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Evaluation of mechanical properties in banana tree fiber reinforced composite

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ABSTRACT

In the rapidly developing world, concern for environmental pollution and the prevention of non-renewable and non-biodegradable resources has attracted researchers seeking to develop new materials and ecological products based on sustainability principles. Fibers from natural sources provide indisputable advantages over synthetic reinforcement materials such as low cost, low density, non-toxicity, comparable strength and minimum problems of waste disposal. In this project, epoxy composite materials reinforced with banana fiber will be prepared and the mechanical properties of these composite materials will be evaluated. Composite samples with different fractions of fiber volume are prepared using the manual application process and applying pressure at room temperature. The samples were subjected to mechanical tests such as traction, hardness test and impact load.

Keywords: Fiber, Composite Materials, Resins

INTRODCUTION

Fiber-reinforced composites for millennia, fiber was used as reinforcement for the production of structural components. There are biblical references from the year 2000 b. Sooner or earlier, the straw-reinforced clay bricks and composite arches found in Egypt and the Magnolias can be traced back to the loam and wattle of buildings in Europe during the Middle Ages. The Japanese samurai warriors used laminated metals in their swords to obtain desirable material properties [13].

In the 19th century iron bars were used as reinforcing masonry, which led to a reinforced masonry structure. Asbestos fibers were used throughout the century to reinforce phenolic resins in the early days of the country. The process of producing strong glass fibers was developed in the late 1930's and the development of the first commercial unsaturated polymer resins came a little later.

The first fiberglass ship was built in 1942 during World War II. Reinforced plastics were used more or less simultaneously in electrical components and aircraft

Banana Fiber

They are essentially hot climate plants. Their origin or homeland should be the tropical forests of Asia. In addition, it is gaining importance as a fiber source. Banana has an important place in our mythology. It2. Manu or Noah (after Western mythology) or HazratNuh (after Muslims), when they started implanting new life on our planet after the flood, sought help from God for a multipurpose plant that serves as food, fruit and fodder. It is said that God gave him banana tree that fulfills most of our desires, since besides cooking fruits and vegetables, flowers and stems, the plant gives fibers for the making of dresses, their leaves are used as plates to naturally different from others to serve medical virtues. The plant grows easily as it forms young shoots. There is evidence of this plant and fruit in different places in our epics Ramayana and Mahabharata.

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Sisal Fiber

Sisal is extracted from the leaves of the Agave sisal plant, which is native to Mexico and today is grown mainly in East Africa, Brazil, Haiti, India and Indonesia. It is grouped under a broad heading of "hard fibers," under which sisal is placed in Manila in durability and strength. The name Sisal comes from a port city in Yucatan, Maya, Mexico. It means cold water. It is also called 'sosquil' and 'green gold'. Agave plants were cultivated by the Mayan Indians before the arrival of Europeans. They prepared the fibers by hand and used them for ropes, carpets and clothing. It is one of the most extensively cultivated hard fibers in the world and accounts for half of the total production of textile fibers. The reason for this is the ease of breeding sisal plants, which have a short renewal time and are fairly easy to grow in all types of environments. The sisal plant produces about 200-250 leaves during its productive period. The life of the sisal plant is 7-10 years. The shape of the sisal leaves is like sword and is about 1.5 to 2.0 meters tall. Young leaves may have teeth along their edges for a few minutes, but lose as they mature. Sisal fiber ranks 6th among fiber plants, accounting for 2% of world production of vegetable fiber (plant fibers provide 65% of global fiber)

LITERATURE REVIEW

N.Venkatswaran*et.al* (2010)

Among the various synthetic materials that have been explored as an alternative to iron and steel for use in the automotive industry, plastics have a large share. Over the last decade, the study of filled plastic composites has shown an immense interest in countering the lack of plastic materials. Plastics are used for almost everything, from commodities to complex structures, machine components, etc. Plastics are widely used because they have less weight, less water absorption, high rigidity and strength. In fact, synthetic fibers such as nylon, rayon, aramid, glass, polyester and carbon are often used as reinforcement of plastics. At present, it is necessary to search for its replacement, which is nothing but natural, because of the uncertain conditions of scarcity and the cost of oil and its by-products. In recent years, the plant / vegetable fiber proves to be an alternative fiber to its synthetic counterpart. Natural fibers are cheaper, biodegradable and harmless to health. In addition, natural fiber reinforced fibers will have good potential for replacement in the future. Natural fibers are obtained from different plant parts and classified accordingly. It is interesting to note that natural fibers such as jute, coconut, banana, sisal, etc. are abundant in developing countries such as India, Sri Lanka and some African countries, but are not used optimally. At present, these fibers are conventionally used to make yarns, ropes, mats and mats and to make articles such as tapestries, tablecloths, handbags and purses. Fibers such as cotton, banana and pineapple are also used in the manufacture of fabric in addition to use in the paper industry

