

Analysis of pepper plant creepers technology using banana tree fiber composites

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Abstract. Planting of pepper trees is now much reduced because there is no such thing as pepper wood. In this study using kepok banana fiber (*paradisiaca forma typical*) because it is a resource that can be renewed and cultivated. This study uses the RSM method and aims to determine the ability of banana tree fiber as a support for pepper plants against tensile strength and inpack strength at the beginning of manufacture and 3 month, Examining the effect of pepper growth on the composite banana tree uphold and knowing the effect of its upholding surface against the attached pepper root. Tensile test results at 0 months averaged 33.926 MPa while the following 6 months there was a decrease of an average of 31.22 MPa. Means tensile strength will decrease as the age of the composite increases. Impact test results at 0 months an average of 65.4824 kJ per square m, the next 6 months there was an average decrease of 65.2824 kJ per square m. It means that the impact strength does not decrease significantly as the age of the composite increases.

1. Introduction

Indonesia is the largest exporter of white pepper in the international market. In 2002, the volume of Indonesian white pepper exports reached 32,190 tons or 78% of the total world exports of white pepper at that time which reached the highest figure of 41,388 tons during the 1985-2004 period. In 2004, total world exports of white pepper fell to 33,074 tons, and 13,760 tons (43%) of which came from Indonesia. However, in 2007 the export volume of Indonesia's white pepper dropped to 11,000 tons [1].

Bangka Belitung Islands Province is one of the centres of Indonesian pepper production. In the world market, Bangka Belitung pepper is known as "Muntok White Pepper", which is white pepper which has a distinctive aroma different from other white peppers. This feature has been patented as a product of geographical identification of Bangka Belitung [2, 10].

Several factors that are suspected to be the cause of the decline in planting area and pepper production in Babylon are: 1) Fluctuations in pepper prices; 2) Disturbance of plant pests (OPT); 3) The impact of illegal tin mining; 4) Development of other plantation commodities, namely Oil Palm and Wrong Plantation one disturbance of plant pests (OPT) is the strength of pepper [3].

So far, the cultivation of pepper plants with live wood tomb is considered not good. The productivity of pepper plants is relatively low due to competition for nutrients, water and CO₂, as well as the effects of allelopathy and excessive shade [4]. Live wood upholds are generally used in extensive and semi-intensive pepper cultivation. The use of live woods in intensive pepper cultivation has not yet been



carried out and still requires further research. Not all types of wood can be used as an uphold for pepper [5].

There is a tendency that the growth and production of pepper plants is better when using dead stones instead of live wood. In the cultivation of pepper with dead wood upholds there is no competition for nutrients, water and CO. Besides that, pepper plants get high sunlight intensity so that the rate of photosynthesis is driven [6].

The problem with the use of dead wood upholds is the high price and the limited availability of good dead wood such as ironwood, trowel and melang which can last up to ± 15 years [7]. PVC paralon pipes as big as pepper stands have been tried in PTP XXIII, but because of their slippery surface the roots cannot be attached properly [8].

Traditional pepper farmers generally state that their limited capital is the reason why they are reluctant to plant pepper, especially when prices are low. Some farmers, especially the older generation, continue to work on pepper, but the area of planting that is cultivated is reduced because they do not have enough capital to buy production facilities [4, 9]. One of the means of production in question is to uphold dead wood.



Figure 1. Pepper tree with uphold dead wood.

This study was conducted to obtain data on the ability of banana tree fibers as an uphold to support pepper plants using the polyester matrix BQTN 157. The final impact of this research is to get the right solution in solving the problem of pepper farmers so that they can garden pepper using new technology.

2. Experimental design

2.1. Materials and equipment

The main ingredient used is banana tree fiber which functions as a reinforcement on the composite. Banana tree bark fibers can be seen in Figure 2.



Figure 2. Banana tree fiber.

While other materials are Unsaturated Polyester Resin as a matrix in composites, Methyl Ethyl Ketone Peroxide (MEKPO) serves to accelerate the hardening of the composite, Wax is used to coat between the mild with the composite, so that the composite is easily released from the mold, NaOH alkaline solution to remove wax-like layers on the surface of fibers such as lignin, hemicellulose and other impurities, the Paralon pipe is used as an enforcement material from banana tree fibers and catalysts. The pipe used is 2 inches in diameter.

The test equipment used was the Universal Testing Machine tensile test with ASTM D-638 testing standards. Tensile testing machines are used as in Figure 3(a). The Scanning Electron Microscope (SEM) Test used was Inspect S50 Figure 3(b).

