# Study Of Manufacturing Composite Particle Boards of Sago/Rumbia Leaf (Gaba-Gaba) Using Epoxy Filler and Fiberglass Filler on Physical Properties of Composites

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**Abstract.** The current development of science and technology, especially in the field of materials, causes people to prefer to use instant construction materials because they are practical, solid and durable, and easy to obtain, so that people, especially sago/rumbia processing farmers, only use the contents of the stems as flour. In contrast, the -other parts of sago/rumbia are no longer used, so they become waste. Research on particle composite materials and sago/sago leaf stalk fibers, using resin fillers and fiberglass catalysts, as a study on the manufacture of composite boards to compare with previous studies using epoxy fillers and fiberglass filler studies to see the ability of physical and economic properties to manufacture boards. Composites in previous studies. This study uses a testing method using the standard SNI 03-2105-2006 [1].

**Keywords**: Sago Leaf Stalk, Epoxy Filler, Fiberglass Filler.

## 1 Introduction

This research used particle fibers from sago leaf stems (Gaba-Gaba) derived from sago trees (Metroxylon sago) as the main ingredient. This research was carried out previously by using a random arrangement of fibers and then using a filler with epoxy adhesive, resins, and catalysts. In general, sago (Metroxylon sago) thrives in freshwater swamp areas, with a distribution of approximately 1,250,000 hectares[2], especially in the material sampling area in Central Oba District, Tidore City, North Maluku Province. Sago has many benefits (many trees), roots, stems, leaves, and midrib and stems are used for residential buildings, and mats and brooms, the contents of the trunk are made of flour (Fatriani 2010 in Samad.s 2017), traditionally the trunk of the sago tree used as a residential wall.

With the development of science and technology today, people prefer to use building materials that are instant, practical, strong and durable, and easy to obtain, so that people, especially sago processing farmers, only use the contents of the stems as flour, while the other parts of sago are no longer used and become waste.

The study of particle composite materials and sago/sago leaf stem fibers is the same as the previous study. However, this study used a filler material with fiberglass adhesive and compared the economic value of making leaf stalk fiber composite materials and to see the composite material's physical properties. To obtain a composite board material with the same results as previous similar studies, it is necessary to know the composition of the mixture of particles and matrix and filler with variations in density to produce a composite board with changes in the character of the composite board to obtain good physical and mechanical properties.

## 2 Research Methods

The composite fiber particle board using epoxy resin and catalyst has the advantage of minimal absorption even better than SNI, JIS, and ASTM D standards, but the manufacture of particle board using resin adhesive and the epoxy catalyst was expensive, with a ratio of 1 kg of resin and epoxy catalyst can only make 1.5 M2 has a board thickness of 4 cm composite fiber particle board with a cost of Rp. 450,000[3].

The nature of particle board is influenced by the raw materials that make it up, the adhesives and formulations used, and the process of making the particleboard, starting from the Preparation of wood raw materials, the formation of particles to the compression process and its completion. The use of the right particle board will affect the duration and utilization obtained from the particle board used. The properties of raw materials that affect the properties of particleboard include the type and density of wood, the shape and size of the wood raw materials used, the moisture content of the wood, the size and geometry of the wood particles, the type and use of the bark[4].

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Composites from plastic sawdust are composites made of plastic as a matrix and filler, which has the combined properties of both, as well as for the use of other types of fillers. The addition of filler into the matrix aims to increase stiffness and reduce density and cost per unit volume, while with the presence of a polymer matrix in it, its strength and physical properties will also increase [5].

## 3 Research Methodology

### 3.1 Materials Preparation

The tools used in this research are; Grate machine as a crusher or grated sago leaf stalk to get partake powder and fiber (matrix) as a binder, an oven as a test material dryer, digital scales as a measure of variable materials, hydraulic machines as a test pressing, test material molds, moisture meter as a measuring tool water content. The materials used in this study were sago palm leaf stalk (Gaba-gab) as the main ingredient, catalyst adhesive, and fiberglass resin as a filler.

Research materials include the Preparation of the main ingredients, namely sago leaf stalks, crushed with a greater machine, and separated fine particles from fibers, then dried naturally under direct sunlight to reduce the water content to 5%.