J.santosh*et.al* (2010)

Several natural fibers such as coconut, sisal, jute, coconut and banana are used as reinforcing materials. In this work, the fibers of treated and non-treated bananas are used for the development of hybrid composite material. The untreated banana fiber is treated with sodium hydroxide to increase the wettability. The untreated banana fiber and the banana fiber treated with sodium hydroxide is used as reinforcing material for both the epoxy resin matrix as the matrix of vinyl ester resin. The coconut shell powder is used in conjunction with banana fiber untreated and treated as reinforcement material. In this procedure, the banana fiber is treated with sodium hydroxide to 5% for an hour and the sample is manufactured by hand.

M.Ramesh*et.al* (2014)

In the world in rapid development, the concern about pollution and the prevention of non-renewable resources and non-biodegradable has attracted researchers seeking to develop new materials and products based en principles of sustainability. The fibers of the natural sources offer undeniable advantages over synthetic reinforcement materials such as low-cost, low density, non-toxicity, resistance comparable and minimum problems of waste disposal. In the present experiment, epoxy composite materials reinforced with fiber of banana and evaluated the mechanical properties of these composite materials. The composite samples that have fractions of different fiber volume were prepared using the hand-rolling process and exert a pressure at room temperature. The samples were subjected to mechanical testing such as tensile, flexural and impact load. The analysis of scanning electron microscopy (SEM) is performed to evaluate the interfaces of the fiber matrix and analyze the structure of the fractured surfaces

METHODOLOGY

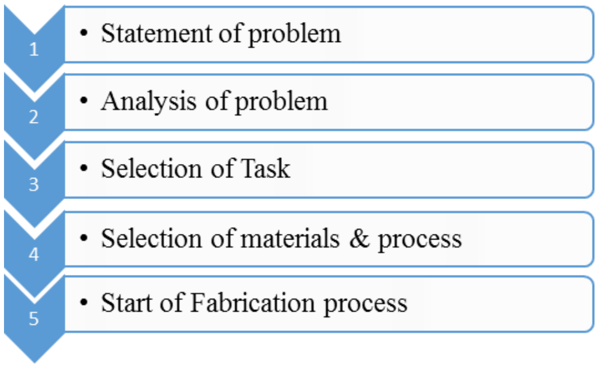

Figure 3.1 methodology chart

Statement of Problem

As in today's fast growing technology, demand of alternate materials compared to conventional materials such as mild steel, aluminum, copper, brass with respect to cost, weight & strength. So in order to increase the strength we are supposed to add composite materials which decrease the weight of the material and even cost. So we are in view to prepare a composite material which may give better strength and light in weight

Analysis of Problem

If we add some extra alloys or increase alloys percentage to mild steel or aluminum the material weight may increase, so in order to reduce the weight we need to move to other material such as composites

Selection of Task

As stated above in the analysis problem we choose to prepare a composite material with natural fiber by basic process they are many process in preparation of composites and to check Tensile test, Impact test, Hardness test & Compression test.

Selection of Materials and Process

The materials for this paper have been chosen i.e banana fiber and sisal fiber. And to prepare the specimen the process have been opted is hand layup method.

Start of Fabrication

After all the process the next step to start the fabrication of the specimen as per the required dimensions. In the process we have been developed the specimen with different fiber orientations such as 0/90/0 and 90/0/90.

Figure: 3.2 banana tree fibre

Nithin A et al., Inter. J. Int. Adv. & Res. In Engg. Comp., Vol.–06(02) 2018 [1445-1450]

Figure: 3.3 Sisal fiber

Figure: 3.4 Specimen cutted into required dimensions

RESULT AND DISCUSSION

Table : 4.1 reading of izode test in 0/90/0 (Banana/sisal/banana)

Slno	Sample	Test	Readings (Joules)
1	B-S-B	IZOD	236
2	B-S-B	IZOD	238
3	B-S-B	IZOD	241

NOTE

- **0/90/0 B-S-B (Banana/sisal/banana)**

Table: 4.2 reading of izod test in 0/90/0 (Sisal/banana/sisal)

Slno	Sample	Test	Readings (Joules)
1	S-B-S	IZOD	228
2	S-B-S	IZOD	231
3	S-B-S	IZOD	235

