Tensile Test on Sisal/Fibre Glass Reinforced Epoxy-based Hybrid Composites

Muhd Zulfadhli Muhd Zaimi, Imran AsyrafRosdi, YusriDahdi

Abstract: The progress of usual fiber underpinned composite produces to substitute engineering resources is coil out to be a movement in engineering application. The target of this study is to examine whether sisal fibers can be crafted into composite physical that next can be substitute synthetic fibers support composites that are expensive. In this discover, sisal fiber will be made into composite panels by employing the hand lay-up technique. The composite panels are next assessed for their mechanical properties.

KeyWords: sisal fibre, synthetic fibers, composite panels.

I. BACKGROUND

Problem with synthetic fiber reinforced composites are they are really costly and difficult to manufacture. Besides that, a problem of exploring new raw materials of manufacturing at very low cost emerging as nowadays a growing population and increasing demand targeted for a need of new type of creations. As it is known that natural fiber reinforced composites usually created from natural fiber such as coir, banana, jute, hemp, flax and others, they are bound as a potential replacement for synthetic fibers especially in composite materials have gained interest among researchers throughout the world. Natural fibers are way cheaper and not difficult to manufacture as the ingredient are easily obtained, compared to the synthetic fiber. This research and test are about to obtain the idea either natural fiber can be bonded together with synthetic fiber by testing its mechanical properties to require the strength. That is the reason why this study is carried out whether a sisal and fiber glass reinforced epoxy-based hybrid composites can be joined together and achieve a new hybrid composites to be used as a new technology. The sisal and fiber glass hybrid composite panels will only go through a mechanical test which is Tensile Test. There will be no hardness, impact and corrosion test to be done in this project. The limitation of this project would be time available as there are lot of things to be done to finish this project.

II. METHODS

First, the sisal fiber was bought at Seri Kembangan. Next, the samples were prepared in the composite workshop by using hand lay-up open mould technique.

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This will be finished by using resins and fibers in a mould. In a lay-up method When they are mixed well together,they are left for curing. Then, the panel cut into size that are suitable for the testing. The next step is to conduct the tensile test on the composite panel. Once the testing is finished, the data will be analyzed and the results will be recorded. Lastly, when the data have been analyzed, the result will be concluded whether the reinforced fiber will be a good composite.

Fiber Preparation

After the sisal fibers were obtained, the fabrication process was then proceeded. The specimens of sisal fiber reinforced composite and fiberglass composite were prepared in the composite laboratory using the hand lay-up and open mould techniques. The sisal fibers which underwent same number of hours of drying process were fabricated into two different composite panels.

A plastic mould having dimensions of 8-inch x 5inch was used. The internal surfaces of the mould were sprayed with a release agent before using the mould to facilitate easy removal of the product from the mould later on. Next, the resin and the hardener were mixed together in a paper cup. The resin to hardener percentage were 70% to 30% respectively. Then, this resin mixture was poured on top of the mould. The sisal fibers were then put on top of the resin layer in a random orientation (chopped-strand) and were pressed using a brush. After that, another layer of resin was applied on top of the fibers. Again, the layers were pressed gently to remove any air bubbles Then, the sisal fiber reinforced composite sample was left to cure for 8 hours at room temperature and then taken out of the mould. The specimens of sisal fiber reinforced composite were then cut to 10 pieces of dimensions 5-inch x 0.5 inch for the purpose of testing. The method was used for this project are same. When the cutting was done, the sisal composite panels can be tested.

Fig. 1 sisal composite panel being; composite panel being cut prepared

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Fig. 2 Composite panel before test

Tensile Test

The Tensile Test will be performed at UNIKL MIAT's physics lab. It will be complete process on both sisal fiber reinforced composite and fiberglass reinforced composites. The sample from each composite panel go through for the tensile testing, achieving the requirement of the ASTM for this test.

The Tensile Test is done by using Shimadzu testing machine. Shimadzu testing machine is linked to a software called TrapeziumX. First of all, the panel will be measured for its length, width, thickness by using verniercaliper. Then, the panel will be marked into three section and both at end section will be measured and marked for a dimension with length of 1.5 inch. Both of these 1.5-inch section will be used as gripping section, leave the middle section free and the middle section will be measured for its value. This value will be taken and used for gauge length. The value of width, thickness and gauge length will be keyed into the TrapeziumX software program. The rate of speed of the force applied towards the specimen will be two millimeters per minute. Finally, the tensile test will be started and forced is applied towards the specimen until it breaks. The result will be obtained after the test is done.

