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BOOK OF ABSTRACTS

INTERNATIONAL CONFERENCE
ON EDUCATION, SCIENCE
AND TECHNOLOGY
(ICESTech)

MARCH 15, 2019

AUDITORIUM UNIVERSITAS NEGERI PADANG

EDUCATION, SCIENCE
AND TECHNOLOGY
IN INDUSTRIAL REVOLUTION 4.0

ORGANIZED BY UNIVERSITAS NEGERI PADANG

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FOREWORD

Rector of Universitas Negeri Padang

A very warm welcome (Selamat Datang) to all speakers and delegates of Konvensi Nasional Pendidikan Indonesia (KONASPI) to Padang, West Sumatera Indonesia and to our International Conference on Education, Science and Technology (ICESTech) 2019 with Education for Industrial Revolution in 4.0, on March, 13th - 16th 2019, organized by Universitas Negeri Padang

It is an honour to be the host of the KONASPI and ICESTech as it provides great opportunity for respectable researchers, experts, scholars, students and even policy makers to share ideas on hot issues and trending topics on Education, Sciences, and Technology.

Our sincere appreciation goes to Kemenristek, Forkom of FKIP leaders of Indonesia, Asosiasi Lembaga Pendidikan Tenaga Kependidikan Negeri Indonesia (ALPTKNI), Kemendikbud, and sponsors. We appreciate your participation in this conference.

I would like to take this occasion to express my appreciation to keynote and invited speakers of the conference, the prominent figures in their field. My appreciation should also be addressed to all co-host universities who have shared significant contribution to make this event possible. To all parallel speakers as well as all participants coming from various places, your contribution makes this conference is truly special.

I appreciate the organizing committee, the scientific committee members, and the international board for their efforts in materializing this conference.

Finally, I encourage delegates to collaborate and participate actively in interesting discussion in this conference. Have a fruitful conference, and please enjoy your visit to Padang.

Sincerely,

Prof. H. Ganefri, Ph.D.

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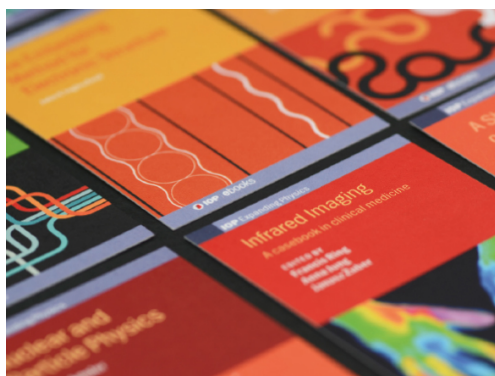
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To cite this article: Hendri Nurdin *et al* 2019 *J. Phys.: Conf. Ser.* **1387** 012103

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Characteristics of Particleboard From Waste *Nypa Fruticans Wurmb*

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Abstract. The development of engineering materials has increased its use. Engineering material which is a combination of various materials that can be made into a product, namely particle board. Nypa plants have the potential to be used as engineering materials. Traditionally, the use of nypa fruit has been carried out by the community, but the skin or nypa fiber only becomes waste that is wasted and untapped. The development of a diversified technology process in the utilization of waste into engineering materials in the form of particle boards is very possible. The particle board innovation made from raw nypa fiber as an interior furniture material that has light strength and weight as a substitute for wood. The process of making particle boards with compacting and composition optimization methods is an effort to obtain new material that can be developed and has quality according to JIS A 5908 standard. Efforts to develop new materials with better performance to replace wood products as furniture. Through the improvement of process technology and the potential livelihoods of plant waste in obtaining advanced materials as raw material for innovation in the manufacture of particle board products based on the waste of nypa fruit fiber.

1. Introduction

Technological progress is very rapid, demanding development in the field of material engineering. The development of material engineering is able to shift the dominance of metal use. Development efforts in obtaining material engineering products carried out in the form of utilization of *Nypa Fruticans Wurmb* fiber waste as raw material for making particle boards. The application of engineering materials is widely used as an application in the manufacturing process as a new material. Particle board is a material that many people glance at because it has a light weight. Particle boards are widely used in a variety of products including wood substitute furniture. The advantages and advantages of particle board materials are easily formed, light weight, corrosion resistant, economical and not sensitive to chemicals. Innovation of particle board material engineering due to its features that are renewable, so it can reduce environmental disturbances. According to SNI [1], particle boards are the result of a mixture of hot compressed wood particles or other lignocellulose materials with organic adhesives. Lime plants contain lignocellulose which is the potential to be used as raw material for making particle boards. Nypa plants grow naturally, utilization by the community is still limited which lives around the beach for daily needs. For example midribs for firewood, leaves for the roof of the house and nypa leaf bones for broom sticks. The part of the nypa plant which is used as particle board material in the form of nypa fruit fiber where the contents of the nipah fruit have been taken for food, namely kolang-kaling. So that the *nypa fruticans wurmb* fiber is a waste that can be reused after processing. Efforts that can be made to increase the economic value of nypa fruit fiber waste is the



