such as fiber-reinforced polymer
- Metal Composites
- Ceramic Composites (composite ceramic and metal matrices)

Composite materials are generally used for buildings, bridges and structures such as boat hulls, swimming pool panels, race car bodies, shower stalls, bathtubs, storage tanks, imitation granite and cultured marble sinks and counter tops. The most advanced examples perform routinely on spacecraft in demanding environments. The earliest man-made composite materials were straw and mud combined to form bricks for building construction.

Kenaf fiber: Kenaf (Hibiscus cannabinus L.) is a traditional, third world crop after wood and bamboo that is poised to be introduced as a new annually renewable source of industrial purpose in the so-called developed economies. Kenaf is a warm-season annual fiber crop growing in temperate and tropical areas.

It is related to cotton, okra, and hibiscus due to systematics. It is a fibrous plant, consisting of an inner core fiber (75–60%), which produces low quality pulp, and an outer bast fiber (25–40%), which produces high quality pulp, in the stem. The plant grows to a height of 2.7 – 3.6 m and is harvested for its stalks, from which the fiber is extracted.

Mankind has skillfully made use of kenaf from ancient times, traditionally as a rope, canvas and sacking. There are numerous advantages of using natural lignocellulosic fibers as reinforcements of the matrix. Especially,

Journal of Chemical and Pharmaceutical Sciences ISSN: 0974-2115

kenaf is well known as a cellulosic source with economic and ecological advantages. Kenaf exhibits low density, non-abrasiveness during processing, high specific mechanical properties, and biodegradability.

Recently, kenaf is used as a raw material to be alternative to wood in pulp and paper industries for avoiding destruction of forests, and also used as non-woven mats in the automotive industries. Kenaf has been deemed extremely environmentally friendly for two main reasons; (a) kenaf accumulates carbon dioxide at a significantly high rate and (b) kenaf absorbs nitrogen and phosphorous from the soil.

Fig. 1 Kenaf plant

Formation of Kenaf fiber: The formation of kenaf fiber is easily done with following processes

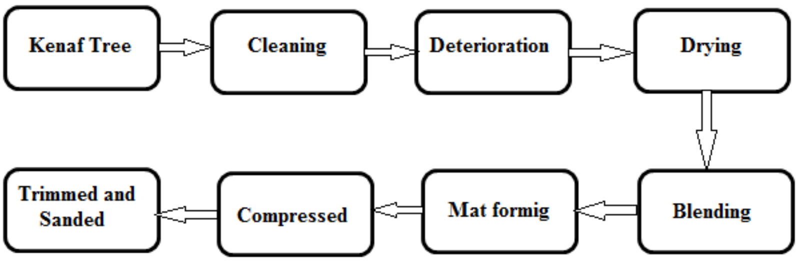


Fig. 2 Formation procedure

After finishing these processes the final fiber will look like the below figure.

Fig.3.Extracted kenaf fiber

EXPERIMENTAL SECTION

This chapter deals with which kind of method used for forming composite material and various type of methods used for testing the behaviour of prepared composite material.

The formation process is involves fiber combined with the resin. The type of resin used in this composite material is poly propylene.The strength of Kenaf fiber is increased with the addition of resin. The method used for forming the composite material is a compression molding process. Composite produced on this type of formation method is uses thermal energy to increase bonding capacity of composites.

The testing which are conducted in prepared specimens are follows

- Tensile test
- Flexural test
- Water absorption test

Compression Molding: This is a process in which a molding polymer is squeezed into a preheated mold taking a shape of the mold cavity and performing curing due to heat and pressure applied to the material.

The method is used mostly for molding thermosetting resins (thermosets), but some thermoplastic parts may also be produced by Compression Molding.

Compression molding process involves the following steps:

- A pre-weighed amount of a polymer mixed with additives and fillers (charge) is placed into the lower half of the mold.
- The charge may be in form of powders, pellets, putty-like masses or pre-formed blanks.
- The charge is usually preheated prior to placement into the mold. Preheated polymer becomes softer resulting in shortening the molding cycle time.
- The upper half of the mold moves downwards, pressing on the polymer charge and forcing it to fill the mold cavity.
- The mold, equipped with a heating system, provides curing (cross-linking) of the polymer (if thermoset is processed).
- The mold is opened and the part is removed from it by means of the ejector pin.
- If thermosetting resin is molded, the mold may be open in hot state – cured thermosets maintain their shape and dimensions even in hot state.
- If thermoplastic is molded, the mold and the molded part are cooled down before opening.