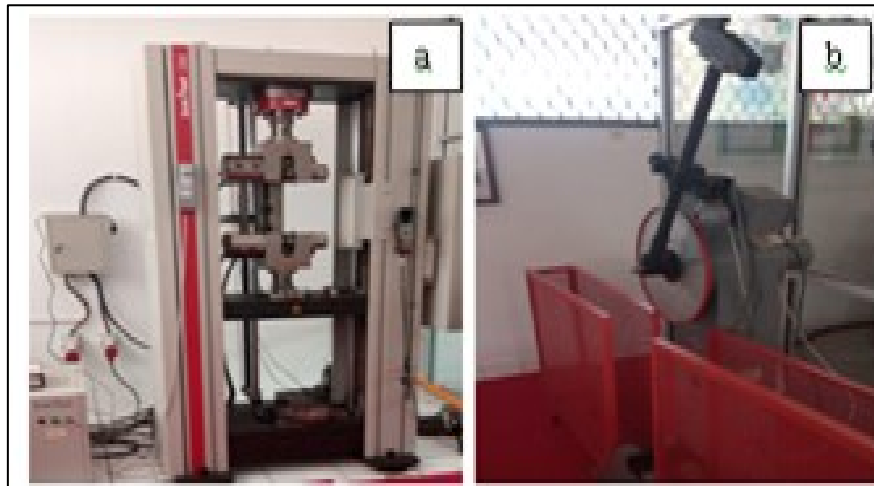


Figure 3. (a) Tensile testing machines (b) Impact testing machines.

2.2. Design of experiments

The analysis was carried out using agarwood fibers on tensile strength, impact strength and growth and the degree of adhesion of the roots to the surface of the rig. The data will be known what the test value is when the age at first is printed, and 3 months after use. Data processing using the one-factor experimental design method then proceed with analysis of variance (ANOVA).

3. Results and discussion

3.1. Tensile testing results

This research was conducted to determine the price of tensile strength and impact strength of a composite material of banana tree fiber with a polyester matrix. For this test performed on 2 periods, namely 0 months and 6 months. The following table and graph of the results of tensile test and impact test at 0 months and 6 months (Table 1).

Table 1. Tensile test results.

No	Soaking Hours	Fiber Length Mm	Tensile Test Results	
			0 month (Mpa)	6 month (Mpa)
1	2	500	34.893	29.518
2	2	500	33.018	32.141
3	2	500	33.519	30.654
4	2	500	34.843	32.123
5	2	500	33.357	31.664

The results of the tensile test at 0 months averaged 33.926 Mpa while in the following 6 months there was a decrease in tensile strength by an average of 31.22 Mpa. Means tensile strength will decrease as the age of the composite increases. The following graph shows the results of the tensile test at 0 months and 6 months.

