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KIU
Journal of Science, Engineering and Technology

KJSET Research Article

Investigation of Natural Banana Fiber -Epoxy Mechanical Properties

Omar Suliman Zaroog [1], Omer Esa Babiker [2]
Department of Mechanical Engineering, Kampala International University, Uganda [1,2]

Corresponding Author: omar.zaroog@kiu.ac.ug[1]

Paper history:
Received 06 December 2024
Accepted in revised form 07 March 2025

Keywords
Composite; banana fiber; epoxy; mechanical properties.

Abstract

World is presently encourage concentrating on diverse fabric that are ecologically neighborly and biodegradable in nature. The characteristic concerned caused the composite distributed of typical polymeric tar and fiber, is one of the recent progressions within the commerce and makes the existing level of inquire about effort. The profiteering of composite substance zone expanding frequently within the building field. The composites comprise two stages which are the base materials and fiber. The availability of distinguishing fibre and uncomplicated mixers have pulled in universal scientists to undertake nearby accessible cheap filaments and to memorize their plausibility of reinforcing purposes and to review they accomplish the thankful essentials of incredibly reinforced composite of polymer pointed at operational request. Fiber strengthened composite of polymer has abundant inclinations, such as negligible exertion of construction, simple to make and way improved quality. Due to this cause the fiber bound combination utilized inside a mixture of foundation as an example of structure fabric. This work portrays the mechanical properties of fiber of banana fortify combine with the astounding orientations to the impression of fiber loadings and fiber length on the mechanical behavior of the composite. The combinations arranged method is hand lay-up. and the mechanical behavior such as the ductile quality test, flexural quality, affect test and solidity test as well as water retention were checked. It observed that there are improved in the mechanical properties of the mixers. The water retention expanded with the incremental of fiber estimate and contains.

Nomenclature and units

1.0 Introduction

The taken a toll of manufacturing an alloy material is as of now expanding so that individuals finding another method to overcome this issue. The utilize of characteristic filaments is one of the modern methods where a unique composite can be shaped that has great mechanical properties. Due to its fetched sparing and time-saving points of interest, the components of the composites are acknowledged universally [1- 5]. The common filaments have more preferences compared to any other filaments. Any composites that are made utilizing common filaments have its special mechanical properties. This empowers the individuals to utilize characteristic fiber to make a composite rather than utilizing glass strands or any other strands [1, 5-11]. This paper contains a point-by-point clarification of a try that was conducted to find out the mechanical behavior of the common fiber.

The normal fiber that was chosen for this try is banana fiber, the framework that elected for strengthening the fiber is epoxy. The banana fiber was chosen since it is accessible in many places in the world. Moreover, it is inexpensive and it has great mechanical properties. A lot of considers were made on banana fiber from the investigates all over the world and it is well known for its great mechanical behavior [12-15]. the framework material (Epoxy) is well recognized for its good quality in strengthening with a normal fiber to form a composite.

Hand lay-up handle has been utilized to manufacture the characteristic fiber with epoxy. Mechanical properties such as pliable quality, flexural quality, affect quality and hardness have been tried in this investigate. This paper contains a total ponder and point by point clarification almost the mechanical properties of normal fiber fortified with epoxy [16. 17].

Composite

Composite could be a blend of two ingredients in which one of them, known as the fortifying stage, is within the shape of strands, papers, or particles, and is encased within the other substances identified as the form stage. The strengthening texture and the lattice fabric can be polymer, ceramic, or metal, [2, 18-21]. Composites for the most part have a fiber or molecule area that's harder and more prominent than the continuous framework area and do work as the critical stack carrying part. The network acts as a stack exchange medium between strands, and in less perfect occurrences where the masses are complex, the lattice may also indeed ought to experience hundreds cross to the fiber pivot. The framework is more noteworthy flexible than the strands and hence acts as a root of composite sturdiness. The framework too serves to ensure the strands against natural hurt some time recently, all through and after composite handling [22].

Natural Fibre

Characteristic filaments are a fiber that crops from plants, creatures and natural procedures. They may be utilized as a chunk of composite ingredients. The strands of the plant are all plant belongings that contains cellulose for illustration bamboo, jute, flax, and sisal. Cellulose strands are used in more wide range of businesses. Due to these reasons, strands are applied in diverse applications, for occurrence, bundling, surface and paper. Characteristic thing filaments are the strands regularly are finished from the result of the plant, for case, coconut and banana fibers. Additionally, stem fiber is the strands which are master from the stalks. Leaf filaments are the strands which are collect from the takes off (sisal and agave) [23, 24].

