Plagiarism Checker X Originality Report

Similarity Found: 11%

DEVELOPMENT OF COCONUT DEHUSKER MACHINE FOR SMALL SCALE INDUSTRY

Fithra Herdian *, Sri Aulia Novita, Indra Laksmana, Mohammad Riza Nurtam, Rildiwan, Zulnadi Department of Agricultural Technology, Politeknik Pertanian Negeri Payakumbuh, *Coressponding author E-mail: f.herdian@yahoo.com Abstract.

West Sumatra-Indonesia has potential to plant coconut due to the coastal location, sunshine level with average temperature 27oC. Coconut is a very productive plant. Coconut dehusking is one of the process that take a lot of time and energy. Most of the farmer still using human manual labor with the help of tools made of iron or wooden crowbar that is mounted standing vertically with blade facing upward about 80 cm from the ground. To increase the quantity of coconut products, it is designed the coconut dehusker machine.

The main component of machine were two rollers that rotate each other in opposite directions with each roller embedded iron-shaped nails that work to tear the coconut husk. Each roller has a different rotational speed. This machine has dimensions of 98 cm x 51 cm x 95 cm. Roller length is 50 cm and diameter 4 inch. Power source of the machine is an 2 HP electric motor, the speed was reduced by using 2 speeds reducer with the ratio of 1:20 and 1:30 respectively.

From the performance test of this machine can dehusk 100 coconut per hour. The operational basic cost of the machine equal to Rp 129.89 per coconut (about 1 cent) and Break Event Point is 12.387 coconut per year from the result of performance test. From

the economic analysis machine can be concluded that the use of this machine is better when compared to human labor which has limitation to duration and capacity.

1. Introduction West Sumatera- Indonesia located in west part of Sumatera island with Coastline stretched along the provinceand the climate with temperature around 270C make this province very suitable for coconut trees. West sumatera have about 87.528 Ha coconut land and produced about 79.617 ton coconut each years.

Coconut husk is not as popular as fruit and coconut shell. Thought it has high economic value (Chauhan & Arya, 2018)? . However, the task such as stripping, decomposition and separation of cocofiber and cocopeat shoud be done (Ngadiman et al., 2018)? . Coconut dehusker is the most consuming part of manpower and time. Some traditional tools are used are machete, silo, and semi-mechanical tools.

With that 50 Kota, Indonesia Herdian et al. JAAST 3(2): 309-318 (2019) 310 consideration the research team tried to make coconut dehusker mechine to improve the quality and quantity of coconut processing (Jacob & Rajesh, 2012).?

Some improvements of existing design such as increase the effectiveness of stripping by modifying the blade, reducing the risk of damage of shells by adding a wedg,e on the side of the blade, finding the optimal torque, rotation speed, and the angle of the blade with algorithm tools like PID control. This research is done to increase utilization of coconut husk and to make design and producing coconut dehusker machine. 2.

Material and Methods Functional Design Literature and survey to stakeholders such as coconut farmers, distributors and retailers was condusted before deciding the appropriate method of solving problems of dehusking machine (Deokar, Malaviya, Mistry, Chaudhari, & Dutta, 2017)? (Widananto & Purnomo, 2013)? .The design is done based on the problems found in the field and has been established problem-solving methods based on the results of the discussion of the research team.

The making of drawing design base on problem-solving and the needs of stakeholders. Determination of components of machinery, tools and supporting materials. Some issues which were found during manufacturing process are dehusking blade modifications and the slope of the knife to improve the effectiveness of stripping, additional of wedge on the side of knife to reduce potential damage to the shell, determination the optimal rpm and adding a reversing switch on the edge of the machine and easy to reach by the operator and adding a pressure handle to the top of the engine, serves to increase pressure on the coconut and as a safety device Table 1.

