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Tensile Test of Terminalia Catappa Fruit Fiber Composite Material

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Abstract: *The development of composites is not only a synthetic fiber composite but also natural fiber composites as they can be recycled. In addition, natural fiber composite also has other advantages when compared with glass fiber, more environmentally friendly because it is able to degrade naturally and the price is cheap, so in this study fiber composite board made of terminalia catappa fruit fiber. The purpose of this research is to know the characteristics of fiber terminalia catappa fruit fiber composite board with poly vinyl acetate matrix. It is expected that from this research can be made composite board that has characteristics according to SNI or ISO standards. Characteristics in question is the mechanical properties (tensile strength and flexural strength). The sample preparation was done by varying the ketapang fiber and the PVAc matrix (40:60, 50:50, 60:40 and 70:30)%. The result of tensile test obtained by tensile strength in sample with variation (60:40)% with maximum 3 MPa and the smallest value at variation (70:30)% with value 2,22 MPa, while the smallest drop point value in variation (70 : 30)% of (3.05% GL) and largest in variation (40:60)% (18.1% GL), and for the smallest specimen length increase in variation (50:50)% by 0.12 mm and the largest on variation (40:60)% by 0.2 mm.*

Keywords: *composite, terminalia catappa fruit fiber, PVAc, tensile strength*

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I. Introduction

The development of composites is not only a synthetic fiber composite but also natural fiber composites as they can be recycled. In addition, natural fiber composites also have other advantages when compared with glass fiber, more environmentally friendly because it can be degraded naturally and cheap, while glass fibers are naturally degraded, glass fiber also produces CO gas and dust that are harmful to health if it is recycled repeated [1]. [2] natural fiber properties abundant amounts, light weight, not rough for equipment manufacture, can be burned by generating energy, not causing skin irritation, good mechanical properties, acoustic properties and good heat insulation, (plant) is 40% below the glass fiber type. Types of existing sound absorbers are panel materials, resonators and porous [3]. Natural fiber porous that has great potential to be developed as a natural fiber material is terminalia catappa fruit fiber. Terminalia catappa is a multipurpose plant. Its seeds can be used as a source of protein and fiber [4]. The leaf extract can inhibit the growth of Bacillus amyloliquefaciens [5]. Terminalia catappa are commonly found in Southeast Asia, brought from Southeast Asia and spread to other parts of the world including India, Polynesia, Madagascar, Pakistan, West Africa, East Africa, South America and Central America [6].

In each region terminalia catappa have different names, among others: hatapang (Batak); katafa (Nias); katapieng (Minangkabau); lahapang (Simeulue); ketapas (Timor); talisei, tarisei, salrise (North Sulawesi); tiliso, tiliho, ngusu (North Maluku); sarisa, sirisa, sirisal, sarisalo (Maluku); kalis, kris (West Papua) [6].

But the utilization of termalia catappa fruit in Indonesia especially in the city of Mataram has not been optimal, this tree grows a lot and is only used as a shade tree and its fruit is wasted to waste. Therefore Termalia catappa fruit wastes are used for sound absorbers and mebeler and have SNI standard tensile properties.

II. Method

The materials needed in this research is Termalia catappa fiber 1 kg, Polivinyl Acetate (PVAc) brand of Rajawali as matrix and purified water as solvent. At the stage of making Termalia catappa fruit fiber samples taken fiber begins with the separation of fruit from the shell and then washed with water until clean. Further terminalia catappa fruit husk that has been washed, dried by drying. Coat dried terminalia catappa then cut to the size of 2 cm and blend to get fiber with a small size and smooth.

After terminalia catappa fruit fiber are obtained, the steps taken in preparing the composite sample of terminalia catappa fruit fiber are weighing and the prepared PVAc matrix with the ratio between fiber volume and matrix are (40:60, 50:50, 60:40, 70:30)%, then mixed by adding 10% water for each concentration. Terminalia catappa fruit fiber and PVAc fibers are further mixed and stirred to obtain a homogeneous mixture. The homogeneous mixture is incorporated in a mold already coated with aluminum foil and then pressed with a manual pressing device. The mixture is left for 3 hours in the mold to obtain a standard sample. The mixture is removed from the mold which is in the form of a ketapang fiber composite, then dried in an oven by heating 40 oC for 6 hours, then the sample is ready for the mechanical properties test process.