Banana Fiber

There's a broad scope of inquiry in these areas; various researchers have inquired about the domestic fully-fledged fiber composite invigorated with in overabundance of some of sorts of the polymer [18]. The banana and glass fiber composites may besides be made for exterior and interior capacities wherever pointless quality is never once more vital, also, it exceptionally well may be seen as the replacement of wood substances and shield the timberland assets [25]. Author [26] have mulled over the mechanical homes for fiber of banana mixed with epoxy as a composite and it observed that the tractable imperativeness is prolonged by strategy for a 90% of the pseudo-stem banana fiber braced composite of epoxy related to original epoxy. His out results he influence quality of pseudo-stem banana fiber lifted by strategy for generally 40% differentiate with the impact imperativeness of immaculate epoxy. The impact control fetched is more vital which signs to higher life span cost of the fabric. They are besides uncovered that once woven of banana fiber had utilized with an epoxy texture at that point the flexural quality extended. There are various reports accessible over mechanical and genuine behavior of domestic developed fiber upheld polymer composites, be that because it may, the impact of fiber assess on the mechanical conduct of banana fiber invigorated polymer composites is barely been accounted for. To this conclusion, the cutting-edge work has grasped with the goals to see at the mechanical behavior of the fiber of banana founded composite of epoxy [27, 28].

Epoxy

The epoxy could be a conceivable polymer, which has tall quality, fitting durability, and obvious strength. It has point by point resistance to chemical ambush and dampness. Epoxy appear small or no shrinkage after curing [29, 30]. Figure 1 appear the epoxy's chemical structure

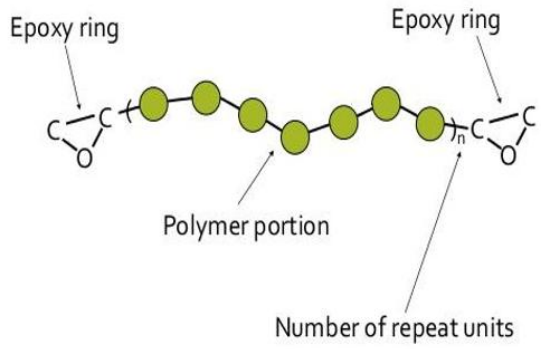

Figure 1. Chemical structure of epoxy

The versatile characteristic made to epoxy along its combination made it appropriate for uncommon mechanical measurements, for illustration, electronic issue epitomes, secured circuit board, floor coatings, preparing, fiber back, and pastes. Be that because it may, the unpreventable capacities in a few predominant subjects restricted the epoxy utilize since of the reality of their delamination, moo impact resistance, basic shortcoming, and break durability conduct [26, 30]. The tangles of epoxy can be crushed through intertwine and alter some time recently their mechanical applications.

2.0 Materials and Methods

Banana Fiber

The fiber of banana gotten from nearby plants it taken from banana stem plant. The filler used in this experiment (Epoxy) is BONDITE 8950-1 A. As a hardener in this experiments BONDITE 8950-1 B was used.

Arrangement Strategy

The banana fiber was cut into three diverse lengths Short (5 mm), Medium (10 mm) and long (15 mm). a daylight used to dry the banana fiber for 24 hours. An oven was used at 90°C for 8 hours to completely drying the banana fiber after it taken from daylight. A volume of dimension of 180 x 180 x 40 mm was prepared as a mold. The banana fiber of specific measure has been blended with lattice blend with their partitioned qualities by strategies for direct mechanical blending and blend are steadily poured in specific shapes, sparing the depiction requisites and see on testing condition. The releasing pro has been utilized on shape sheet which supplies accommodating to composites ejection from the shape within the wake of reestablishing the composites. A slipping roller used for arranging of the caught discuss from the uncured composite and shape has been closed at temperature 27° C span 24 hours.

The composite fabric has been cut in fitting estimations with offer assistance of zig saw for mechanical tests agreeing to the ASTM standard. The assignment and detail composition of composites is appeared in Table 1.

After the creation handle, the composite fabric was cut into the suitable estimation for the mechanical testing. For the tensile test, the dimensions were 150 × 15 mm2 and check length was 70 mm. Flexibility was attempted in universal test machine.

Example estimation for the flexural test was 100 mm ×15 mm × 70 mm and three-point twist test methodology was utilized for finding the flexural quality utilizing Universal Testing Machine Instron 1195.

Example estimation for impact test was 60 mm × 15 mm. Affect testing was coordinated in influence testing machine. Izod affect testing is a methodology for choosing the impact resistance of composites. In influence test, an arm held at a specific stature is released in the midst of the testing. The arm influenced the illustration and breaks the illustration. Its impact imperativeness is gotten from the essentialness expended by the composite or test.

