Study of properties of Aegle Marmelos Reinforced Composite Fiber

Rohit Kumar
Guided by- Mr. Piyush Tiwari
Mechanical Engineering Department
C.V. Raman University Bilaspur C.G.
e-mail - rohitcdr@gmail.com

Abstract— Natural particulate and natural fibre composites have attracted substantial importance as a potential structural material. Different types of composite have different characteristics depends up on their composition. The fundamental properties of composite material is that they are cheap and eco friendly. Composites are low cost light in weight, biodegradable and renewable and completely or partially recyclable. Due to these attractive properties of the composite material there is a need to further explore the possibility of new natural particulate to be used as reinforcement in polymer composites. In this paper, Aegle Marmelos (locally known as Bel) is taken as natural fiber for analyzing. This paper mainly concentrates on made to prepare and study the mechanical and environmental behaviour of Aegle Marmelos Reinforced Composite Fiber. This paper also focuses on evaluation of the mechanical properties like impact strength of Aegle Marmelos fiber composites using different tests.

Keywords- C*omposite material , Aegle Marmelos fiber, Izod Impact test and tensile test.*

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I. INTRODUCTION

Composite is a combination of two or more materials (mixed and bonded) on a macroscopic scale. Generally, a composite material is composed of reinforcement (fibers, particles, flakes, and/or fillers) embedded in a matrix (polymers, metals, or ceramics). The matrix holds the reinforcement to form the desired shape while the reinforcement improves the overall mechanical properties of the matrix. When designed properly, the new combined material exhibits better strength than would each individual material.

Natural fibres are classified on the basis of the origin of source, into three types

1. Plant Fibres
2. Mineral Fibres
3. Animal Fibres

1. *Plant Fibres:* Plant fibres are usually consists of cellulose: examples cotton, jute, bamboo, flax, ramie, hemp, coir, banana and sisal. Cellulose fibres are used in various applications. The category of these fibres is as following: Seed fibres are those which obtain from the seed e.g. Kapok and cotton. These fibres have superior tensile properties than the other fibres. Because of these reasons these fibres are used in many applications such as packaging, paper and fabric. Fruit fibres are the fibres generally are obtained from the fruit of the plant, e.g. coconut fibre. Similarly, stalk fibre are the fibres which are obtain from the stalks (rice straws, bamboo, wheat and barley). Leaf fibres are the fibres those are obtained from the leaves (banana and sisal). Skin fibres are those fibres which are obtained from the bast or skin surrounding the stem of the plant.

2. *Mineral Fibres:* Mineral fibres are those which are obtained from minerals. These are naturally obtained fibre or somewhat changed fibre. It has different classifications they are taking after: Asbestos is the main characteristically happening mineral fibre. The Variations in mineral fibre are the serpentine, amphiboles and anthophyllite. The Ceramic filaments are glass fibre, aluminium oxide and boron carbide. Metal filaments incorporate aluminium strands.

3. *Animal Fibres:* Animal fibre by and large comprises of proteins; cases, silk, alpaca, mohair, downy. Animal hairs are the strands got from creatures e.g. Sheep's downy, goat hair, horse hair, alpaca hair, and so forth. Silk fibre is the filaments gathered from dry saliva of bugs or crawling creatures throughout the time of planning of cocoons.Composites of natural fibre used for drives of structural, but typically with synthetic thermo set matrix which of course bound the environmental benefits. Nowadays natural fibre composites applications are usually found in building and automotive industry and the place where dimensional constancy under moist and high thermal conditions and load bearing capacity are of importance [2, 3]. Natural fibres like cotton, sisal, jute, abaca, pineapple and coir have already been studied like a reinforcement and filler in composites. Among various natural fibres, banana fibre is considered as a potential reinforced in polymer composites due to its many advantages such as easy availability, low cost, comparable strength properties etc. Generally, natural fibres consist of cellulose, lignin, pectin etc.

II. LITERATURE SURVEY

Natural fibers may enhance mechanical properties of Polymers with some considerations and improvement to the surface characteristics natural fiber. There are several factors related to the natural fibers which influence the performance of the composites such as the composition of all the elements, Moisture absorption, impurities, orientation, and volume fraction.