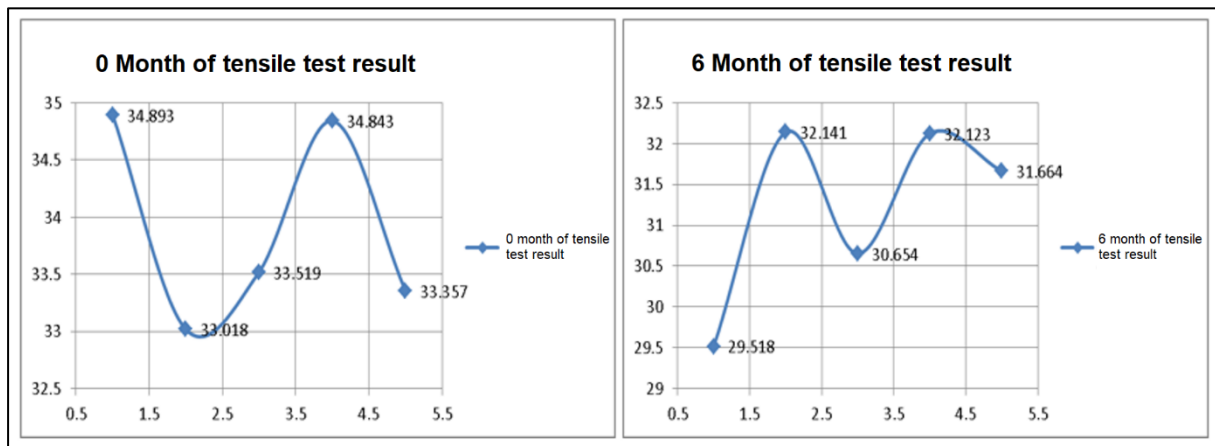


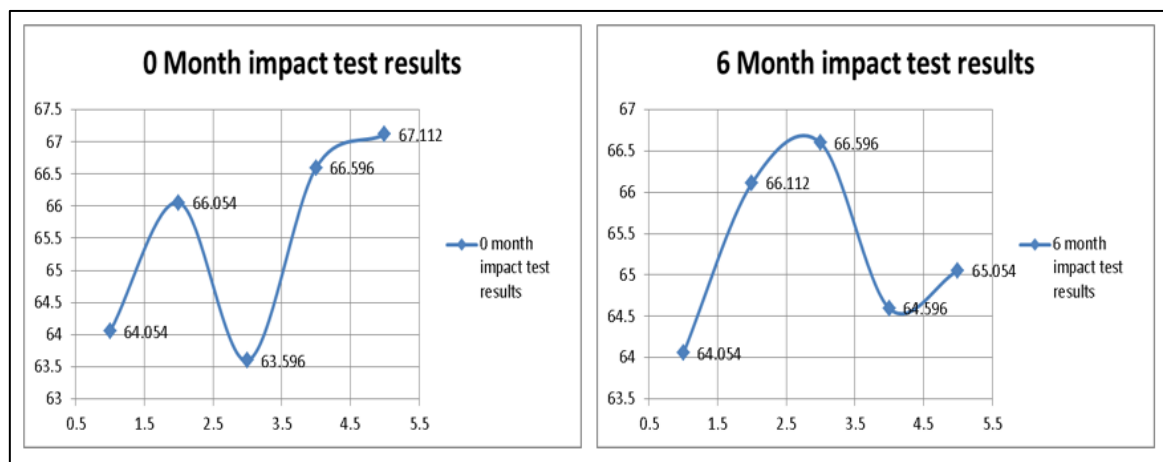
Figure 4. Graph of tensile test results.

3.2. Impact testing

Impact test results at 0 months on average 65.4824 kJ / m² while in the following 6 months, there was a decrease in impact strength by an average of 65.2824 kJ / m². It means that the impact strength does not decrease significantly as the age of the composite increases. The following Table 2 shows the results of impact test and Figure 2 shows the impact test chart at 0 months and 6 months.

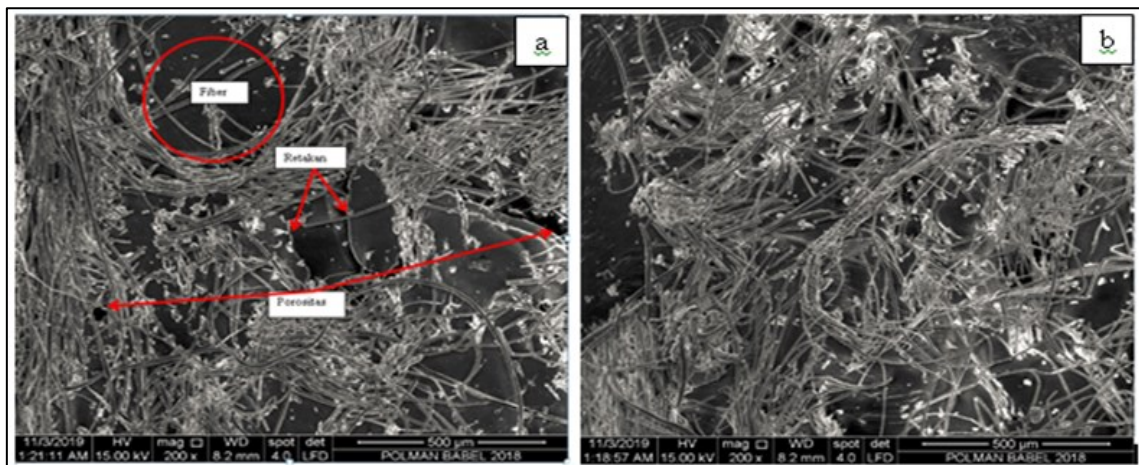
Table 2. Impact testing.

No	Soaking	Fiber Length mm	Impact Test Results	
	Hours		0 month (kj/m ²)	6 month (kj/m ²)
1	2	500	64.054	64.054
2	2	500	66.054	66.112
3	2	500	63.596	66.596
4	2	500	66.596	64.596
5	2	500	67.112	65.054

**Figure 5.** Impact test graph.

3.3. Scanning Electron Microscope (SEM) test results

SEM testing uses Scanning Electron Microscope (SEM) Inspect S50. In SEM testing, 200 times magnification is performed by looking at the difference between the highest and lowest tensile test values. SEM results can be seen in Figure 6 as follows:

**Figure 6.** Scanning Electron Microscope (SEM) test results.

Based on SEM results for the value of the smallest tensile test is influenced by porosity and cracks that exist in some parts of the surface. Whereas for the largest tensile test value the surface results are very good because of SEM results with 200 times magnification with a distance of 500 μm not found porosity and cracks, and also very even distribution of fiber. The results of fiber binding with resin are quite good although there is still some dirt attached.

4. Conclusions

From the results of the Tensile test results in 0 months an average of 33.926 MPa while in the following 6 months there was a decrease in Tensile strength by an average of 31.22 MPa. Means tensile strength will decrease as the age of the composite increases. Impact test results at 0 months on average 65.4824 kJ / m^2 while in the following 6 months there was a decrease in impact strength by an average of 65.2824 kJ / m^2 . This means that the impact strength does not decrease significantly when the composite age reaches 6 months. SEM results for the smallest tensile test values are influenced by porosity and cracks that exist in some parts of the surface. Whereas for the greatest tensile test value the surface results found no porosity and cracks, and also the spread of fiber is very even. The results of fiber binding with resin are quite good although still there is some dirt attached. Then it can be concluded that this composite of banana tree fiber can be used for pepper tree stands.

5. References

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