TABLE 1: Designation and composition of composites

Description	Combination
Sample C1	Epoxy of (90 wt. %) and (10 wt. %) Fiber with length of (5 mm).
Sample C2	Epoxy of (85 wt. %) and (15 wt. %) Fiber with length of (5 mm).
Sample C3	Epoxy of (80 wt. %) and (20 wt. %) Fiber with length of (5 mm).
Sample C4	Epoxy of (90 wt. %) and (10 wt. %) Fiber with length of (10 mm).
Sample C5	Epoxy of (85 wt. %) and (15 wt. %) Fiber with length of (10 mm).
Sample C6	Epoxy of (80 wt. %) and (20 wt. %) Fiber with length of (10 mm).
Sample C7	Epoxy of (90 wt. %) and (10 wt. %) Fiber with length of (15 mm).
Sample C8	Epoxy of (85 wt. %) and (15 wt. %) Fiber with length of (15 mm).
Sample C9	Epoxy of (80 wt. %) and (20 wt. %) Fiber with length of (15 mm).

The made composite was cut within the estimation of 20 mm × 20 mm for hardness test. The hardness test was driven in a hardness test machine. The 100 N loads were associated on the composite and the holding time was 10 seconds. Hardness is characterized as the capacity to restrict to space, which is obtained by evaluating

the relentless significance of the space. Within the hardness test, a square base pyramid molded gem is utilized for testing.

Water absorption test

To observed the water, contain within the composite a hygrothermal tests was conducted. Test specimens subjected to hot and wet test in the lab. The test conducted in accordance of ASTM C481-94 standard. Specimens were subjected to submersion in 50º C water for 60 minutes, at that point the temperature raised to 70˚ C for 280 minutes, and keeping it covering with hot water of temperature of 70˚ C for 180 minutes, after that it heated to 70˚ C in dry condition. These tests were performed according to ASTM D5229 standard.

3.0 Results

Tensile Strength Test

It has been watched that the tensile properties of the composite contain banana fiber and epoxy increments with increment in fiber length and stacking. For the composition which is of short (5 mm) with (10%) + Epoxy (90%) shows tensile of 12.5 MPa and expanded with increasing of fiber percentage till reach to 19.5 MPa of short length and fiber of 20%. In term of fiber length it is clearly that the tensile stress increase with increment of the fiber length. The short fiber length has the lowest tensile stress. The result is coordinating with another researcher (REF 4). Figure 2 shows the tensile test results

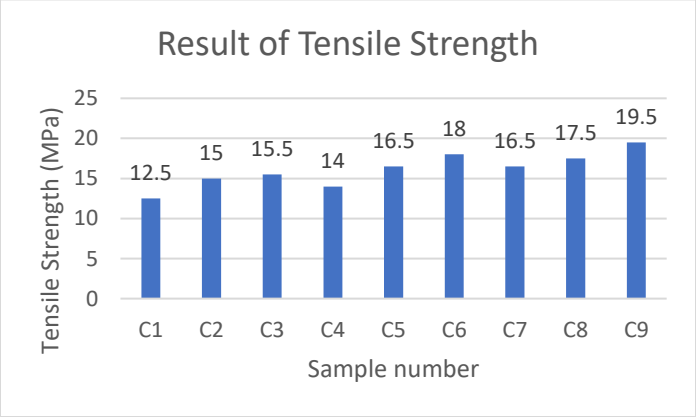

Figure 2: Results of tensile strength test

Flexural Strength Test

Figure 3 shows the result of flexural test. It is clearly that increasing of the fiber length the composite's flexural quality begin with increases up to 10 mm length of the fiber, however after this length the flexural quality started to decrease. Also, increasing the fiber stacking lead to increase flexural quality, however, the increment continues till fiber stacking of 15% after this ratio it begin to decrease. Accordingly, the foremost extraordinary flexural quality can be found with fiber length of 10 mm and fiber content of 15%.

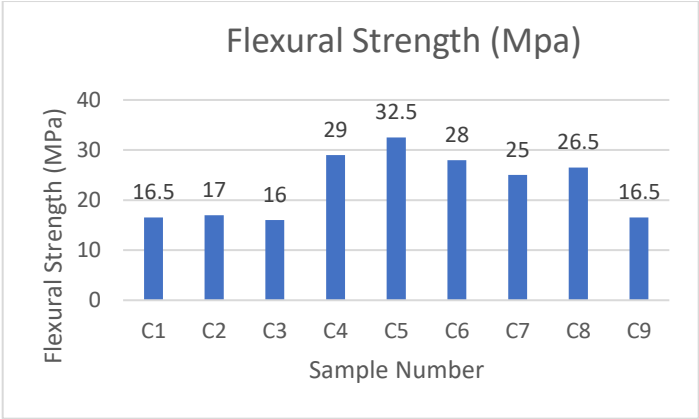

Figure 3: Flexural test result

For the result, it is clearly watched that the 5th composition has the most elevated flexural quality. The comes about for 10mm fiber length are higher compared to the 5mm and 15mm fiber length. The most reduced flexural quality is gotten from the third composition.15 mm fiber length has less flexural quality. This comes about is nearly comparable to comes about gotten by other analysts where the flexural quality increments when the fiber proportion is higher.

