WELCOME SPEECH
FROM THE CONFERENCE CHAIR

Assalamu’alaykum wrwb,

Welcome to Padang!

Dear authors and all participants of International Conference of Applied Science on Engineering, Business, Linguistics, and Information Technology (ICo-ASCNITech) 2017 to be held in Kyriad Bumiminang Hotel in Padang, Sumatera Barat-Indonesia on 13-15 October 2017.

This annual event is organized by Politeknik Negeri Padang (Indonesia) and Politeknik Ibrahim Sultan (Malaysia). About 200 titles by more than 350 authors are registered to this prestigious conference from more than 30 local and international higher education institution as well as research bodies. This is a great opportunities to share information of applied research, technology and innovation among researchers and academicians, students, government, industries and other stakeholders. Hopefully this wonderful agenda would considerably contribute to Indonesia economic competitiveness as well as other countries which are the theme of this conference, “Fostering global economic competitiveness through innovation in applied science and technology”.

Best Regards,

Assoc. Prof. Gusri Yaldi, PhD
Chairman of ICo-ASCNITech 2017
Assalamu’alaykum wrwb,

Politeknik Negeri Padang is pleased to conduct the International Conference of Applied Science on Engineering, Business, Linguistics, and Information Technology (ICo-ASCNITech) 2017. As a leading higher vocational educational institution in Indonesia, Politeknik Negeri Padang must develop its international reputation to achieve long term vision as the best higher vocational education in South Eastern Asia by 2025. This international event is part of our strategic plans toward that vision which also to strengthen our cooperation with international universities like Politeknik Ibrahim Sultan, Malaysia.

We would like to warm welcome all authors and participants to Padang city. Meeting with other researchers and academician from different universities, countries and cultures during the conference is of course a valuable experience toward your future career. As our special guests, we recommend you to try an internationally famous and delicious cuisine from Padang called “Rendang”. We hope you enjoy your stay while in Padang and good luck with your presentations.

Warm Regards,

Aidil Zamri, ST., MT.
Director of Politeknik Negeri Padang
Abstract — Oil palm empty bunches (TKKS) are solid waste from oil palm plantation industry with fiber content of ± 70%, and can be used as a booster composite board. From the result of previous research, the physical and mechanical properties of composite board from TKKS fiber of mechanical defiberation that fulfill SNI standard is long fiber at 900 RPM and fiber round 600 RPM. Nevertheless, each board between the left, middle and right sides there are very large differences in properties, especially the flexural strength and compressive strength of the fiber. This is due to the uneven distribution of adhesives, so that some parts of the board are too much adhesive and the rest are few. This situation occurs because the fiber length of defiberation used is not the same, the fiber used varies between 3-10 cm long. Long fibers in addition to the adhesive mixing process are very difficult and long, also resulting in uneven board strength on each side. To improve the efficiency of the adhesive mixing process with the fibers and the uniform spread of adhesive on all sides of the board it is necessary to use uniform short fibers (length 1 cm, 2 cm, 3 cm or 4 cm), the solution is the use of a fiber counter machine to obtain a short fiber and uniform.

This research is aimed to design / design and model the TKKS fiber system of Hammer Mill system to obtain short fibers of uniform size. Engine design results obtained engine capacity of ± 150 kg/hour, 2.5 HP drive power, 3 cm diameter shaft shaft with a length of 40 cm. The machine consists of the channel unit that is the inlet and outlet, the counter unit, the body unit and the driving unit. The enumerator unit consists of a chopping blade attached to 4 rods of a chopping knife holder, knife holder pin, knife divider plate and chopping shaft. Body unit consists of top cover, bottom cover and strainer. The drive unit consists of the driving force, the belt and the pulley. On the rod of cradle holder mounted 3 knives with a length of 8 cm x 5 cm wide x 0.4 cm thick with a blade angle 45°. Position of a single blade attached at the top of the rod holder with 450 angle and two side left and right side. The measuring rod of the measuring chest is 8cm wide x 5cm x 13cm long, retaining pin with Ø 1.5cm, knife plate Ø 30cm, and shaft count Ø 3cm by 40cm long. From the results of testing the performance of the engine on the diameter of the filter hole 1 cm obtained a well spinning machine, the enumerator unit to cut the TKKS fiber continuously without choking. The clipped fibers come out of the filter and continue into the funnel out continuously according to the ingredients. Obtain engine capacity ± 80 kg / hour, uniformity of TKKS fiber for fiber length <15 mm ie 8%, fiber length 15-25 mm ± 75% and fiber size> 25 mm ie 10%.