NOTE

- **0/90/0 S-B-S(Sisal/banana/sisal)**

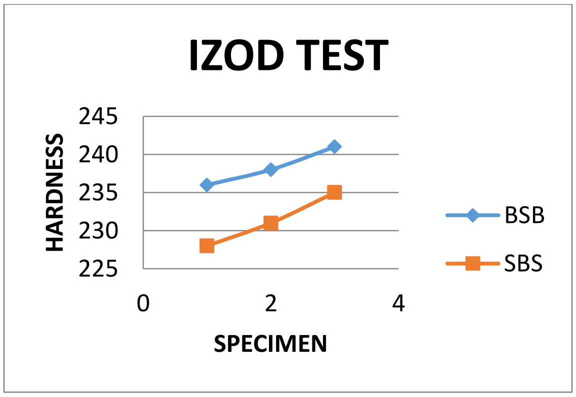

Figure: 4.1 IZOD TEST GRAPH

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Table:4.3 reading of charpy test in 90/0/90 (Banana/sisal/banana)

Sno	Sample	Test	Readings (Joules)
1	B-S-B	CHARPY	158
2	B-S-B	CHARPY	160
3	B-S-B	CHARPY	166

NOTE

- **0/90/0 B-S-B (Banana/sisal/banana)**

Table :4.4 reading of charpy test in 90/0/90 (Sisal/banana/sisal)

Slno	sample	Test	Readings
1	S-B-S	CHARPY	156
2	S-B-S	CHARPY	161
3	S-B-S	CHARPY	165

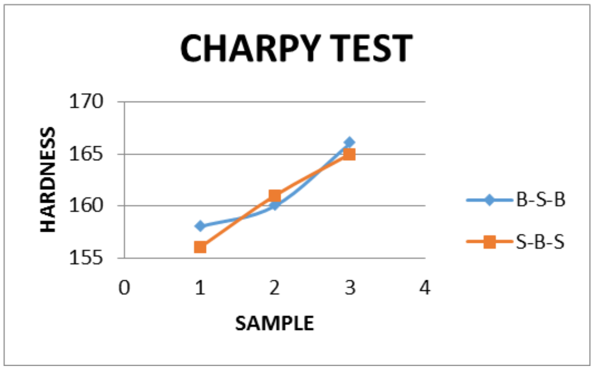

Figure : 4.2charpy test grap

Table :4.5 Reading of brinell hardness test90/0/90 (Banana/sisal/banana)

Slno	Sample	Test	Readings
1	B-S-B	**Brinell hardness test**	**178.53**
2	B-S-B	**Brinell hardness test**	**181.50**

NOTE

- **B-S-B (Banana/sisal/banana)**

Table : 4.6 reading of brinell hardness test 90/0/90 (Sisal/banana/sisal)

Slno	Sample	Test	Readings
1	S-B-S	**Brinell hardness test**	**156.23**
2	S-B-S	**Brinell hardness test**	**160.50**

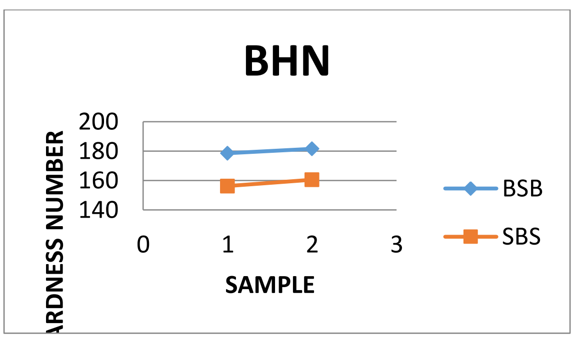

Figure: 4.3 BHN GRAPH

Comparission table

Table 4.6Comparision table

Sl No	Testing	Fiber type	Readings
1	Charpy	B-S-B	High
2	Charpy	S-B-S	Low
3	Izod	B-S-B	High
4	Izod	S-B-S	Low
5	Brinell hardness test	B-S-B	High
6	Brinell hardness test	S-B-S	Low

Note

- B-S-B (Banana/sisal/banana)
- 0/90/0 S-B-S(Sisal/banana/sisal)

CONCLUSIONS

In the experimental study, the banana fibers are used as a reinforcing material with epoxy matrix, the composites have been fabricated and physical characteristics of these materials are examined.Fiber volume fraction plays vital role in determination strength of composite which has been clearly exhibited in above results. From the experiment, the following conclusions have been drawn.

1. The maximum toughness of B-S-B fiber is observed under charpy test is avg of 161.33 joules.
2. The maximum toughness of S-B-S fiber is observed under Izod test is avg of 160.66 joules.
3. By comparing above test B-S-B fiber is capable of absorbing maximum energy.
4. The hardness of material For B-S-B fiber under brinell test is 180.01.
5. The hardness of material for S-B-S fiber under brinell test is 158.36.
6. By comparing above test B-S-B fiber is having maximum hardness.

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