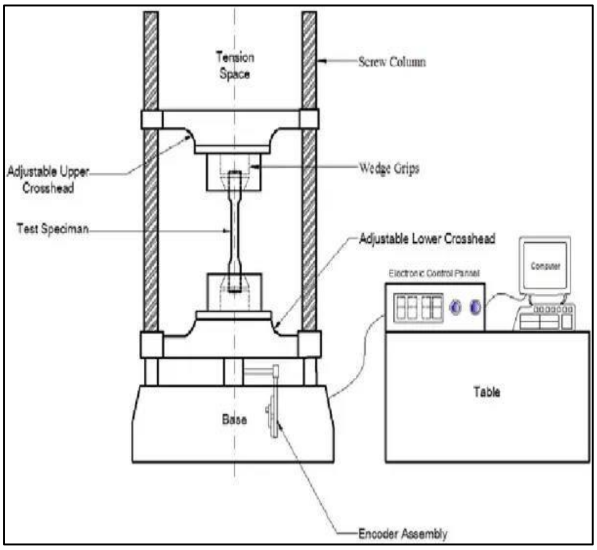

Fig. 3 Tensile Test

III. RESULTS

Sisal and Fiberglass reinforced composite

Table. 1 Result for sisal fiberglass panel

Sisal Fibreglass Reinforced composites	Force Stroke 1mm. N	Maximum force at entire area. N	Maximum stress at entire area. N/mm2	Maximum strain at entire area. %
A1	637.863	5263.43	42.1075	4.78460
A2	975.062	4955.79	39.6463	4.00849
A3	992.334	4703.95	36.1842	3.50910
A4	906.342	4231.33	33.8507	3.75182
A5	995.676	5295.64	40.7357	3.94781

Stress over strain graph for sisal fiberglass panel

Fig. 4 tensile test for panel

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Sisal reinforced composites

Table. 4 Result sisal composite panel

Sisal Reinforced composites	Force Stroke 1mm. N	Maximum force at entire area. N	Maximum stress at entire area. N/mm2	Maximum strain at entire area. %
B1	861.545	6352.57	5.004172	4.16912
B2	955.546	7054.86	56.4389	3.77076
B3	924.003	6234.58	49.8767	3.91704
B4	1137.91	6960.53	55.6842	3.52098
B5	832.682	5598.94	43.0687	3.81267

Fig. 5 tensile test on sisal panel

Full Analysis

Based on the data calculated and shown in the tables, the average maximum stress before the sample breaks for the sisal fiber reinforced composite is 42.015 N/mm2. As for the maximum strain, the average value is 3.838%. Meanwhile, for the sisal fiberglass reinforced composite, the average maximum stress value before the sample breaks is 38.50488 N/mm2. The average maximum strain for the fiberglass is 4.000364%.

By comparing the value of average stress and strain of these two types of composite, it can be seen that the sisal reinforced composite has a higher value of maximum stress before it breaks which is 42.015 N/mm2, compared to sisal fiberglass reinforced composite which has a maximum value of 38.50488 N/mm2. But, for the maximum strain value, which shows that fiberglass has a higher maximum strain value, which is 4.000364% compared to sugarcane fiber reinforced composite, which has a value of 3.838%.

Therefore, this result has shown that the sisal reinforced composite has a higher strength overall when compared with sisal fiberglass reinforced composite when tested with tensile test.

IV. CONCLUSIONS

The results of the strength of the sugarcane fiber from this study may not be truly fixed just yet. Many factors can still be considered to increase the strength of the sugarcane fiber reinforced composite. For example, the amount of fibers can be increased when producing the composite to increase its strength. Moreover, using treated solution on the sugarcane fibers may result in different values of strength produced. Besides that, the strength of sisal fiber reinforced composite may be different if the fibers were left to dry for a longer period of time. Other than that, the strength may be increased by fabricating the sisal fiber in a different way. There are several other procedures that can be used in fabricating a composite, for example, the use of vacuum bagging and the use of honeycomb core. By taking these different procedures into account, the strength of the sisal fiber reinforced composite may change compared to the results in this study. All these factors and more if considered, may produce different results for the sugarcane fiber reinforced composite.

These findings would promote more researches to be carried out to not just relate, but also progress forward in developing aviation materials and systems[1-17].

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