Keywords — Composite board; Blank Bunches of Palm Oil (TKKS); TKKS fiber counter; Hammer Mill System
I. INTRODUCTION

Oil palm empty bunches (TKKS) are waste from palm oil processing factories whose availability in Indonesia is quite abundant ± 6,034,325.7 tons (Deptan, 2011). TKKS fiber is a natural fiber and fiber content of ± 70%, can be used as a fiber berkaret, matres, mattress, mat and raw materials fiber-based composite board.

The results of research on the manufacture of composite board in the form of particle board, such as making TKKS fiber into particle board (Anwar Kasim, 2007; Indra Mawardi, 2009), improvement of mechanical properties and physical properties of fiber (Abral 2012-2011). Fiber from sago plant can be increased its power as much as 254% and decrease the water absorption after soaked with NaOH (Abral, 2012b). Therefore, these basic research results can actually be implemented into commercial particle board products. However, for commercial products need large quantities of raw materials and mass production of products, especially raw materials of TKKS fiber.

From the previous research, TKKS fibers have been produced by mechanical decomposition process with 4 kinds of fiber, ie dry fiber at 900 Rpm round, dry fiber at round 600 Rpm, mixed fiber (dry fiber 1-3 cm + petals) and wet fiber. Capacity of ± 250 kg / hour machine with decomposition of Mill hammer system (Junaidi, 2016). The four types of fibers have been made of composite boards with some treatments. From result of examination of physical and mechanical properties of composite board fulfilling SNI standard is long fiber at round 900 Rpm and fiber at round 600 Rpm. Nevertheless, each board between the left, middle and right sides there are very large differences in properties, especially the flexural strength and compressive strength of the fiber. This is due to the uneven distribution of adhesives, so that some parts of the board are too much adhesive and the rest are few. This situation occurs because the fiber length of defiberation used is not the same, the fiber used varies between 3-10 cm long. Long fiber in addition to adhesive mixing process very difficult and long, also resulted in uneven board strength on each side.

The purpose of this research is to design / design and model the TKKS fiber system of Hammer Mill system to obtain short fibers of uniform size. (length 1 cm, 2 cm, 3 cm or 4 cm)

II. RESEARCH METHODOLOGY

A. Materials and Tools

The material used for the development of this TKKS fiber counter machine is: an angle iron with size 6 cm x 6 cm x 0.4 cm for fabric tool making, cylinder iron Ø 5 cm for the manufacture of decomposers, strip plate size 2 cm x 2.5 cm for decomposition rod / blade, sheet plate size 120 cm x 240 cm with thickness 0.25 cm for house decomposer. For engine driving using 2.5 HP round motor 1500 Rpm, pulley, and V type B belt. The fiber material used is TKKS fiber mechanical decomposition results of previous research. Equipment for testing engine performance using stopwach, calipers and steel ruler.

Machines used for the manufacture and assembling of fiber enumerator machines include lathe, milling machines, grinding machines, cutting machines, CNC, scrap machines, drilling machines, welding machines, and plate bending machines.

B. Method

The research was conducted in three stages: design, manufacture and technical evaluation machines. Broadly speaking, the stages of this study as in Figure 1.

1. Designing Machine of TKKS Fiber Enumerator

The design of the machine prototype includes calculating engine capacity and engine power. To obtain the engine power must be known in advance the shear stress of a single knife enumerator against the fiber based on the cross-sectional area of the knife. Then determine the overall total shear force based on the number of the enumerator knife. Next is the calculation of the belt and pulley, the diameter of the enumerator shaft, the calculation of pegs and bearing.

From the calculation engine design obtained ± 300 kg / hour engine capacity (set). rotation shaft shaft 519 rpm, engine power ± 2.5 Kw. One belt used is a type B belt with a length of 45 inches. The diameter of 30 mm shaft axle, the bearing used to support both the decomposer shaft is the cylindrical roller bearing number N307 NU307 (Sularso, 1997 p. 146) with specification, 35 mm inner diameter, outer diameter 80 mm and 21 mm bearing thickness. The design of the machine as shown in Figure 2.

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B. Method

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Figure 2. Design of Enumerator Machine TKKS fiber

Machine components that have been designed as shown in Figures 3, 4, and 5. Several dimensions of the component size of the enumerator unit in Fig. 3 are the shaft length of 40 cm, the shaft axis 3 cm, the distance between the plate cavity holder of the stand holder of 14 cm. Number of cavities 4 pieces. Machine components that have been designed as shown in Figures 3, 4, and 5. Several dimensions of the component size of the enumerator unit in Fig. 3 are the shaft length of 40 cm, the enumerator shaft 3 cm, the distance between the plate cavity holder of the stand enumerator of 14 cm. Number of cavities 4 pieces.