### 3.2 Composite Board Manufacturing Process

The manufacture of composite boards using Metroxylon sago fiber particles (Gaba-Gaba), mixing particles and fibers using a random system (random) with a particle ratio, the fiber for the sample with code A is the formulation of 0.5 Kg particles: 0.5 Kg fiber and 0.5 Kg Fiberglass Catalyst and 15 ml of resin. Sample with code B 0.5 Kg Particles: 0.5 Kg Fiber and 0.5 Kg Fiberglass Catalyst and 15 ml Resin 0.5 Kg Particles: 0.5 Kg Fiber and 0.5 Kg Fiberglass Catalyst and 15 ml 0.5 Kg Resin Particles: 0.5 Kg Fiber and 0.5 Kg Fiberglass Catalyst and Resin 10 ml. Samples with code C 0.5 Kg particles: 0.5 Kg fiber and 0.5 Kg Fiberglass catalyst and 15 ml resin 0.5 Kg particles: 0.5 Kg fiber and 0.5 Kg Fiberglass Catalyst and 15 ml resin to get a thickness of 2 cm with mold size of 30 x 30 cm. The comparison is mixed and in the mixer for about 15 minutes until evenly distributed. The mixture of materials is put into a mold with a mold size of 30 cm x 30 cm, and then it is pressed/pressed with a pressure of 150 Kg/m2 using a hot press of 150 0C. The finished test sample with a size of 30 x 30 cm, then the composite board was cut according to the SNI 03-2105-2006 standard.

The result of the finished composite board is left for ten days to get the most negligible weight of the material/composite board, namely the saturated weight according to the material, before being mixed and printed. Next, the test material is cut according to the testing standard using SNI 03-2015-2006, 5cm x 5 cm according to the specified test sample, namely 3 test samples, with 1 sample each. Testing of composite boards from the stalks of sago palm leaves (Metroxylon sago), which is reviewed from the physical properties and physical properties compared with previous studies, then calculates the costs needed in making the composite board the costs of making composites in previous research. This testing method is used for the testing method with the standard SNI 03-2105-2006, then compared with the [6] standard and the Japanese Agricultural Standard for Glued Laminated Timber Notification No. 234 of 2003 (JPIC 2003) [7].

## 4 Result and Discussion

### 4.1 Water Absorption Test Results

According to Bowyer 1966, the density of composite particleboard, the higher the value of resilience.

The results of the water absorption test show that the composite board with various formulations used in each sample with the same thickness shows different specific gravity. The test results can be explained in the table as follows:

**Table 1.** Test Results for Composite Boards of Sago (Gaba-Gaba) Leaf Stalks.

| Sample | Composite Formulation | Strong Pressing ($kg/cm^2$) | Old Pressing (Hour) | Pressing Temperature ($^oC$) | Initial Weigh t | After Soaking 24 Hours | Water Absorption (%) |
|---|---|---|---|---|---|---|---|
| Sample A 2 cm | 0.5 Kg : 0.5 Kg : 1 Kg : 15 Ml | 150kg/cm² | 1 | 150 | 50 | 54.6 | 9.2 |
| Sample B 2 cm | 0.5 Kg : 0.5 Kg : 0.7 Kg : 10 Ml | 150kg/cm² | 1 | 150 | 43 | 48 | 11.63 |
| Sample C 2 cm | 0.5 Kg : 0.5 Kg : 0.5 Kg : 1 Ml | 150kg/cm² | 1 | 150 | 44.5 | 50.1 | 12.58 |
| Standard Control SNI 03 2015 2006 | | | | | | | Max 12 |

Source*: Researcher Testing at the Architectural Laboratory*

The physical properties of the sago/rumbia leaf stalk composite board using fiberglass catalyst resin showed excellent results in the table above. Each sample showed a very significant absorption trend, where the formulation/mixing using fiberglass catalyst resin with a higher percentage of use affects the increase in adhesion is quite good, but the higher the percentage of filler resin and fiberglass catalyst in the test material causes an increase in the density of the composite material.

The filler in the composite material, the higher the percentage, and the better the filler will fill the cavities contained in the composite material, thereby reducing water absorption in the material. While in both samples B and C, the filler is reduced as a binder resulting in more excellent water absorption. This is presumably because the pores in this composite are more numerous.

From the results of research using the same material and the same testing method, a comparison of the cost of making composite materials can be made, and the results of this test can be presented in the following table:

**Table 2.** Comparison of Test Results.

| Previous Research | | | | Current Research | | | |
|---|---|---|---|---|---|---|---|
| Sample | Initial Weight | After Soaking 24 Hours | Water Absorption (%) | Sample | Initial Weight | After Soaking 24 Hours | Water Absorption (%) |
| MUP A 2 cm | 50 | 54.8 | 9.60 | SAMP A 2 cm | 50 | 54.6 | 9.2 |
| MUP B 2 cm | 40 | 44.8 | 12.00 | SAMP B 2 cm | 43 | 48 | 11.63 |
| MUP C 2 cm | 39.8 | 45.31 | 13.84 | SAMP C 2 cm | 44.5 | 50.1 | 12.58 |

In the comparison of previous studies and current research using fiberglass resin and catalyst with the same test method using the standard method of SNI 03-2105-2006 got results that were not much different, where the formulation of the binder was catalyst and resin, the higher the percentage, the lower the porosity of the test material, so that the water absorption decreases. The test results can be explained in the image below, showing the water absorption level in previous studies and current research:

