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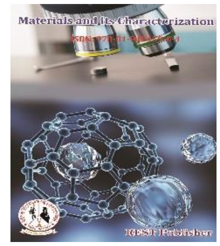

Natural Fiber Reinforced Polymer Composites: Impact of Chemical Treatment

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Abstract: *Over the past few decades, composite materials have become increasingly important in a variety of engineering applications. Researchers are now concentrating their efforts to find eco-friendly materials to replace traditional or existing damaging materials. For the current issue, the readily available natural material is best, however their qualities must be researched for a variety of uses. The naturally occurring Ridge gourd (Luffaacutangula) is chosen in this suggested study as reinforcement for creating the composite material. Chemically treated and untreated reinforcement are evaluated for the composites' mechanical properties, and composite specimens are made by altering the weight percentage. This essay tries to concentrate on the impact of chemical treatment on the improvement of the mechanical properties of natural fibre reinforced composite. the automated by performing the various tests, the behaviour of the composites has been examined. The ASTM standard is followed in the preparation of the composite specimens..*

Keywords: *Composite material, Ridge gourd (Luffaacutangula), Chemical treatment.*

1. INTRODUCTION

Composite materials provide a number of advantages over traditional materials, including increased specific strength, stiffness, and fatigue properties that allow for more flexible structural design. Composites are materials made of weaker materials embedded with stronger load-bearing material, or reinforcement (known as matrix). In order to support the structural load, reinforcement offers strength and stiffness. The reinforcement's position and orientation are maintained by the matrix or binder (organic or inorganic). matrix, reinforcement, and high moisture absorption Chemical processing has been used to enhance surface qualities and boost adhesion in order to overcome these drawbacks. Because natural fibres are biodegradable, affordable, readily available, and have a low density compared to all synthetic fibres, they are attractive to researchers. Comparing synthetic fibre to conventional materials, the former has a higher stiffness and strength to weight ratio. Poor adhesion between the fibres in natural fibre composites is one of their main drawbacks The processing of natural fiber reinforced polymer composites have been increased in recent years by increasing strength through chemical modification by eliminating foreign materials include wax, lignin, hemicellulose content in the fiber. Different chemical treatments can be done in natural fiber to modify their properties. Some treatments used to promote the adhesion by chemically coupling the adhesive to the material such as alkaline, silene and acrylic acid [1]. Srinivasa C. V etal [2] examined the areca fibers from the areca husk were alkali treated with potassium hydroxide (KOH) to obtain better interfacial bonding between fiber and matrix. The treated composite specimen posses superier mechanical properties when compared to untraeted areca fibers. The chemical treatment in the coconut sheath fiber, the cellulose content was increased, but hemicelluloses, lignin and other materials content was decreased compared to untreated (raw) coconut sheath fiber [3]. O.M.L. Asumani etal [4] presented the article on the effect of alkali treatment combined with three-aminopropyltriethoxysilane treatment of kenaf fibres improves the tensile and flexural properties of kenaf fibre reinforced polypropylene composites. Alfa fiber act as on of the prominent natural fiber the alkali treatment of fibers Alfa improves the quality of the fiber/matrix interface. Alfa fibers are comparable to other natural fibers used as reinforcement in polymer matrices. They are completely suitable for use as reinforcement in composites[5]. M.M. Kabir et al. [6] examined the various different surface treatments applied to natural fibres for advanced composites applications, the chemical treatment is an essential processing parameter to reduce hydrophilic nature of the fibres and thus improves adhesion with the matrix. The effect of chemical treatment on the mechanical properties of sisal fibre reinforced polyester composites was investigated KOH treatment on the sisal fiber results in greater mechanical properties [7]. The influence of chemical treatment on the flax fibers are also done and revieved the strength properties of the untreated fiber posses lesser values to enhance adhesion [8]. The Ridge gourd (Luffaacutangula) have been fabricated with Epoxy resin CY-230 and HY-951and treated with alkali treatment to get greater mechanical properties than the treated ridge gourd fiber [9]. The simultaneous effects of coupling agents on the mechanical, morphological, and water sorption properties of luffa fiber (LF)/polypropylene(PP) composites were analysed In order to enhance the interfacial interactions between the PP matrix and the luffa fiber [10].

2. EXPERIMENTAL

2.1 Matrix Material: The matrix material selected here is Epoxy 103 resin with HY951 hardner as the binder for the resin.

2.2 Natural Fiber: Ridge angled gourd, or angled loofah (Luffaacutangula) is a cucurbitaceous vegetable originated in sub-tropical region of Asia. Ridge gourd is generally monoecious in nature with pistillate (female) flowers borne in axil of flowers and staminate (male) flowers in raceme. Luffaacutangula is a tropical plant belonging to the family of Cucurbitacea, with a fruit possessing netting like fibrous vascular system. The Luffaacutangula strut are characterized by a micro cellular architecture with continuous hollow microchanels which forms a vascular bundles and yield a multimodal hierarchical pore system. Luffa sponge is a light-weight natural material which has the potential to be used as an alternative sustainable material for various engineering applications such as packaging, acoustic and vibration isolation, and impact energy absorption.

FIGURE 1. Outer core open as mat

FIGURE 2. The portion used for making composite

2.3 Surface Treatment : The Alkali treatment of cellulosic fibers is also called mercerization it is the usual method to produce high quality fibers. The Alkali treatment will improve the fiber-matrix adhesion due to the removal of natural and artificial impurities present in the fiber. The alkali treatment will reduces the fiber diameter and thereby increases the aspect ratio thus the development of a rough surface topography and enhancement in aspect ratio offer better fiber-matrix interface adhesion and an increase in mechanical properties. The Alkali treatment increases the surface roughness resulting in better mechanical interlocking and the amount of cellulose exposed on the fiber surface and it increases the number of possible reaction sites and allows better fiber wetting. Surface Treatment of the natural fibers was performed by rinsing the fibers in 10% NaOH solution for one hour and followed by washing with distilled water repetedly. The NaOH treatment removed wax and fatty substances and changed surface topography of the fibers.

