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Development of Models Products-Based Learning Through Design of Learning Devices Using Oil Palm Empty Fruit Bunch (OPEFB) Fiber

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Abstract--To improve the competency of vocational education graduates especially Diploma Three Mechanical Engineering who have skills and readiness work is by the development of learning models. To produce application products would require the selection of products and learning tools that are effective and efficient. OPEFB is a waste from POM which is still open wide to be developed as Reinforcement in composite materials. To achieve the objectives of this study required a OPEFB decomposer machine. The design of the OPEFB decomposers consists of the main components, namely the chopping knife, the retaining knife, the parser, and the filter to produce the OPEFB Fiber. The manufacturing technology chosen in the design of this tool consists of several stages of work, namely cutting technology, machining, forming, grafting, and assembling. The result of experiment of capacity relation with efficiency shows that at 1200 rpm rotation is obtained 96,78%. Using a compound blade and an optimum capture capacity based on the efficiency of 1200 rounds obtained 98.68 Kg/hour. From the whole series of tool design activities in this research can be concluded that the resulting tool is able to work optimally in producing OPEFB fiber and can be used as a product-based learning tool.

Keywords:* *Learning device, Product-based learning, OPEFB

I. INTRODUCTION

Readiness graduates enter the work world of vocational education graduates equipped with special skills. that in the development of vocational education is closely related to the world of work where vocational education is influenced by various technological changes, organizational change of work, and changes in competence [1].

The readiness of graduates of vocational engineering education based on industrial laboratory and plantation goggles can be classified as low [2].

Technological transformation in the implementation of Vocational Education can be done by applying several learning models such as learning with constructivism approach, work-based learning, competency-based learning, and implementation of technology character development program [3] as well as according to Ganefri [4] product-based learning model is an appropriate alternative learning model for vocational education. In line with the opinion of Rahmawati, [5] that to respond to the challenges of the work needs of vocational education graduates must have special skills through learning the training model. From several opinions of researchers who have described above concluded that the model of product-based learning can be done to achieve the goal of vocational education vocational graduate work.

To further improve the effectiveness of learning one of them is by developing a model of learning design that includes analysis, tools, implementation and evaluation of learning, so that learners can acquire new skills, knowledge and attitude in learning but also able to apply on the job [6].

One learning tool is the availability of an efficient and effective tool for use in learning. Therefore, the design of the Oil Palm Cloud Decomposition (OPEFB) tool in this research is something new from the development of the existing OPEFB chopper enumerator and decomposition tool.

OPEFB waste is the most solid waste generated by the palm oil industry which is about 22-23% of the total fresh fruit bunches (FFB) processed. The total amount of OPEFB waste throughout Indonesia in 2009 is estimated at more than 4.2 million tonnes [7].

In the current technological development OPEFB waste has been widely utilized in various products, both as fertilizer, fuel, and cellulose (fiber).

From the problems disclosed above, the researcher considers it necessary to conduct research on the development of solid waste POM in the form of OPEFB which will be used as application of engineering product that is composite material. To be used as a product of course waste OPEFB processed first into OPEFB fiber. Starting from long-term research, the research undertaken is the design engine of OPEFB decomposers into OPEFB fiber as a tool in the development of efficient and effective product-based learning model.

LITERATURE REVIEW

A. Produk-Based Learning

The results of Bruri's research [8] indicating that the improvement of machining skills can not be separated from similar skills needed by the industrial world, therefore higher education institutions can develop learning practices in making workpieces that lead to products according to the needs of the industrial world or product-oriented. R. Mursid, [9] said that the need for mastery of knowledge and practice skills in the students is necessary to know the direction and the benefits of the development of vocational education in the future.

Similarly Ganefri and Hidayat H., [4] stated that the product-based learning model is an appropriate alternative learning model for VET, using this model, learning will be more meaningful. In addition, product-based learning models that have been implemented in VET can help learners prepare for entering the workforce, developing critical thinking, and having good morals. Therefore, it can provide support to learners to be more active in the learning process that impact on the learning outcomes and their results [4].

Skills required by participants participating in a product-based learning model are not spared from the concept of a collaborative learning model as illustrated in Fig. 1 [10]

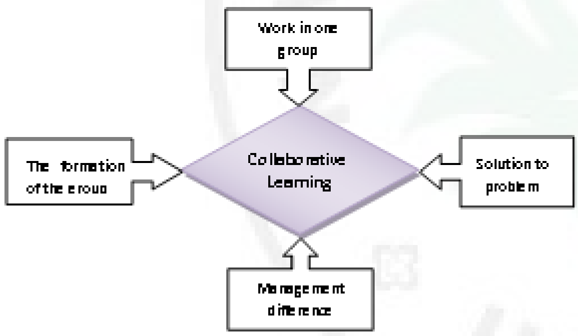


Fig. 1. Collaborative learning scheme

Collaborative-based learning model for students of Mechanical Engineering Program in Production field is through several phases of agreement, exploration, transformation, presentation and reflection [11].

