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Mechanical Properties of Composite Polymer Mixture Of Banana And Pineapple Fiber for Sound Wave Absorbers

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Abstract. This study aims to determine the tensile strength of composite fibers of banana and pineapple. Mixed fiber composites use polyester resin as the binding matrix. The research sample was made by varying the fiber concentration with a matrix using mass fractions ((10:90)%, (20:80)%, (30:70)%, (40:60)% and (50:50)%). From the results of tensile strength testing, betel fiber composites with fiber (50: 50)% concentration is the best fiber because it has a maximum stress of 15.422 Mpa, elasticity modulus of 1350.5 MPa, elongation of 0.0402 mm and break point value of 0, 0048. This tensile strength value is greater than the standard SNI 03-2105 which is a minimum of 8 MPa and higher than previous researchers who use natural fiber.

Keywords: composite of banana and pineapple fiber

1. Introduction

The progress of science and technology has resulted in pollution that disrupts human comfort and health. One of the most common pollution is noise or noise pollution, especially for buildings or buildings that are close to the highway. To overcome this, various types of sound absorbing materials were developed, to create buildings or buildings with certain acoustic characteristics so as to create comfort and be able to reduce noise caused.

The materials commonly used as sound absorbers are fibers, both natural fibers and synthesis. When compared with synthetic fibers, natural fibers are more profitable to develop. This is because natural fibers are made from materials that are easily obtainable, are biodegradable or can be broken down again if they are damaged or cannot be used anymore and the manufacturing process is not complicated and economical. The development of natural fiber composites not only includes the development of natural fibers in the form of fiber composites and composite structures as described previously. Natural fiber research also exists in the form of particle composites. The results of this study indicate that the optimum composition is achieved by adding 6% (volume) of empty oil palm bunches fiber [1].

Natural fiber which has great potential to be developed as a natural fiber material is banana fiber. The results of the study of banana fiber composites are able to absorb sound with a sound absorption coefficient of 0.84 at a fiber volume fraction of 50%, this shows that banana stem fiber composites are able to absorb sound well for low frequency and medium frequency, in accordance with ISO 11654: 1997 standards (E) where the sound absorption coefficient of acoustic material is at least 0.15. [2].

In addition to the ability to absorb sound, an important variable that needs to be considered in the manufacture of composites is the mechanical properties of the specimen tensile test. Preliminary research conducted by several researchers, among others, coconut fiber composites with PVAc matrix produced maximum tensile strength in composition (70:30)% by 2 MPa [3], water hyacinth fiber composites produced a maximum tensile strength of 1.7 MPa [4] , banana stem fiber composites with epoxy resin matrix with maximum tensile strength in composition (50:50)% of 10.93 Mpa [5].



Banana and pineapple fiber is a natural fiber in the manufacture of composites scientifically, both of which are widely used by the community as banana midribs used as food packaging materials. Banana and pineapple fiber has another potential to be developed, namely as a silencer composite material which is expected to have tensile strength according to SNI standards and better than previous studies.

2. Materials and Methods

This research is an experimental research that is the manufacture of fiber composite materials can be used as sound absorbing material in accordance with ISO, SNI and ASTM (American society for Testing Materials) standards.

Before it is ready to be used as a basic ingredient in making composites, fiber is processed through several stages including: Selecting dried banana midribs, and choosing dried pineapple leaves. Furthermore, the fiber is trimmed and then cut to a size of 2 cm mixed according to concentration and blended. after that the fiber is ready for use. Furthermore, the fiber obtained is weighed to determine its density. This is done to facilitate the determination of the concentration of fiber to be used as research specimens.

Composite making is done by mixing the fiber that has been weighed with polyester resin. The mixture is then added with hardner as a catalyst. All ingredients are then stirred until the mixture looks even and homogeneous. The mixture is then poured into the mold that has been prepared.

The mold used has been adjusted to the dimensions needed for each measurement. Each specimen was made with a ratio of fiber and resin concentration, (10: 90)%, (20: 80)%, (30: 70)%, (40: 60)% and (50: 50)%. Making one sample takes 24 hours starting from the process of seeding to the drying process.

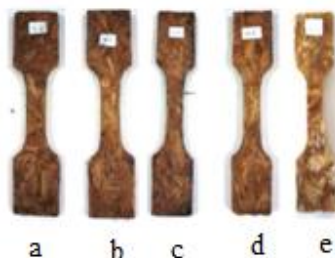


Figure 1: Composite Tensile Test Samples of Mixed Banana and Pineapple Fiber
a (10: 90)%, b (20: 80)%, c (30: 70)%, d (40: 60)% and e (50: 50)%.

Measurement of composite tensile strength using UTD AnD brand, RTG 1310 model. As in Figure 2 :



Figure 2. Tensile strength test equipment

(Source: Physics Laboratory, Faculty of Mathematics and Natural Sciences UNRAM)

3. Results and Discussion

The results of the tensile test were obtained in the form of maximum tensile strength, elastic modulus, length increase and break point. The maximum tensile stress is obtained from the maximum load regarding the cross-sectional area of the sample tested. Fiber composite material has a maximum maximum tensile stress, its value increases in proportion to the increasing concentration of fiber used

The highest maximum tensile stress is found in samples with fiber (50: 50)% concentration, and the lowest tensile stress is owned by the composite with fiber concentration (10: 90)%, as shown in figure 3. The properties of composite materials are strongly influenced by the nature and distribution constituent elements and interactions between the two. Other factors that can affect the nature of composite materials include, shape, size, orientation, fiber distribution and matrix properties used. Composite properties depend on the nature of the constituent material. The strength of fiber composites is determined by the fibers used [6].