Figure 3. Component Unit of Fiber Enumerator

In FIG. 3, there are several units of the enumerator component, ie, the enumerator knife holder component with the shape is widened and has a 45 degree angle at the top and is flat on the left and right sides of the width 80 mm x 50 mm x height 130 mm ( Figure 4)

In the eye of the wooden crab has a very sharp cutting eye with an angle of 45°. The wooden crab is placed on the sloping position 45° on the knife holder component to function the fiber lengthwise, and upon arrival the fiber-retaining blade will be cut off, while the left and right side blade the counter rod in a straight position to cut the incoming fiber material on the side. Furthermore, the components of this enumerator machine consists of a shaft enumerator Ø 3 cm x 40 cm, the frame length 56.5 cm x 49 cm wide x 60 cm, upper cover measuring 42 cm x 31 cm x 18 cm, bottom cap 18 cm x 31 cm x 42 cm.

2. Manufacture of TKKS Fiber Enumerator Machine

After the design of the machine is ready then made component and assembling. Engine components are installed based on the units on the machine.

3. Technical Evaluation

The testing process includes the ability of the enumerator unit to chop the TKKS fiber continuously, whether the engine power is capable of counting the TKKS fiber repeatedly or the machine is not choked up. Then the engine capacity will be calculated based on the moisture content of the material, and the subsequent characteristics of the resulting chopsticks include the uniformity of the length of the fiber in accordance with the size of the filter hole with multiple replications.
**Performance Analysis of Machines**

Based on the data obtained from the process of testing the machine will be analyzed to determine the things as follows:

1. The relationship between the capacity and the water content of the material.
2. The relationship between Efficiency with the water content of the material.
3. Relation of diameter of filter hole with uniformity of fiber length.

**III. RESULT AND DISCUSSION**

1. **TKKS Fiber Enumeration Production Results**

The enumeration of this machine is done on the unit of enumerator. The three enumerator of blades are mounted on one stem of the knife holder. Production of the rod of the enumeration knife holder by the cutting, welding and drilling process, and the making of the bolt hole using tap for the preparation of the thread, the shape of the rod holder of the finished blade as shown in Fig. 6.

![Image of Enumerator knife Installed on Stick of Knife Holder](image1)

Figure 6. Enumerator knife Installed on Stick of Knife Holder

Furthermore, all the enumerator blades are mounted on the rod of the knife holder that is on the left side, right side and in front with the slope 45°. After all the enumerator blade is attached to the fourth rod of the knife holder, then the rod of the knife holder is mounted on the pin holder rod holder of the chopping knife on the 2nd and 3rd cavities which are 2 sticks each of the chopping knife holder. After that the retaining pin is strengthened by the welding process on the pin holder plate, which pin plate number is 5 pieces. The shape of the enumeration unit that has been made is mounted on the enumerator machine as shown in Fig. 7 and the whole fiber counting machine of the manufacture as shown in FIG8.

![Image of Fiber Enumerator Creation](image2)

Figure 8. Fiber Enumerator Creation

2. **Performance Testing Machine**

The engine performance test is performed only to observe the ability of the enumerator knife to cut fiber with short size. Performance testing machines have not used some treatment. Fiber used with a small water content of 10.3%. The size of the filter hole used in this test is only Ø 10 mm. In testing before the engine is modified, the use of strainers holes with Ø 3 mm and 5 mm resulted in the engine getting stuck. From the results of tests that have been done well spinning machine, the enumerator unit to cut TKKS fiber continuously without choking. The clipped fibers come out of the filter and continue into the funnel out continuously according to the ingredients. Obtain engine capacity ± 30 kg/hour, uniformity of TKKS fiber for fiber size <15 mm ie 8%, fiber size 15-2.5 mm ± 75% and fiber size> 2.5 mm ie 10%. The low engine capacity is due to the fiber being chpped with low water content, so the fibers become clay. The shape of fibers that have been cut into pieces by the enumerator blade as in Figure 8,
CONCLUSION

The results of the study that has been done has been designed and made prototype machine TKKS fiber hole system counter. The main parts of this machine are: enumerator unit consisting of the counter shaft, the chopping knife, the stem of the chopping knife holder, the pin, and the holder plate of the rod of the knife holder. The funnel unit consists of an inlet, an outlet and a filter, a frame unit and a drive unit.