Impact Test

Impact test result is shown in figure 4. From the figure it is clearly seen that the impact result is affecting by the fiber length and fiber content, increasing the fiber length as well as fiber content led to increase the impact quality. The foremost extraordinary impact result was observed at high length (15 mm) and high content (20% fiber).

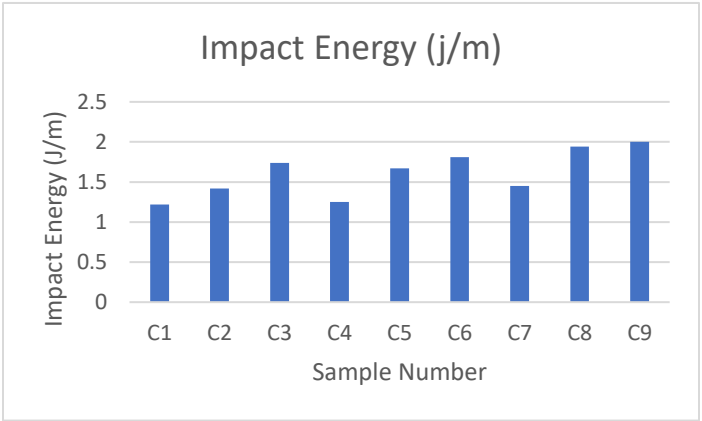

Figure 4: Impact test result

For the comes about, it is clearly watched that the 15 mm (20%) + Epoxy (80%) composition has the most elevated affect

quality. When the fiber length increments the affect quality moreover increments. The least impact strength is 1.22 j/m which is from the first composition.

Hardness Test

It remarkably well may be realized from the hardness result (Figure 5) that the sample hardness increases with an extension in fiber length, the length of 15 mm shows the highest hardness. However, the increasing the fiber content also increased the hardness till the middle fiber content (15%) and it decreased after that point.

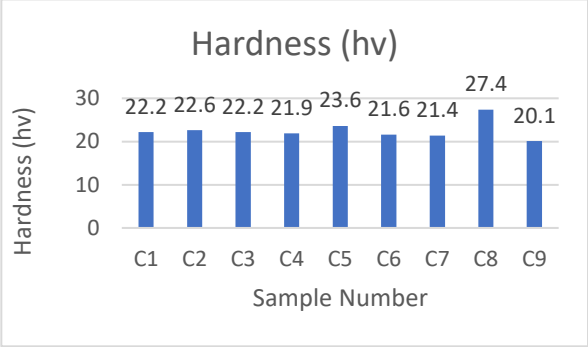

Figure 5: Hardness test result

From the comes about, it is clearly watched that the 15 mm (15%) + Epoxy (85%) composition has the most noteworthy hardness quality.

Water absorption test

Each sample was test for water absorption. The composition of 5 mm (10%) + Epoxy (90%) showed water absorption of 11.32% while 15 mm (15%) + Epoxy (85%) reach 18.63%. This result showed that the water absorption increased with the incremental of fiber contains and fiber length. This will be clarified by the polarity compatibility of the resin's particles with the fiber's surface. Wetting is influenced by such compatibility and insolvent wetting is known to extend the number of blemishes and voids between the polymer and the fiber [31].

4.0 Conclusions

In this paper, mechanical properties of normal fiber fortified epoxy composite were examined. An unused composite fabric has been created which is a banana fiber fortified epoxy composite. Nine tests with diverse compositions were made and utilized all through the explore. The nine distinctive composites were arranged utilizing banana fiber, epoxy and hardener. For the tensile quality test, it is clearly watched that long fiber has higher tensile quality. For the flexural quality test, it is clearly known that medium estimate fiber has higher flexural quality. Other than, for the impact test little fiber length has the most elevated affect esteem and for the hardness test, long fiber includes a higher hardness esteem. Destitute interaction between the networks causes unpredictable scattering of the fabric driving to uneven mechanical properties. Lastely, water retention expanded with the incremental of fiber estimate and contain

Acknowledgment

The authors would like to acknowledge Universiti Tenaga Nasional, Malaysia for the financial support to complete this research project. The acknowledge extended to the lab of Mechanical departments at Universiti Tenaga Nasional, Malaysia to perform the tests at their labs

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