B. Oil Palm Empty Fruit Bunch (OPEFB)

OPEMFB is the most solid waste generated by the palm oil industry, about 22-23% of the total fresh processed fruit diet, OPEFB is a type of palm oil waste generally recycled to produce energy. The OPEFB waste treated the preliminary results of the POM survey in a POM-2 Tanjung Morawa Kuala Sawit POM-2 garden with a treatment capacity of 30 tonnes TBS / hour. As a waste containing a very high lignocellulosic material. OPEFB to date have not been used optimally. During this burnt OPEFB and ashes are used as fertilizer. In addition, the economic value is relatively low [12].

C. Fiber

Fiber is a material that is generally much stronger than the matrix and serves to provide tensile strength, while the matrix serves to protect the fiber from environmental effects and collision damage. Many fibers can be used to enhance composite properties. Natural fibers can become fillers in the composite due to their cellulose content, some natural fibers that contain cellulose such as kenaf, sugar cane, maize, abaca, rice, hemp and d 'other. [13, 14]. Fiber Palm Oil (EPB) is chosen because it is in abundance. In addition, the use of EPB which is a by-product of POM that can alleviate the problem of POM solid waste disposal is known for its long history as an enhancer in polymeric composites [14].

Although tensile strength and natural modulus of elasticity are not as good as fiberglass, tensile strength and modulus of elasticity are close to fiberglass, giving the opportunity to replace glass fibers by reinforcers [15].

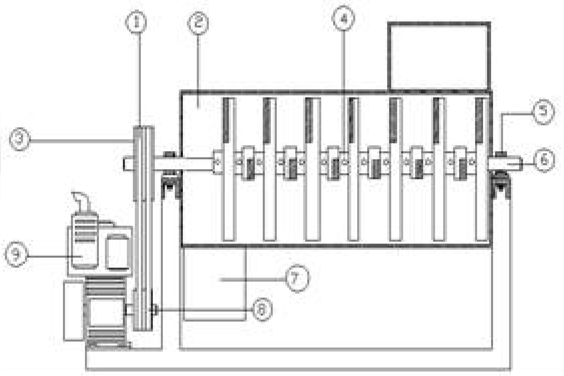
In general, the mechanical properties of the thermoplastic reinforced natural fibers and the results of the thermosetting composite tests show an improvement by adding natural fibers as reinforcement. Polylactic acid (PLA) based composites showed significant improvements in both tensile and flexural strength while polystyrene (PS) and epoxy (EP) composites were virtually unchanged or only slightly improved observed mechanical properties. Natural fiber reinforced PLA composites have excellent adhesion leading to higher observed forces over PS and EP composites [16].

D. Counter Device for OPEFB

The crusher that is planned to build is a machine modified from a machine that has been there. Where there are differences in the machine that will be designed this time using the blade model composite comb. The comb has a cutting angle as an anchor when the core blade is operating. In addition to the comb becomes a barrier, the comb also makes uniform or uniform pieces.

II. METHOD

The sketch of the OPEFB envelope motor that is planned to be designed can be seen in Fig. 2. Which is a sketch of the OPEFB decomposition machine.



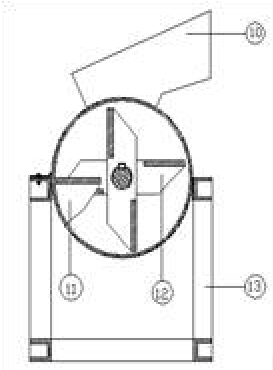


Fig. 2. OPEFB Decomposer Sketch

In the design phase of the OPEFB decomposition machine using a blade blade model composed 100 kg / hour capacity. Discuss the calculations by adjusting the work steps according to the plan.

The stages of the discussion are; Power Supply Power Planning, Feed Planning for Round Blade Movement, Power Planning for OPEFB Counting, Auxiliary Blade Design and Component Design of the OPEFB Decomposition Machine.

To test the step of the tool performed, namely; the preparation of the OPEFB materials obtained from the POM (Fig. 3), the placement of the equipment in the form of a single OPEFB decomposition unit (Fig. 4), digital balance sheet, stopwatch, and other devices .