From the results of the design of this fiber enumerator engine obtained ± 300 kg / hour engine capacity, engine power 2.5 HP with motor round 1500 Rpm. From the results of testing the performance of the machine with water content of 10.3% fiber obtained ± 30 kg / hour machine capacity, TKKS fiber uniformity for fiber size <15 mm ie 8%, fiber size 15-2.5 mm ± 75% and fiber size> 2.5 mm ie 10%.

THANK-YOU NOTE

Acknowledgments are submitted to DRPM Kemenristek Dikti who has financed this research through applied product scheme research (PPT) State Polytechnic Padang Bach I T.A. 2017 No Contract: 044 / PL9.1.4 / LT / 2017.

Then also thanks to Mr. Tim Reviwer, my friends and lecturers of Mechanical Engineering Department of Padang State Polytechnic and Student who have assisted in making and repairing and testing this machine.

BIBLIOGRAPHY


Carll C. 1986. Wood Particle and Flakeboard; Types, Grade, and Unes. USA Madison : Forest Products Laboratory University of Wisconsin.


PNP, *Skim Penelitian Unggulan Perguruan Tinggi*.


Kementrian Pertanian. Statistik Perkebunan Indonesia (2009-2011)


LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : PROSIDING

Judul Karya Ilmiah (paper) : Development of TEKS Fiber Chiller Country Machine

Jumlah Penulis : 1 orang
Status Pengusul : Penulis Pertama/penulis ke- / penulis Korrespondensi**

b. ISBN/ISSN : 978-967-600-778-1

Kategori Publikasi Makalah : ✔ Prosiding Forum Ilmiah Internasional
(beri ✔ pada kategori yang tepat)

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Padang, 27 Juli 2018
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Dr. Ir. Res. Riniwardi, MT., MPd
NIP
Unit Kerja : Jurusan Teknik Mesin
Politeknik Negeri Padang
**LEMBAR HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW**

**KARYA ILMIAH : PROSIDING**

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Padang, 26 Juli 2018
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Dr. Yuli Yuli, Dr.
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Politeknik Negeri Padang
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by

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Word count: 3677
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Development of TKKS Fiber Enumerator
Machine Hammer Mill System

Junaidi¹, Maimuzar², Adriansyah³, Alfian⁴
Politeknik Negeri Padang, Kampus Liman Menis, Padang, 75590, Indonesia
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Abstract — Oil palm empty bunches (TKKS) are solid waste from oil palm plantation industry with fiber content of ± 70%, and can be used as a booster composite board. From the result of previous research, the physical and mechanical properties of composite board from TKKS fiber of mechanical defibration that fulfill SNI standard is long fiber at 900 RPM and fiber round 600 RPM. Nevertheless, each board between the left, middle and right sides there are very large differences in properties, especially the flexural strength and compressive strength of the fiber. This is due to the uneven distribution of adhesives, so that some parts of the board are too much adhesive and the rest are few. This situation occurs because the fiber length of defibration used is not the same, the fiber used varies between 3-10 cm long. Long fibers in addition to the adhesive mixing process are very difficult and long, also resulting in uneven board strength on each side. To improve the efficiency of the adhesive mixing process with the fibers and the uniform spread of adhesive on all sides of the board it is necessary to use uniform short fibers (length 1 cm, 2 cm, 3 cm or 4 cm), the solution is the use of a fiber counter machine to obtain a short fiber and uniform.

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![Diagram](image)

Figure 1. Flow Diagram of Research

From the calculation engine design obtained ± 300 kg / hour engine capacity (set), rotation shaft shaft 519 rpm, engine power ± 2.5 Kw. One belt used is a type B belt with a length of 45 inches. The diameter of 30 mm shaft axle, the bearing used to support both the decomposer shaft is the cylindrical roller bearing number N307 NU307 (Salaro, 1997 p. 146) with specification, 35 mm inner diameter, outer diameter 80 mm and 21 mm bearing thickness. The design of the machine as shown in Figure 2.
In Figure 4 the enumerator holder rod is placed 3 pieces of a knife with a length of 80 mm x width of 50 mm x 4 mm thick. The stem of the counting enumerator stand is 4 pieces mounted on the holder plate. The holder rods 1 and 3 are installed in cavity 2, and the holder rods 2 and 4 are mounted in cavity 3.

In the eye of the wooden crab has a very sharp cutting eye with an angle of 45°. The wooden crab is placed on the sloping position 45° on the knife holder component to function the fiber lengthwise, and upon arrival the fiber-cutting blade will be cut off, while the left and right side blade the counter rod in a straight position to cut the wooden fiber material on the side. Furthermore, the components of this enumerating machine consists of a shaft enumerator 0.3 cm x 40 cm, the frame length 56.5 cm x 49 cm, upper cover measuring 42 cm x 31 cm x 18 cm, bottom cap 18 cm x 31 cm x 42 cm.