Tensile Test. Tensile test is a measurement of the ability of a material to withstand forces that tend to pull it apart and to what extent the material stretches before breaking.

The specimens were positioned vertically in the grips of the testing machine. The grips were then tightened evenly and firmly to prevent any slippage with gauge length kept at 50mm. Specimens for the Tensile Test are cut on a jig saw machine as per ASTM standards. The dimensional details of each type of specimen are presented in respective diagrams. Specimens are cut from laminas on a jig saw machine as per ASTM D 638 Standards.

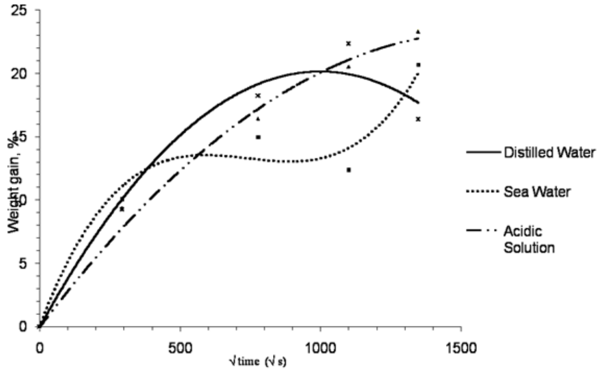
Flexural Test: Flexural strength is the ability of the material to withstand bending forces applied perpendicular to its longitudinal axis. Sometime it is referred as cross breaking strength where maximum stress developed when a bar-shaped test piece, acting as a simple beam, is subjected to a bending force perpendicular to the bar. There are two methods that cover the determination of flexural properties of material: three-point loading system and four point loading system. As described in ASTM D790, three-point loading system applied on a supported beam was utilized.

Water absorption Test: The increase in mass of laminates immersed in water for a period of 4 weeks. It can be seen that the kenaf fiber reinforced laminates, for any fiber volume fraction, absorb significantly more water than those made with the glass fibre. Additionally, as seen by Rouison for hemp fiber reinforced polyester, the mass increase of the kenaf fiber reinforced laminates increases with increasing fibre volume fraction in contrast to that of the glass fibre reinforced laminates.

RESULTS AND DISCUSSION

Theresults of the material are found with experimental testing and the major behaviour weight gain by the prepared material. These values are compared with the normal materials.

These two graphs are shows the behaviour of material and from that we can know the kenaf fiber is a one of the better natural fiber among all kind of natural fiber. Because it have the mechanical properties at its better value and we can suggest it for its excellent properties.



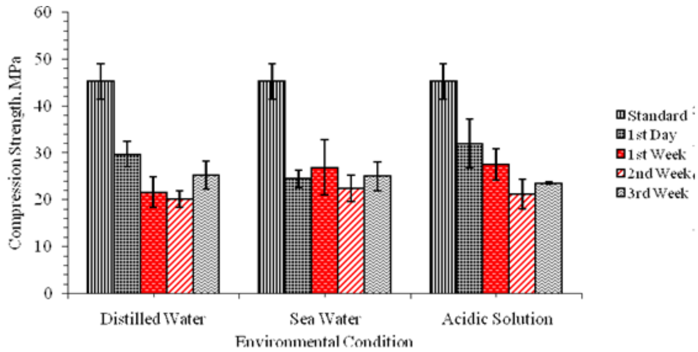


Fig.5 Weight gained by specimen **Fig.6 Compression Strength**

ACKNOWLEDGMENT

Authors wish to express their sincere thanks to chairman and Managing Director of Mailam Engineering College Shri. M.DHANASEKARAN M.A., M.Ed., D.Ag., D.F.T., and secretary Shri.V.SUGUMARAN, for providing the opportunity and facilities to undertake the project. The authors would also like to Dr. S.SENTHIL, M.Tech., Ph.D., Principal, Mailam Engineering College for his kind permission to work on this project and providing facilities for the effective execution of this project. Finally, we thank Microlab Chennai for providing all he facilities for conducting required testing on prepared material.

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