technology of utilizing the nypa fiber waste as the raw material for making particle boards. The usefulness of nypa fruit fiber is carried out by a technological process so that there is a diversification of the use of agricultural waste into particle board engineering material. Research on the use of plant waste has been carried out. Research on tea leaf waste can be used as an alternative material either alone or in combination with wood particles for the manufacture of particle boards [2]. One of the most important reasons for the increasing trend in the production of natural fiber composite is due to easy economical disposal of the wastes [3]. Composite board material made from nipah leaf has good tensile physical properties and bending is still needed the right mix formula [4]. The composite board of bagasse waste has good and potential strength and deflection behavior as a substitute for wood on interior furniture [5]. The bagasse waste-based composite board obtained density characteristics of 0.41 gr/cm^3 , 2.1% water absorption with the development of a thickness of 9.09% while drawing composite particle boards that met standard quality [6]. Development of further research on bagasse fiber-based particle composite boards using resin adhesives which yield tensile strength of 1.81 MPa, with strain 13.52% [7]. Through improving technology in the process of making particle board products using compacting, optimizing the composition of the content of the heavy fraction of nypa fruticans wurmb fiber into particles is an effort to improve the quality of the repairs produced. Before particle boards based on nypa fruit fiber waste are produced, it is necessary to evaluate the quality characteristics of particle boards according to standards [8]. The characteristics obtained are recommendations for furniture manufacturers as the development of furniture materials in accordance with SNI standards [1].

2. Research Methods

The research method carried out focused on the experimental study of composite board characteristics which included the quality test of the resulting composite board quality. The object of the research studied was particle boards made from *Nypa Fruticans Wurmb* fiber (Figure 1) and tapioca (Figure 2). Nypa fruit fiber as a composite board material is first chopped to become a particle (mesh) measuring 1.2 mm. Comparison of particle variations affects the strength of the particle board in the manufacturing process [9]. Comparison of variations of 90%: 10%, 80%: 20%, 70%: 30%, and 60%: 40%. Then the printed particle board measures $250 \times 250 \times 12 \text{ mm}$ with cold pressing at a pressure of 100 kg/cm^2 . Then heated at 120°C for 60 minutes using the oven. Conditioning is carried out for several days in sunlight to achieve uniform water content distribution and release residual stress in the board due to compression. Cutting the particle board as a test sample according to the standard [8] as shown in Figure 3. The tests carried out in this study were in the form of measuring the characteristics of the particle boards produced so that they were expected to be close to the standard values of particle boards.



Figure 1. Nypa Fruticans Wurmb (Fibre and Particle)



Figure 2. Tapioca

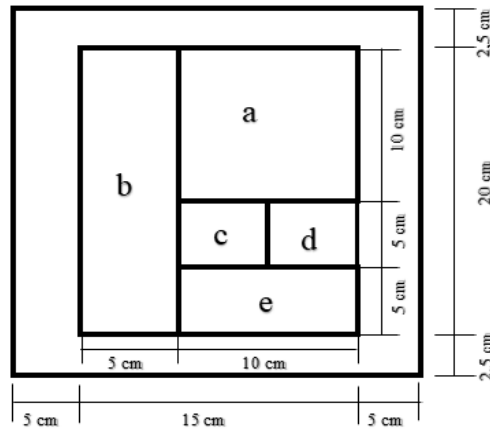


Figure 3. Cutting pattern of test specimens

Caption:

- Examples of density tests
- Examples of Modulus of Elasticity (MoE) and Modulus of Rupture (MoR).
- Examples of air absorbency and thick development tests.
- Example of water content test.
- Example of screw holding strength test.

