Experimental and Analysis of Clutch Plate by using juliflora Fiber and banana fiber with Epoxy Composites

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Abstract-Automobile Clutch plates performance on contact conditions at the pad to disc interface. The aim of this study is to analyze the effect of different material composition on friction & wear of Clutch Plate material.The review of paper is to represent a general study on the alternative material for the clutch plate material. In the present work, juliflora fiber and banana fiber reinforced epoxy composites were developed. The effect of fibre loading varying from on the mechanical properties of bamboo fibre and chicken feather epoxy composite was studied. The study of mechanical properties of the composites was also investigated.

1.INTRODUCTION

In order to converse natural resources and economize energy, reduction of wear has been the main focus of automobile manufacturers in the present scenario. Weight reduction can be achieved primarily by the introduction of better material, design optimization and better manufacturing processes. The introduction of composite materials was made it possible to reduce the weight of clutch plate without any reduction on wear capacity and stiffness. Since, the composite materials have more elastics strain energy storage capacity and high strength to weight ratio as compared with those are being replaced by composite clutch plate.

1.2 CLUTCH PLATE

A **clutch** is a mechanical device that engages and disengages the power transmission, especially from driving shaft to driven shaft.

Clutches are used whenever the transmission of power or motion must be controlled either in amount or over time (e.g., electric screwdrivers limit how much torque is transmitted through use of a clutch clutches control whether automobiles transmit engine power to the wheels). In the simplest application, clutches connect and disconnect two rotating shafts (drive shafts or line shafts). In these devices, one shaft is typically attached to an engine or other power unit (the driving member) while the other shaft (the driven member) provides output power for work. While typically the motions involved are rotary, linear clutches are also possible. In a torque-controlled drill, for instance, one shaft is driven by a motor and the other drives a drill chuck.

2. SELECTION OF MATERIALS

This chapter describes the details of processing of the composites and the experimental procedures followed for their mechanical characterization. The materials used in this work are

- juliflora fiber
- banana fiber
- epoxy resin

2.1 JULIFORA FIBER

Juliflora, also known as Prosopis juliflora, is a tree species native to South and Central America. The tree is known for its tough and durable wood, as well as its fiber, which has various uses. The fiber of the juliflora tree is obtained from the bark and is commonly known as mesquite bark fiber. It is a strong and coarse fiber that is resistant to moisture, making it ideal for use in outdoor products. The fiber can be processed using different methods, such as hand-spinning or machine spinning. Hand-spinning involves separating the fiber from the bark, carding and combing it, and then spinning it into thread or yarn. Machine spinning involves using machines to extract and spin the fiber. The juliflora fiber is commonly used for making rugs, carpets, mats, ropes, and twines. It is also used in the production of paper, as well as for stuffing in pillows and cushions.

In recent years, there has been a renewed interest in juliflora fiber as a sustainable and eco-friendly material. This has led to a revival of traditional techniques for processing the fiber, as well as the development of new methods for using it.

Today, juliflora fiber is primarily produced in South and Central America, with countries such as Mexico, Guatemala, and Peru being major producers. The fiber is also starting to gain popularity in other parts of the world as an eco-friendly alternative to synthetic materials

Juliflora Fiber Mechanical Properties Values

Juliflora, also known as Prosopis juliflora, is a plant species that has been studied for its potential as a source of natural fiber. The mechanical properties of juliflora fiber can vary depending on various factors such as the growth conditions, harvesting methods, and processing techniques. However, here are some typical values for juliflora fiber mechanical properties:

Tensile strength: 350-500 MPa

Tensile modulus: 9-12 GPa

Elongation at break: 2-4%

Flexural strength: 120-150 MPa

Flexural modulus: 4-6 GPa

It's important to note that these values are only rough estimates, and may vary depending on the specific properties of the juliflora fiber being studied.