Testing is done by varying the rotation from 900 to 1350 rpm.

Fig. 3. OPEFB from POM

Fig. 4. Set-up of OPEFB tools

III. Results and Discussion

A. Counter Device For OPEFB

OPEFB decomposers completed from design results with a capacity of 100 kg/h are shown in Fig. 5.ation). This template was designed for two affiliations.

Fig. 5. OPEFB toolkit

B. Testing

In the experiments, it was performed several times by varying the rotation, namely 1000 up to 1350 rpm for several experiments and the results are shown in Table 1. With the result of counted OPEFB fiber taken based on optimal test result at 1200 rpm rotation with capacity 98,68 kg/h and its efficiency 96,78% as shown in Fig. 6.

TABLE I. RESULTS OF EXPERIMENTS RECAPITULATION

No	Rotary (rpm)	Results of enumeration of OPEFB			
		capacity (kg)	Results of enumeration (kg)		
			Chopped up	Not Chopped	Efficiency (%)
1	900	60,80	53,75	7,05	88,40
2	950	63,50	57,30	6,20	90,24
3	1000	67,67	62,12	5,55	91,80
4	1050	73,55	68,15	5,40	92,66
5	1100	81,15	75,47	5,68	93,00
6	1150	90,40	85,78	4,62	94,89
7	1200	98,68	95,50	3,18	96,78
8	1250	110,79	105,50	5,29	95,23
9	1300	127,30	118,25	9,05	92,89
10	1350	148,87	132,67	16,20	89,12

Fig. 6. The results of calculations on rotation 1200 rpm

DISCUSSION

From Table 1 it was informed that rotation variations performed on trials ranging from 900 to 1350 rpm were found to increase the decomposition capacity of OPEFB fibers, but from the analysis it was concluded that at 1200 rpm rotation was the optimum result, which in the rotation above 1200 rpm showed that the efficiency of decomposition drop.

The results of the analysis of rotation relationships with capacity are shown in Fig. 7 and Fig. 8 of rotation relationship with efficiency. The 1350 rpm decomposition results indicate that there are still undeclared TKKS packs, as shown in Fig. 9.

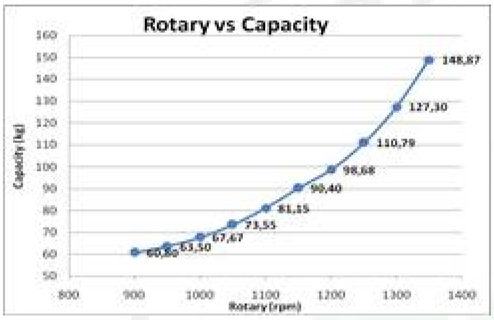


Fig. 7. Analysis of the variation rotation with capacity

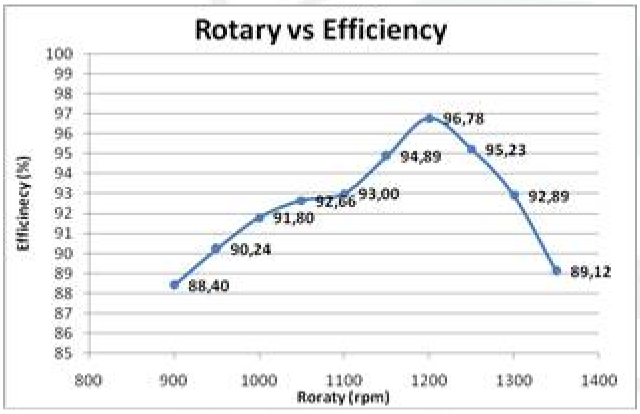


Fig. 8. Analysis of the variation rotation with efficiency

Fig. 9. OPEFB decomposes at 1350 rpm rotation

This happens because most motor rotation, its capacity decreases and the percentage will increase the efficiency of the enumeration.

IV. CONCLUSION

From the results of the activities described above can be concluded that:

1. The higher the rotation, the higher the capacity of OPEFB decomposes, but in terms of efficiency, the 1200 rpm rotation is the optimum rotation to produce OPEFB fiber of 96.78% with a capacity of 98.68 kg/h.
2. In the initial round of 900 rpm obtained OPEFB that do not decompose by 7.05 kg and on high rotation also OPEFB that does not decompose of 16.20 kg, it is concluded that the high rotation of the chopping blade becomes a suppressor.
3. The ease of operationalization and maintenance of the machine at the time of the experiment was concluded that the TKKS decomposer machine is suitable as a learning device in the development of product-based learning model.

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