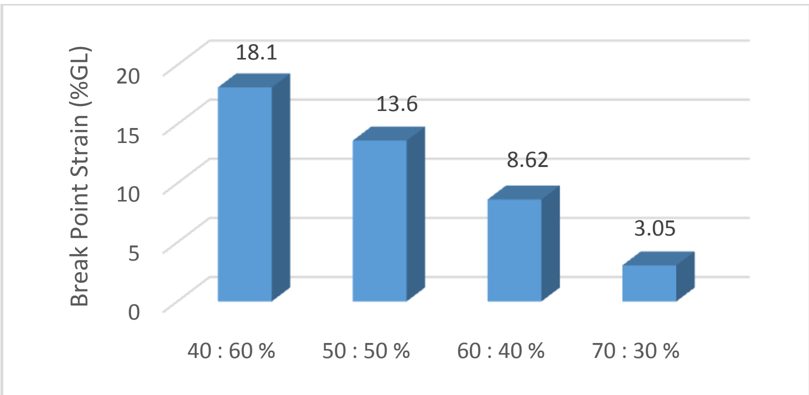
III. Result And Discussion

The sample tensile strength measurements refer to the ASTM (American Society for Testing Materials) using the UTD brand test apparatus AnD model RTG 1310. The sample for tensile test is shaped as shown below.

(a) (40:60)% (b) (50:50)% (c) (60:40)% (d) (70:30)%

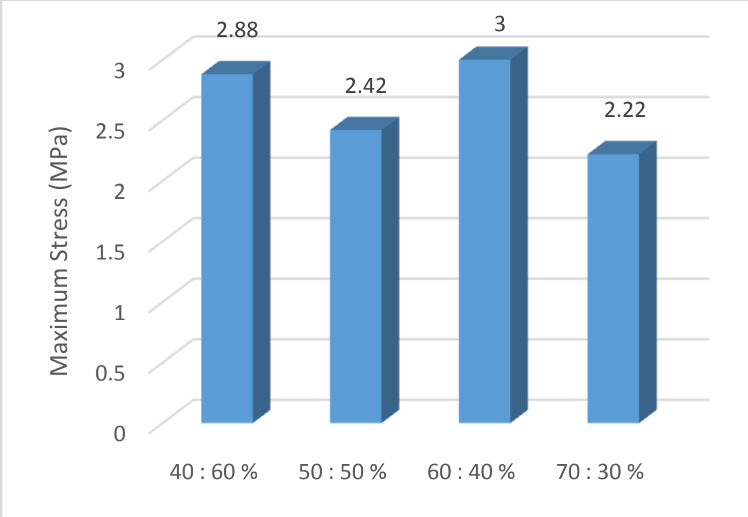
Figure 1 Composite sample for tensile test for each concentration

Based on the tensile test results for the maximum load that causes the breaking object, the highest value is in the sample (a) of 18.1% GL and the lowest value at (d) of 3.05% GL as shown in graph 1.



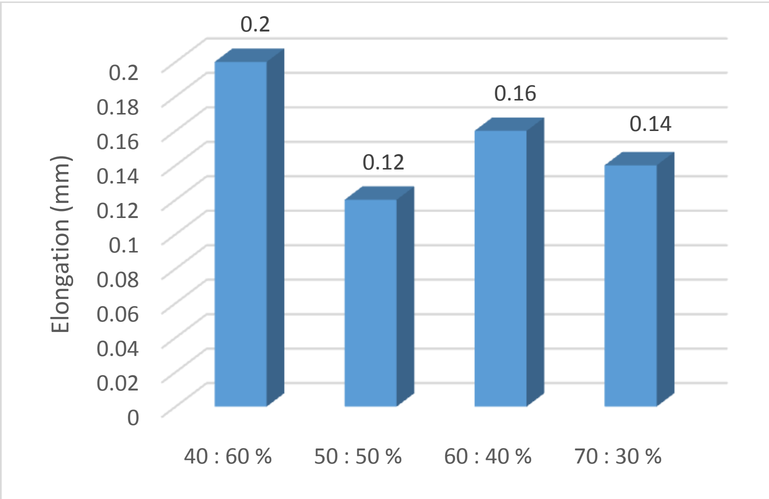
Graph 1 Break Point Strain from variation of sample concentration

Graph 1 shows that the compound fracture point of the terminalia catappa fruit fiber and PVAc fibers increases with the increase of adhesive matrix variation. This looks slightly different to the composite tensile strength as shown in graph 2.