Test of particle board physical properties based [8], can be calculated with the formula as follows:

$$\text{Density} \quad : \quad \rho = \frac{m}{V} \quad (1)$$

$$\text{Water Content} \quad : \quad Cw = \frac{B2-B1}{B1} \times 100\% \quad (2)$$

$$\text{Thickness Development} \quad : \quad TD = \frac{T^2-T^1}{T^1} \times 100\% \quad (3)$$

3. Result And Discussion

In this study, raw materials were prepared as much as possible to facilitate the process of making and printing particle boards. The need for raw materials in the form of nypa fruit fibers that have been made into particles is calculated by predicting the amount of variation in the mix between nypa fruit fiber and tapioca adhesive. This is intended to get the optimum variation produced as a prototype model that can be developed as a substitute for interior furniture. From the manufacture and make of particle boards some physical prototypes were obtained as development products. The results of the manufacture and treatment of particle board in the form of density, moisture content, and thick development. In Figure 4 shows the type of particle board product prototype results.



Figure 4. Particle board produced

The test results for particle board physical properties based on nipah fiber waste obtained its density values for each variation. In testing the density value by comparing the mass of the particle board to its volume. The higher the overall density of the particle board, the higher the strength and stiffness of the particle board, but it also affects the stability of the dimensions [10]. Figure 5 shows a graph of the average value of the test results for particle board density

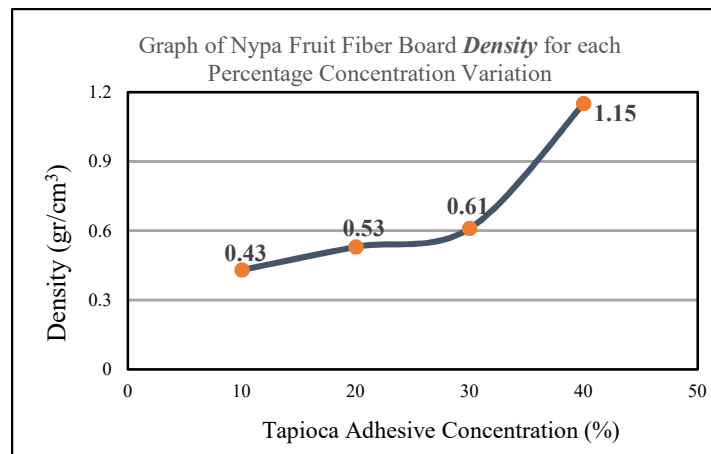


Figure 5. Graph of Average Density Value

In Figure 2 shows that the average value of the particle board produced by nypa fiber ranges from 0,43 - 1,15 gr/cm³. In accordance with the JIS standard [8], the density value of a particle board only ranges 0,40-0,90 gr/cm³. From this study particle boards that meet the requirements according to JIS standards are variations in concentration of 90:10, 80:20, 70:30. However, this study shows that the maximum average density value obtained in the concentration variation of 60:40 is equal to 1,15 gr/cm³. The particle board density value is influenced by the form factor of raw material and physical structure [11]. Increasing the amount of adhesive used along with increasing the particle board density value produced [12]. From the evaluation of the quality characteristics of particle board density at a concentration variation of 60:40 it is very appropriate to be used as raw material for interior furniture, because of the high value of the particle board density the better the ability.

In addition, the water content is the amount of water content contained in the particle board in a state of equilibrium with the surrounding environment. High water content is caused by the particle board's hygroscopic properties because it contains lignin and cellulose. The ingredients of lignin and cellulose are very easy to absorb and release water. In figure 6, a graph of the particle board moisture content is shown.

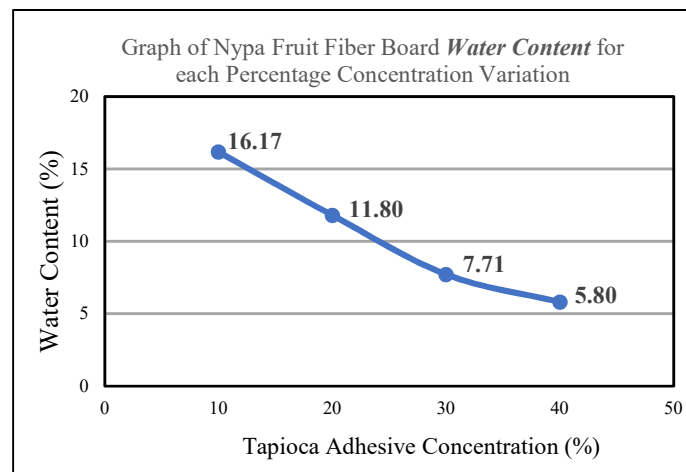


Figure 6. Water Content Graph

In Figure 6 shows that the average value of particle board water content ranges from 5.8-16.17%. Under certain conditions particles from the particle board which have hygroscopic properties, can absorb and release moisture content when conditions of high air humidity [13]. In accordance with the JIS standard [8], the water content value of a particle board only ranges 5 - 13%. The results of this study indicate that the average value of particle board water content with a concentration variation of 60:40, 70:30, 80:20 which is in accordance with JIS standards. In figure 6 the minimum average value of water content is 5.8% at a concentration variation of 60:40. The higher the level of adhesive the lower the water content value produced, because many adhesives can produce bonds or adhesions between particles so that it closes the cavity or pore on the particle board. This condition occurs because of the treatment of heat press that is carried out during the pressing process. From the evaluation of the 60:40 particle board quality, it is also appropriate to be used as raw material for interior furniture.