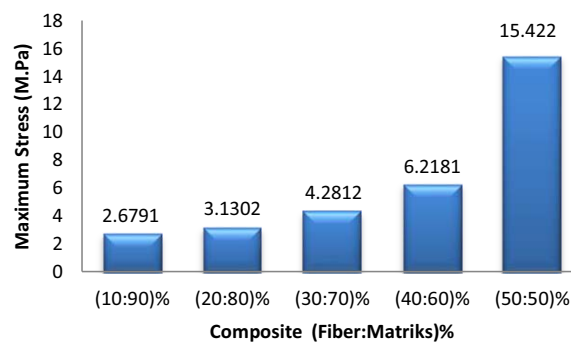


Figure 3. Graph of maximum tensile stress of fiber composites

Other data obtained from the tensile test in the form of elastic modulus. Modulus of elasticity is a measure of the strength of a material to be elasticity. The greater the strain (Ultimate Tensile Strength), the smaller the elasticity of the material. In the tensile strength test, the sample is given a pull in a longitudinal direction. The data obtained shows that the betel fiber composite has an elastic modulus that is inversely proportional to the maximum tensile strength.

Figure 4 Modulus of elasticity of areca fiber composites increases with increasing concentration of matrix, the highest elasticity modulus value at composition (50:50)% is 1350.5 Mpa and the smallest in composition (10:90)% is 691.04 Mpa. Increased modulus of elasticity due to a decrease in tensile strain is greater than the decrease in tensile strength [7]

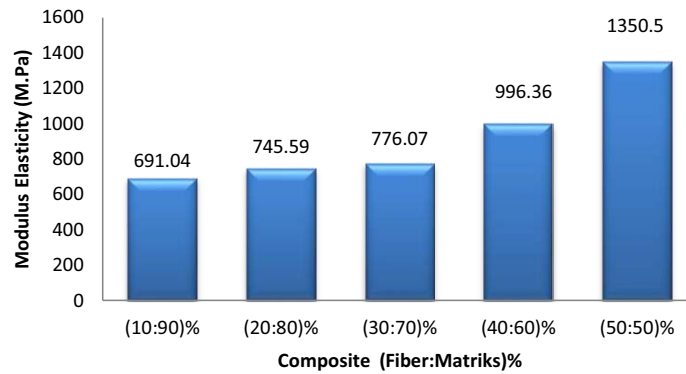


Figure 4. Graph of elasticity of fiber composite modulus

The next data is the relationship between the specimen concentration ratio and elongation (length increase) as shown in Figure 5.

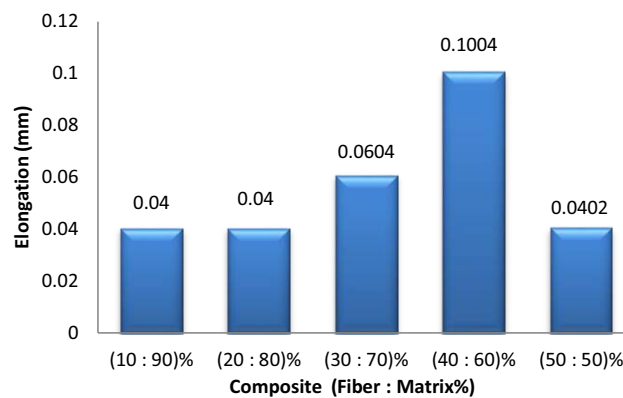


Figure 5. Graph of fiber composite elongation

Unlike the previous data, elongation graph shows fluctuating data, with the largest elongation value in composition (40:60)% of 0.1004 mm and the smallest in composition (10:90)% and (20:80)% of 0, 04 mm. The latest data is the relationship between specimen concentration ratio and break point, as shown in Figure 6.

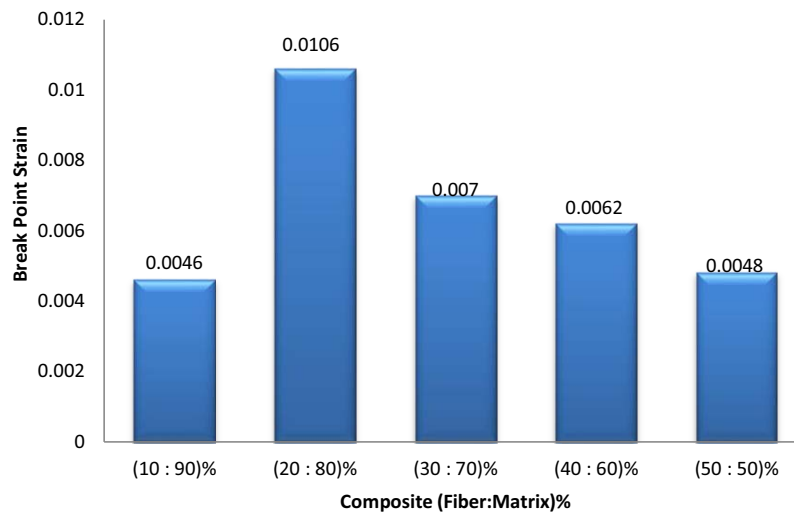


Figure 6. Graph of composite fiber break points

Figure 6 shows the greatest break point value in composition (20:80)% of 0.0106 and the smallest in composition (10:90)% of 0.0046.

4. Conclusion

Based on the results of the description and discussion that has been described it can be concluded that the best sample in composition (50:50)% with tensile strength or maximum stress 15.422 Mpa, elasticity modulus of 1350.5 MPa, elongation of 0.0402 mm and break point value of 0, 0048. This value of this tensile strength is greater than the standard SNI 03-2105 which is a minimum of 8 MPa and higher than previous researchers who use natural fibers. This is influenced by several factors, including the type of fiber and matrix used.

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