Graph 2 Maximum stress from the lowest concentration of composite sample samples to the highest

Graph 2 shows the highest maximum voltage values in the sample with a 60% ratio of terminalia catappa fiber and 40% of the 3 MPac PVAc adhesive matrix, and the lowest maximum voltage in the sample with a ratio of 70% ketapang fiber and 30% adhesive glue PVAc 2.22 MPa For extension specimen (elongation) obtained results as in graph 3.



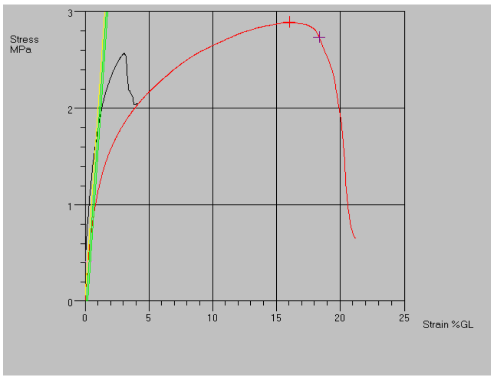
Graph 3 of the average extension of concentration variation

Graph 3 shows composites with composition (50:50)% giving the smallest increment length of 0.12 mm and composition (70:30)% by 0.14 mm, composition (60:40)% by 0.16 mm and increase the largest length on the composition (50: 50%) of 0.12 mm. It can be concluded that the composite of ketapang fiber with a PVAc adhesive matrix is resilient enough, this is also demonstrated by the fracture model occurring after the tensile test as shown in FIG. 2 is shown to provide a fracture with fibrous and dark characteristics (dull).

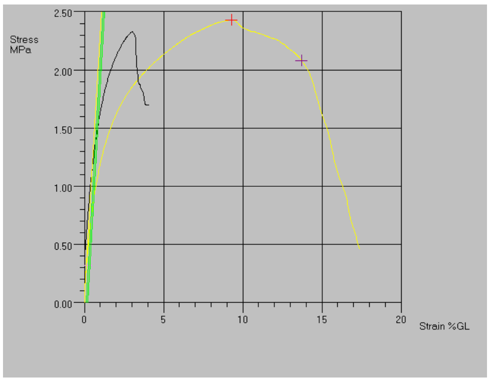
(a) (40:60)% (b) (50:50)% (c) (60:40)% (d) (70:30)%

Figure 2 Fractures that occur in each of the composite sample variation

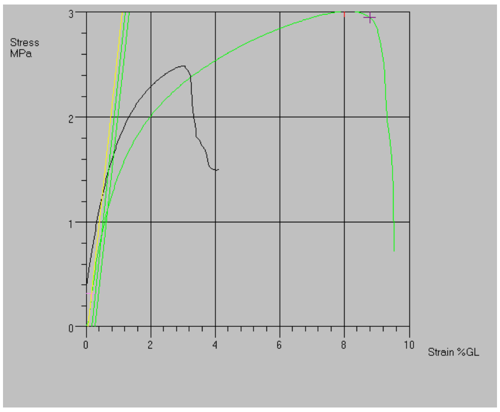
The ductile properties provided by the coco fiber composite with the PVAc matrix are also shown in the graph of the relationship between stress and strain given by the sample as shown in graphs 4 below:



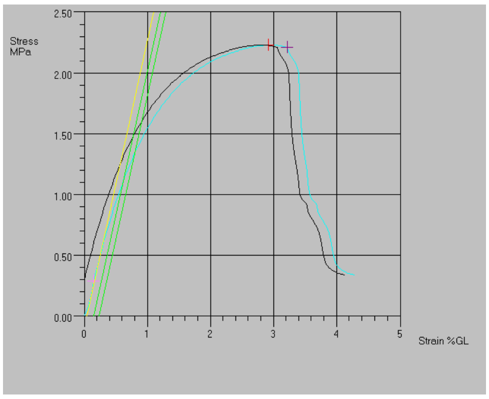
(a)
(40:60)%



(b)
(50:50)%



(c)
(60:40)%



(d)
(70:30)%

Graph 4 The stress relationship and strain specimen for each concentration

IV. Conclusion

Based on the results of the description and discussion that has been described can be concluded that the largest tensile strength in the sample with the variation (60:40)% with a maximum stress value of 3 MPa and the smallest in the variation (70:30)% with a value of 2.22 MPa, the smallest drop in the variation (70:30)% (3.05% GL) and the largest in variation (40:60)% (18.1% GL), and for the smallest specimen length increase in the variation (50:50) % by 0.12 mm and largest in variation (40:60)% by 0.2 mm.

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