The thick development is the increase in the dimensions of the thick particle board due to water filling the cavity of the particle board after being immersed for 24 hours [10]. Data from the thick development test after soaking for 24 hours is presented in graphical form (Figure 7).

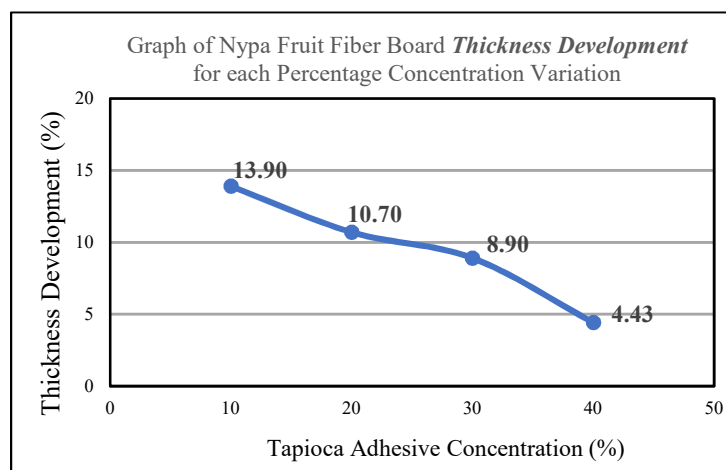


Figure 7. Graph Thickness Development of Particle Board

In Figure 7 shows that the average value of particle board thickness development with 24-hour immersion ranges from 4.43-13.9%. The standard JIS requires a maximum development value of 12% thick. The results of this study indicate that the value of particle board thickness development at a percentage concentration variation is 80:20, 70:30, 60:40 meets compliance with standards [8]. In figure 7 the minimum average value of development is 4.43% at 60:40. The development of the resulting particle board thickness was influenced by variations in the use of adhesives, the more

adhesive used the smaller the development percentage of particle board thickness was due to the good bond between the main ingredients of nypa fruit fiber and tapioca adhesive. From the evaluation of particle board quality 60:40 it is very appropriate to be used as raw material for interior furniture, which is a cloth that is not exposed to water or in a damp place.

Based on the density value of the resulting particle board, it is called a high density category, particle board with a density value above 0.8 gr/cm^3 . This shows that there is a fairly good bond between the main raw material of Nypa fruit fiber and tapioca adhesive, and is also influenced by the press process given in the process of making the particle board. In accordance with JIS standards requires a density value of $0.4 - 0.9 \text{ gr/cm}^3$. While the average value of water content obtained a minimum value of 5.8%, at variations in percentage concentration 60:40. From Figure 5 it is shown that the more adhesive used the smaller the average value of the particle board water content. So that the ability of particle boards made using tapioca adhesive is influenced by variations in the adhesive used. When viewed from the results obtained in variation 60:40 it has fulfilled with JIS standards. The particle board characteristics at a percentage concentration variation of 60:40 can be used as raw material for furniture, namely furniture that is not exposed to water or is in a humid place. So that particle boards made from nypa fruit fiber with using tapioca adhesive can be recommended as furniture raw materials.

4. Conclusion

Based on the testing and research conducted on particle boards made from nypa fruit fiber with tapioca adhesive, the optimum results were obtained which can be concluded that the diversification of nipah fruit fiber was used as raw material for making particle boards with tapioca adhesive. The making of particle board made from Nypa fruit fiber was done by manual compression. Physical properties testing was carried out to obtain particle board characteristics, including density values of 1.15 gr/cm^3 , moisture content of 5.8%, thickness development 4.43%. The quality characteristics obtained at a percentage concentration variation are 60:40. From the manufacture and testing of particle boards, it can be stated that the factors that influence the strength of the particle board include variations in the mixture, raw material particles, adhesives, and the forging process. From the results of the data obtained by particle board of nypa fruit fiber with tapioca adhesive and compared with quality standards. The raw material for making particle board can be used wurmb nypa fruticans waste (nipa fruit fiber) added tapioca adhesive which has characteristics according to standards.

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