Most of the industrial and manufacturing parts are exposed to tribological loadings such as adhesive, abrasive, etc. in their service. Therefore, tribological performance of materials becomes an essential element to be considered in design mechanical parts. In other words, understanding the tribological behavior of natural fiber/polymer composites has an equal role to be considered with the mechanical properties of those materials [26]. Nevertheless, less work has is found on the effects of natural fibers on the tribo-performance of polymeric composites in the literature. Some studies have been emphasized that the teratology behavior of composite polymers based on the natural fiber is not intrinsic behavior and it strongly depend on many processing's parameters such as operating parameters, characteristics of polymer martial, physical and interfacial adhesion properties of fiber, additives and contact condition. Few works have been attempted to investigate the tribological behavior of polymeric composites based on natural fibers such as Kenai [1], Oil palm [2], Sisal [2], Cotton [3], Jute [3], Betel nut [4], Bamboo [5]. Polymers have displayed different teratology behaviors with different type of natural fibers. In general, one can say that after certain sliding distance, steady state can be achieved.

III. EXPERIMENTS

3.*1.**Removal of fiber*

1.Taking bel according to record quantity from natural tree of bel.
2.Break the outer shell of bel and remove the inner matter.
3. For separation of real fiber from the inner matter, wash it normally chilled water and then boiled water.
4.take out the fiber from washing tank.

3.2`Preparation Of Fiber

1 For. good quality of fiber it will be washed for tow to three times
2.weted fiber are drying by naturally with sunrays for 24 hours.
3.after the drying process it will be packed in air shield packet to protect from moisture
.

3.3.Mixing of fiber with epoxy and hardener and making a composite

The composite is made by lay-up procedure where all the processes are done without any machine all by worker himself. The epoxy is made in matrix form and stirred with the fibre and poured in mould for casting.

IV. TESTING AND RESULTS

4.1. Tensile test

The samples prepared for tensile test had a dimension as per ASTM: D638-10. The samples were tested at a crosshead speed of 10mm/min, using UTM, at the room temperature. The Tensile test determines the overall strength of a given object. In it, the specimen is fitted between two grippers and load is applied slowly which pulls the object apart until it breaks.

Weight of fiber	Tensile strength (M Pa)
20 %	18.31

4.2. Flexural test

The Flexural method measures the behaviour of materials subjected to simple beam loading. It is also called as transverse beam test. It plays a very important role in structural application purposes. To determine the flexural strength of composites a three-point bending test was carried out as per ASTM D790-03 procedure. The samples were tested at a crosshead of 10 mm/min,

Weight of fiber	Flexural strength (MPa)
20%	48.28

4.3. Validation of the experimental results

Validation of the experimental results is carried out using regression analysis. In this work, one factor analysis has been carried out with a single factor, weight of the fiber (W). Regression equations are modelled with the experimental results to identify the relation between the input parameter 'w' and the responses, tensile strength and flexural strength, given in the equations 5.1 to 5.6.

$$Ts= 5.195 + 0.9324*A – 0.014*A2$$
$$Fs=28.235- 2.506*A + 0.1752* A2$$

4.4. IMPACT TEST

Samples of Aegle Marmelos composite fibers dimensions 67.5mm x 3mm x 10mm with weight 20% were taken to find the impact strength. The samples taken were fabricated in cris cross orientation as mentioned above in preparation of composites.

After fabrication, the test specimens with notch angle 0.5^o were subjected to impact test as per ASTM standard. The standards followed are ASTM D256 for impact test.

Weight of sample fiber	J	J/m	Kg.cm/cm
20%	1.82	606.666	61.8630

CONCLUSION

When the density of fiber is increased then the hardness of composite material is increased. Weight of fiber increases then the tensile strength is also increases. Proper chemicals must be selected while using composites in application according to the need. Proper precaution is needed for the mixing of fiber, epoxy and hardener for better result. The flexural strength properties is greatly influenced by the density of fiber.

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