2.4 Preperation of The Specimen:

2.4.1 Mould: A mould made up of EN31 steel of dimension 180*160*3 mm is prepared. Casting of the composite materials is done in this mould is done by compression moulding technique.

2*.4.2 Specimen:* The Epoxy resin 103 and the hardener HY-951 is mixed with a ratio of 10:1. This solution is used as Matrix and the different types of natural fibers are used as reinforcements. the types of composites manufactured are untreated single layer, double layer, triple layer and the alkali treated single layer, double layer, triple layer with different weight ratio.

3. RESULTS AND DISCUSSION

3.1 Tensile Test:

The different tensile strength of different layers of specimens are as shown in the figure below

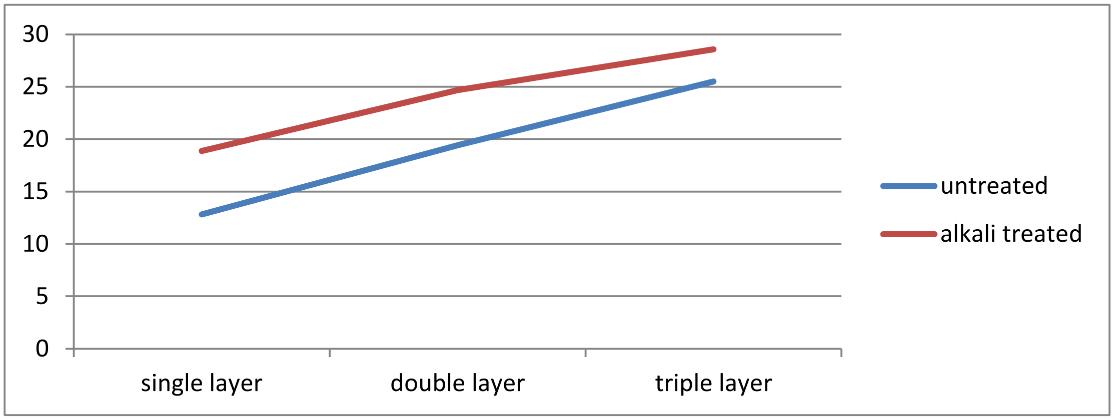

FIGURE 3. Tensile Test

The figure represent the variation of tensile strength of the composites with the different weight percentage of the reinforcement. The graph have been plotted taking weight fraction of different layer fiber along the X-axis and Tensile strength (MPa) along the Y-axis. The tensile strength of specimen increases on the triple layer. The alkali treated triple layer specimen posses higher tensile strength of 29MPa.

3.2 Hardness:

The hardness value of both the untreated and alkali treated composite specimens with different layers are as shown in the figure below. The hardness was measured on the equipment Shore durometer which is used to measure the hardness for the composite material specimens. From the graph it shows the triple layer specimen shows the greater hardness.

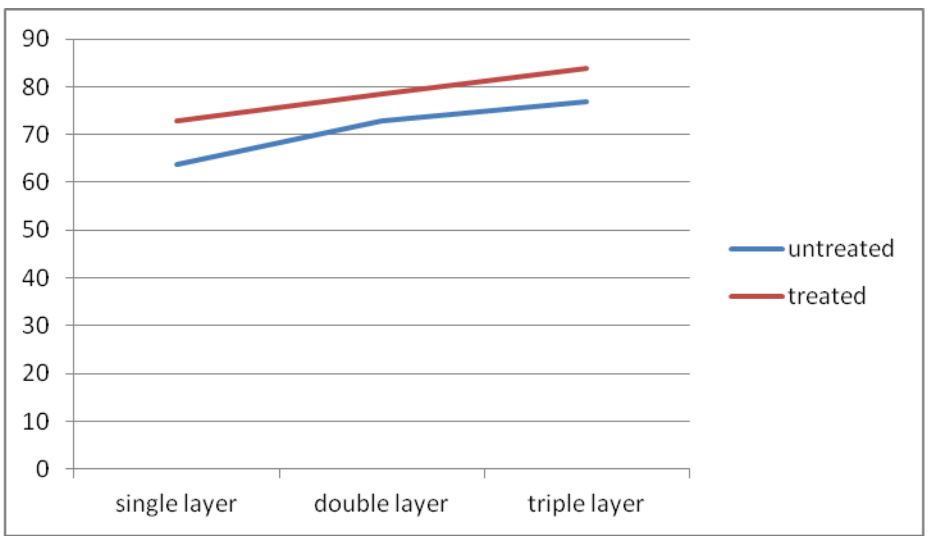

FIGURE 4. Hardness

4. CONCLUSION

In the present work the Ridge gourd (Luffaacutangula) / epoxy reinforced composites has been prepared by compression moulding method by using alkali treated and untreated fiber. The composite specimens are prepared with different weight percentage for single layer, double layer and triple layer for both alkali treated and untreated fiber. The specimens are prepared by ASTM standards for different mechanical testing and the tested results are tabulated. The alkali treated composite specimen shows greater mechanical properties compared to the untreated one. The alkali treated triple layer specimen posses greater and high properties because the chemical treatment will increase the interfaces between the fibre and matrix material. From the result it is identified that specimens with chemical treated shows more strength than the untreated.

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