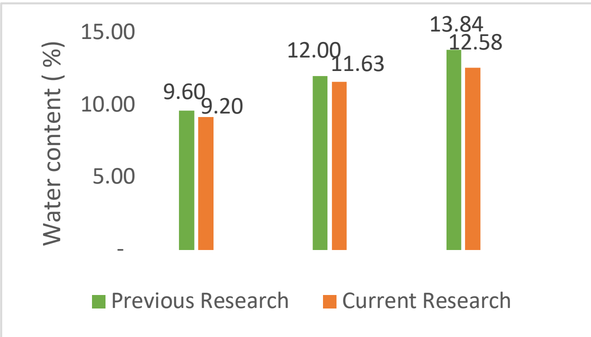


**Fig. 1.** Comparison Chart

In the graphic image above, comparing the results of the previous test and the results of the current test with the same test material, the difference between using a different binder (filler), shows that the water absorption level is minimal. In contrast, the previous study seen in sample A, 9.60 % rate of water absorption, and current research is seen in sample A 9.20%. Meanwhile, in the previous study, sample B was 12.00%, and in the current study, sample B was 11.63 %, the previous study sample C was 13.84%, and sample C in the current study was 12.58 %. This result shows that the absorption of composite materials using fillers and resin fiberglass catalysts is very good at absorbing the sago leaf stalk material (Gaba-Gaba) to reduce the porosity of the composite material, thereby reducing porosity. The material then the rate of water absorption is minimal.

## 4.2 Composite Material Manufacturing Financing

The financing for manufacturing composite boards in previous studies with current research uses the same type of material, but the differences are: previous studies used a binder (filler) as a binder/filler is an epoxy resin and catalyst. In contrast, the current study uses a resin binder (filler) and fiberglass catalysts. Both of these studies used the same manufacturing and testing method, namely the SNI 03-2105-2006 standard. Thus, it can be seen the difference in the cost of making composite materials as described in the following table.

**Table 3.** Differences in Cost of Making Composite Boards Sago/Rumbia Leaf Stalks.

| No | Sample | Ingredient | Dimensions | Unit | Volume | Unit Price (Rp) | Amount (Rp) |
|---|---|---|---|---|---|---|---|
| Previous Research | | | | | | | |
| 1 | 1 Test Sample | Particles and Fibers Gaba-Gaba | 30x30x2 cm | Kg | 3.89 | 75,000 | 291,750 |
| | | Epoxy Catalyst and Resin | | Kg | 2 | 178,000 | 356,000 |
| | | Diluent | | Kg | 5 | 7,250 | 36,250 |
| | **Total 1** | | | | | | **684,000** |
| 2 | 1 Test Sample | Particles and Fibers Gaba-Gaba | 30x30x2 cm | Kg | 3.89 | 75,000 | 291,750 |
| | | Epoxy Catalyst and Resin | | Kg | 1 | 50,000 | 50,000 |
| | | Diluent | | Kg | - | - | - |
| | **Total 2** | | | | | | **341,750** |
| **Differences 1 and 2** | | | | | | | **342,250** |

The table above shows the difference in the cost of making sago/rumbia leaf stalk composite boards in a previous study using a resin filler and an epoxy catalyst. The more expensive financing lies in the resin and epoxy catalyst and requires an adhesive diluent. While the manufacture of composite boards using resins and fiberglass catalysts does not require special diluents, however, the fascial properties of composites using resin fillers and fiberglass catalysts have better absorption rates. (Case Study of banda Aceh City) [Model Tarikan Pergerakan Sepeda Motor Pada Pusat Perbelanjaan (Studi Kasus: Di Kota Banda Aceh)]". Jurnal teknik sipil, 06 (03), 251-260, (2017).

## 5 Conclusion

Based on the results of research on the study of making composite particle boards of sago/rumbia leaf stalk (Gaba-Gaba) using epoxy filler and fiberglass filler on the composite fascial properties and the cost of making composite boards, it can be concluded that;

1. The manufacture of composite boards using a filler resin and an epoxy catalyst has composite physical properties. The results in previous studies show that the physical properties value is smaller than the standard SNI SNI 03-2105-2006, which is less water absorption, which is a maximum of 12% with a ratio of 1: 1: 1
2. The manufacture of composite boards using filler resin and fiberglass catalyst with the same mixture composition and the same method shows that the physical properties of water absorption are smaller than in previous research and the value is still below the required standard of SNI 03-2105-2006.
3. Economically, in this study, the manufacture of sago/rumbia leaf stalk composite boards, using a resin filler and a fiberglass catalyst, is 50% cheaper than previous studies using an epoxy resin, and catalyst properties of water absorption are smaller than previous research, and the value is still below the required standard of SNI 03-2105-2006.
4. Economically, in this study, the manufacture of sago/rumbia leaf stalk composite boards, using a resin filler and a fiberglass catalyst, is 50% cheaper than previous studies using an epoxy resin and catalyst.

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