2.2 BANANA FIBER

Banana fiber, a lingo cellulosic fiber, obtained from the pseudo-stem of banana plant (Musa sepientum), is a bast fiber with relatively good mechanical properties. The pseudo-stem is a clustered, cylindrical aggregation of leaf stalk bases. Banana fiber at present is a waste product of banana cultivation and either not properly utilized or partially done so. The extraction of fiber from the pseudo stem is not a common practice and much of the stem is not used for production of fibers. The buyers for banana fibers are erratic and there is no systematic way to extract the fibres regularly. Useful applications of such fibres would regularize the demand which would be reflected in a fall of the prices.

Chemical composition of banana fibers	
Cellulose (%)	60-65
Hemi cellulose (%)	6-19
Lignin (%)	5-10
Pectin (%)	3-5
Ash (%)	1-3
Extractives (%)	3-6

Banana fibers have highly strength, light weight, smaller elongation, fire resistance quality, strong moisture absorption quality, great potentialities and biodegradability. Banana fiber has recognized for apparels and home furnishings Banana fiber has great potentialities for paper making special demand of handmade paper. Banana fiber is making products like filter paper, paper bags, greeting cards, lamp stands, pen stands, decorative papers, rope, mats and composite material etc. Banana fiber is used in currency notes in Germany and trial run in India also. Polypropylene reinforced with banana fiber is used by automobile companies for making under floor protection panels in luxurious cars like Mercedes.

Mechanical properties of banana fibers	
Tensile Strength (Mpa)	529-914
Specific Tensile Strength (Mpa)	392-677
Young’s Modulus (Gpa)	27-32
Specific Young’s Modulus (Gpa	20-24
Failure Strain (%)	1-3
Density (Kg/m3)	950-750

2.3 EPOXY RESIN

Epoxy Resins Epoxy resins have been commercially available since the early 1950’s and are now used in a wide range of industries and application

Epoxies are classified in the plastics industry as thermosetting resins and they achieve the thermo set state by means of an addition reaction with a suitable curing agent.

3.MECHANICAL PROPERTY TESTS

Tensile tests are performed for several reasons. The results of tensile tests are used in selecting materials for engineering applications. Tensile properties frequently are included in material specifications to ensure quality. Tensile properties often are measured during development of new materials and processes, so that different materials and processes can be compared. Finally, tensile properties often are used to predict the behavior of a material under forms of loading other than uniaxial tension. The strength of a material often is the primary concern. The strength of interest may be measured in terms of either the stress necessary to cause appreciable plastic deformation or the maximum stress that the material can withstand. These measures of strength are used, with appropriate caution (in the form of safety factors), in engineering design. Also of interest is the material's ductility, which is a measure of how much it can be deformed before it fractures. Rarely is ductility incorporated directly in design rather, it is included in material specifications to ensure quality and toughness.

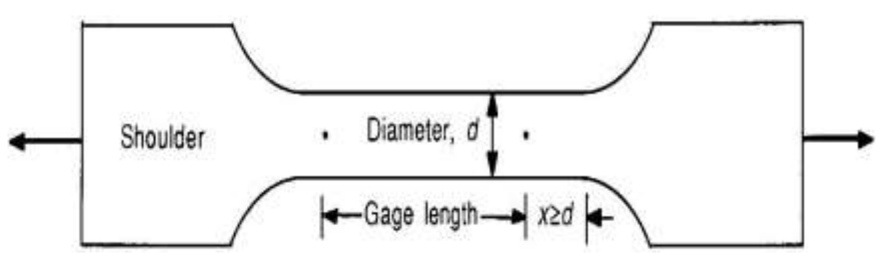
Low ductility in a tensile test often is accompanied by low resistance to fracture under other forms of loading. Elastic properties also may be of interest, but special techniques must be used to measure these properties during tensile testing, and more accurate measurements can be made by ultrasonic techniques.This chapter provides a brief overview of some of the more important topics associated with tensile testing.

- Tensile specimens and test machines
- Stress-strain curves, including discussions of elastic versus plastic deformation, yield points, and ductility
- True stress and strain
- Test methodology and data analysis

It should be noted that subsequent chapters contain more detailed information on these topics.

Tensile Specimens andTesting Machines

Consider the typical tensile specimen. It has enlarged ends or shoulders for gripping. The important part of the specimen is the gage section. The cross-sectional area of the gage section is reduced relative to that of the remainder of the specimen so that deformation and failure will be localized in this region.