2. Manufacture of TKKS Fiber Enumerator Machine
After the design of the machine is ready then made component and assembling. Engine components are installed based on the units on the machine.

3. Technical Evaluation
The testing process includes the ability of the enumerator unit to chop the TKKS fiber continuously, whether the engine power is capable of counting the TKKS fiber repeatedly or the machine is not choked up. Then the engine capacity will be calculated based on the moisture content of the material, and the subsequent characteristics of the resulting chopsticks include the uniformity of the length of the fiber in accordance with the size of the fiber hole with multiple replications.
Performance Analysis of Machines
Based on the data obtained from the process of testing the machine will be analyzed to determine the things as follows:
1) The relationship between the capacity and the water content of the material.
2) The relationship between Efficiency with the water content of the material
3) Relation of diameter of filter hole with uniformity of fiber length.

III. RESULT AND DISCUSSION

1. TKKS Fiber Enumeration Production Results
The enumeration of this machine is done on the unit of enumerator. The three enumerator of blades are mounted on one stem of the knife holder. Production of the rod of the enumeration knife holder by the cutting, welding and drilling process, and the making of the bolt hole using tap for the preparation of the thread, the shape of the rod holder of the finished blade as shown in Fig. 6, which are 2 sticks each of the chopping knife holder. After that the retaining pin is strengthened by the welding process on the pin holder plate, which pin plate number is 5 pieces. The shape of the enumeration unit that has been made is mounted on the enumerator machine as shown in FIG. 7 and the whole fiber counting machine of the manufacture as shown in FIG. Furthermore, all the chopping blades are mounted on the rod of the knife holder that is on the left side, right side and in front with the slope 45°. After all the chopping blade is attached to the fourth rod of the knife holder, then the rod of the knife holder is mounted on the pinholder rod holder of the chopping knife on the 2nd and 3rd cavities which are 2 sticks each of the chopping knife holder. After that the retaining pin is strengthened by the welding process on the pin holder plate, which pin plate number is 5 pieces. The shape of the enumeration unit that has been made is mounted on the enumerator machine as shown in FIG. 7 and the whole fiber counting machine of the manufacture as shown in FIG 8.

![Figure 6. Enumerator knife Installed on Stick of Knife Holder](image6)

![Figure 7. Enumerator Unit of Results Creation](image7)

2. Performance Testing Machine
The engine performance test is performed only to observe the ability of the enumerator knife to cut fiber with short size. Performance testing machines have not used some treatment. Fiber used with a small water content of 10.3%. The size of the fiber hole used in this test is only 0.10 mm. In testing before the engine is modified, the use of strainers holes with 0.3 mm and 5 mm resulted in the engine getting stuck. From the results of tests that have been done well spanning machine, the enumerator unit to cut TKKS fiber continuously without choking. The chopped fibers come out of the filter and continue into the funnel cut continuously according to the ingredients. Obtain engine capacity = 30 kg/hour, uniformity of TKKS fiber for fiber size <15 mm ie 8%, fiber size 15-2.5 mm = 75% and fiber size > 2.5 mm = 10%. The low engine capacity is due to the fiber being chopped with low water content, so the fibers become clay. The shape of fibers that have been cut into pieces by the enumerator blade as in Figure 8.
CONCLUSION

The results of the study that has been done has been designed and made prototype machine TKKS fiber hole system counter. The main parts of this machine are: enumerating unit consisting of the counter shift, the chopping knife, the stem of the chopping knife holder, the pin, and the holder plate of the rod of the knife holder. The funnel unit consists of an inlet, an outlet and a filter, a frame unit and a drive unit.

From the results of the design of this fiber enumerator engine obtained 300 kg / hour engine capacity, engine power 2.5 HP with engine weight 1500 Rpm. From the results of testing the performance of the machine with water content of 10.5% fiber obtained 30 kg / hour machine capacity, TKKS fiber uniformity for fiber size <15 mm is 8%, fiber size 15-2.5 mm is 75% and fiber size> 2.5 mm is 10%.

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BIBLIOGRAPHY


Carly C. 1986. Wood Particle and Flakeboard : Types, Grade, and Uses. USA Madison : Forest Products Laboratory University of Wisconsin.


PNP, *Skin Penelitian Unggulan Perguruan Tinggi.*


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