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INVESTIGATION OF LUFFA FIBER REINFORCED EPOXY MATRIX COMPOSITES – STUDY ON ITS PROPERTIES AND EFFECTIVE UTILIZATION

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ABSTRACT

In an area of increasing pollution and environmental degradation, it has become imperative to manufacture products that do not affect the environment. In the field of composite materials, Natural fiber, such as, luffa possess good reinforcing capability when properly compounded with polymers. The fiber is relatively inexpensive, originate from renewable resources and have high strength as others. Development of a simple manufacturing technique for luffa fiber composites that minimises fiber degradation and can be used in developing countries, is the main objective of our study. This paper deals with preparation and investigation of bio based composites of natural fibre in epoxy resin. Natural fibre used here luffa which are mixed with epoxy resin. This composite is manufactured using compression moulding process. Mechanical properties of each composite with and without treatment are determined through tensile, flexural, impact tests.

Keywords—luffa fibres, Compression moulding method

1. INTRODUCTION

Composite materials 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. This composites can be preferred because stronger, lighter or less expensive when compared to traditional materials.

GREEN COMPOSITES

Fiber reinforced polymeric composites have been used for a variety of structural applications because of their high specific strength and modulus compared to metals. Initially developed for the aerospace industry, high-performance or 'advanced' composites are now found in applications from automotive parts to circuit boards, and from building materials to specialty sporting goods. Most composites currently available on the market are designed with long-term durability in mind and are made using non-degradable polymeric resins, such as epoxies and polyurethane, and high-strength fibers, such as graphite, aramids, and glass. Many of these polymers and fibers are derived from petroleum, a non-replenishable commodity. The push now is to use composites in place of common plastics in consumer products to improve performance and reduce weight and cost.

With increasing of population and more uses of products and recording double digit growth of world wide disposing of wastes are so critical as well as expensive.Because some of the composites are made using two dissimilar materials, they cannot be easily recycled or reused. Most composites end up in landfills, while some are burnt after use, although there are some efforts to recycle or reuse them. Both these disposal alternatives are expensive and wasteful, and may causes to pollution. In addition, landfills are decreasing in number, making less space

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available to discard waste. Many applications, e.g. secondary and tertiary structures and those used in consumer products for casing, packaging, etc., do not require the high mechanical properties that advanced composites possess.

2. CONSITUENTS OF COMPOSITE

Green composites consists of following elements are given below

- Natural fiber
- Filler materials
- Resins

Natural fiber:

These natural fibers are low-cost fibers with low density and high specific properties. These are biodegradable and nonabrasive, unlike other reinforcing fibers. Also, they are readily available and their specific properties are comparable to those of other fibers used or reinforcements.

Filler materials:

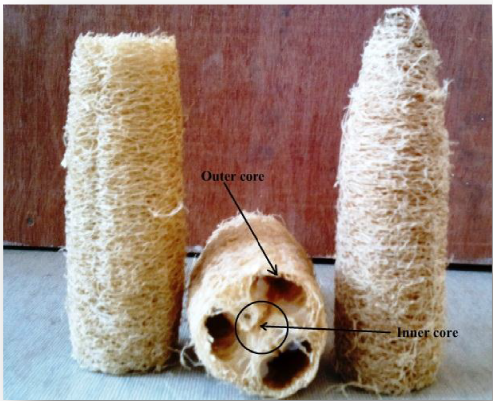
Fillers are particles added to material plastics, composite material, concrete to lower the consumption of more expensive bindermaterial or to better some properties of the mixture material.

Resins:

The resin is one of the bonding material for mating together of fibers to each other permanently. Resins are valued for their chemical properties and associated uses, such as the production of varnishes, adhesives and food glazing agents.

Luffa fiber:

Luffa is a genus of tropical and subtropical vines in the cucumber (cucurbitaceae) family. The luffa are not frost-hardy, and require 150 to 200 warm days may be allowed to mature and used.



Epoxy Resin:

Epoxy resins, also known as polyepoxides are a class of reactive pre-polymersand polymers which contain epoxide groups. Epoxy resins may be reacted cross-linked either with themselves through catalytic homopolymerisation, or with a wide range of co-reactants including poly-functional amines, acids and acid anhydrides, phenols, alcohols, and thiols. These co-reactants are often referred to as hardeners or curatives, and the cross-linking reaction is commonly referred to as curing.

3. TESTING PROCESS

- Tensile test
- Impact test
- Flexural test

TENSILE TESTING MACHINE

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Tensile testing utilizes the classical coupon test geometry as shown below and consists of two regions: a central region called the gauge length, within which failure is expected to occur, and the two end regions which are clamped into agrip mechanism connected to a test machine.

FLEXURAL TESTING

This is much more problematical. The results obtained are essentially dependent on the type of compression fixture used. Also, the gauge length is conical, as if it is too long, the specimen willbuckleandflex, resulting in premature failure. If it is too short, then the proximity of the tabs will adversely affect the stress state, resulting in artificially high values. The most widely used compressive test technique is the Celanese fixture, shown below. Cylindrical in design, a small specimen sits within a set of trapezoidal grips, encased in collars and an alignment shell. The gauge length depends on the type of test material and varies between 12.7mm for longitudinal specimens and 6mm for transverse specimens. Again, it is a good idea to tab the specimens.

HARDNESS TEST

Hardness is resistance of material to plastic deformation caused by indentation. Sometimes hardness refers to resistance of material to scratching or abrasion. In some cases relatively quick and simple hardness test may substitute tensile test. Hardness may be measured from a small sample of material without destroying it. There are hardness methods, allowing to measure hardness.

Tensile test

	CS Area [mm²]	Peak Load [N]	%Elongation	UTS [N/mm²]
Min	39.000	686.043	1.385	17.589
Max	39.000	686.043	1.385	17.589
Avg	39.000	686.043	1.385	17.589
Std Dev.	0.000	0.000	0.000	0.000
Variance	0.000	0.000	0.000	0.000
Median	39.000	686.043	1.385	17.589

Flexural test

	CS Area [mm²]	Peak Load [N]	Flexural Strength (MPa)	Flexural Modulus (GPa)
Min	39.000	57.634	46.551	2766.902
Max	39.000	57.634	46.551	2766.902
Avg	39.000	57.634	46.551	2766.902
Std Dev.	0.000	0.000	0.000	0.000
Variance	0.000	0.000	0.000	0.000
Median	39.000	57.634	46.551	2766.902

4. CONCLUSION

The environmental benefits of utilizing left over products have offered options instead of using new fibers ,where it could increase the demand of new natural material and high energy consumption. Therefore, the awareness of environmental issues

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through the use of eco-friendly material that is locally available and easily renewable.

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