The gage length is the region over which measurements are made and is centered within the reduced section. The distances between the ends of the gage section and the shoulders should be great enough so that the larger ends do not constrain deformation within the gage section, and the gage length should be great relative to its diameter. Otherwise, the stress state will be more complex than simple tension. Detailed descriptions of standard specimen shapes are given in Chapter 3 and in sub-sequent chapters on tensile testing of specific materials.

3.1 Tensile Strength

The tensile test of the composites was performed as per the ASTM D3039 standards. The test was done using a universal testing machine (Tinius Olsen H10KS).The specimen of required dimension was cut from the composite cast. The test was conducted at a constant strain rate of 2 mm/min. The tensile test arrangement is shown in figure

Tensile test is used to determine the tensile strength of the specimen, % elongation of length and % reduction of area. Tensile test is usually carried out in universal testing machine A universal testing machine is used to test tensile strength of materials. It is named after the fact that it can perform many standard tensile and compression tests on materials, components, and structures. The specimen is placed in the machine between the grips and an extensometer if required can automatically record the change in gauge length during the test. If an extensometer is not fitted, the machine itself can record the displacement between its cross heads on which the specimen is held. However, this method not only records the change in length of the specimen but also all other extending / elastic components of the testing machine and its drive systems including any slipping of the specimen in the grips. Once the machine is started it begins to apply an increasing load on specimen. Throughout the tests the control system and its associated software record the load and extension or compression of the specimen.

TENSILE TEST

Tensile test is used to find out

Tensile strength

Yield strength

% Elongation

% Reduction

3.2 HARDNESS TEST

This gives the metals ability to show resistance to indentation which show it's resistance to wear and abrasion. Hardness testing of welds and their Heat Affected Zones (HAZs) usually requires testing on a microscopic scale using a diamond indenter. The Vickers Hardness test is the predominant test method with Knop testing being applied to HAZ testing in some instances. Hardness values referred to in this document will be reported in terms of Vickers Number, HV

3.3 IMAPCT TEST

An impact test is a type of mechanical test used to measure the ability of a material to resist fracture or failure under high strain rates. Here are some details about the impact test:

Test method: There are different test methods for impact testing, but the most commonly used methods include the Charpy test and the Izod test.

Test specimen: The test specimen is a small rectangular or V-notched bar made from the material being tested. The specimen is usually machined to specific dimensions and then notched to create a stress concentration point.

Test apparatus: The test apparatus typically consists of a pendulum or striker that is released from a certain height to strike the specimen, causing it to break. The energy absorbed by the specimen during the impact is measured and used to calculate the impact strength of the material.

Testing conditions: The impact test is typically carried out at room temperature, but it can also be performed at higher or lower temperatures depending on the material being tested. The impact velocity and specimen orientation can also be adjusted based on the test standard and requirements.

Test results: The test results typically include the energy absorbed by the specimen, as well as the type of fracture (ductile or brittle) observed during the test. These results can be used to evaluate the toughness and impact resistance of the material being tested.

The impact test is widely used in various industries, including aerospace, automotive, and construction, to evaluate the impact resistance and durability of materials used in critical applications.

4.Test results

4.1.Tensile test

ID	Thickness (mm)	Width (mm)	CSA mm^2	YL KN	TL KN	YS N/mm^2	TS N/mm^2	IGL mm	FLG mm	%E
1	14to15	15	225	17.38	26.13	198.91	238.27	75.04	77.05	2.09

4.2.hardness survey

Identification	Impression (Hardness Value in HRB)
1	39.1,41.3 & 43.9

4.3.impact test (Charpy)

Identification	Impact Value in Joules
1	

5.CONCLUSION

Traditionally **natural fibers** are used to make high strength ropes in South India. The results found that the mechanical properties have a strong association with the dynamic characteristics. Both of the properties are greatly dependent on the volume percentage of fibers. The composite having a Juliflora Fiber And Banana Fiber volume of showed a significant result compared to old clutch plate. It has been noticed that the mechanical properties of the composites material such as tensile strength, hardness and wear etc.

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