Functional design Main Function Consideration Component Dehusking coconut and does not cause shell damage with efective and eficient performance - As operator aids to increase pressure on the shell and can increase the effectiveness of stripping. - Operator safety tools Top handle operator Place of position of knife implement roller Implemen of coconut dehucking knife Power source electric motor Power transmition chain and gear Reduction of rotation Speed reducer Container and separation of coconut fiber and cocopeat Container and separator of coconut husk Herdian et al.

JAAST 3(2): 309-318 (2019) 311 Rotation control VFD Inverter Revertion rotation Revertion control Structural Design (a) (b) (c) Fig. 1. (a) Handle, (b) Roller and (c) Knife Figure 1 shows the handle that has function to protect and it will switch off the machine when it open. The two rollers has opposite direction. On the roller the knife is installed for shredding the husk of coconut. Figure 2 shows the machine design. Fig. 2.

The coconut dehusker machine Herdian et al. JAAST 3(2): 309-318 (2019) 312 Circuit Model of rotation control Fig. 3. Circuit diagram of the motor The circuit in figure 3 is a series of motor rotation controller for coconut dehusker. C1 is the main contactor. When the machine works to peel the coir, then this contactor switch will be in connected state, this switch connects 3 phase motor with utility.

Whereas C2 actives, then the motor will work in the opposite direction. For controlling the speed the motor is connected to Variable Speed Drive inverter . Programming this inverter can make the machine be more efficient and effective for dehusking. Performance Test Performance tests include: capacity, stripping perfection, tested from observation and percentage of material damage.

Capacity are calculated using a formula : CP = Capacity (piece/hours) Q = Quantity (piece) T = Time (hours) Economical Analysis The economical analysis of the machine can be calculated using fixed cost, variable cost and number of working hours per year and the effective working capacity of the M M C B C 1 C 2 C 1 C 2 S 1 L S P b C 2 C 1 R S T U V W N M C B machine. Similar analysis have been used in: Nurmeji et al., (2019); Prayogi et al., (2018); Womsiwor et al.,

(2018); and Jabbar et al., (2018) here are some calculated variables: Herdian et al. JAAST 3(2): 309-318 (2019) 313 Break event point: BEP aims to know the minimum production volume so that the income will cover the total cost of production. BEP can be calculated using the equation: BEP = Break event point (piece/years) FC = Fix cost (Rp/years) VC = Variable cost (Rp/hours) PSP = Product selling price after processed by machine (Rp/piece) RMP = Raw material prices (Rp/piece) ? = Rendement CP = Capacity Fix cost

component: FC = Fix cost (Rp/years) D = Depreciation machine (Rp/years) I = Capital interest (Rp/years) Depreciation of the machine: (straight line methods) D = Depreciation of the machine (Rp/years) P = Machine price (Rp) S = End price of machine (Rp) N = Economic life (years) Capital interest : I = Capital interest (Rp/years) r = Interest rate of bank (%) P = Price of machine (Rp) S = end price of machine (Rp) Variable cost : VC = Variable cost (Rp/hours) M = Maintenance cost (Rp/years) Herdian et al.

JAAST 3(2): 309-318 (2019) 314 Maintenance cost: M = Maintenance cost (Rp/years) P = Price of machine (Rp) S = End price of machine (Rp) Operational costs are the expenses which are related to the operation of a business, or to the operation of a device, component, piece of equipment or facility. CGP = Cost of goos processing (Rp/kg) FC = Fix cost (Rp/years) VC = Variable cost (Rp/hours) n = Working hours per years (Hours/years) EC = Effective capacity (kg/hours) 3.

Result And discussion Design and Performance Test Inovation in this research relates to a cylindrical double roller for dehusking coconut coir equipped with an elbow peeler to hold the coconut shell so that it does not break when the coconut is peeled and the coconut coir toothed so as not to accumulate in the roller. Some machine which has almost similar machine design such as in (Putera, Intan, Mustaqim, & Ramadhan, 2019)? Coconut dehusking is one of the processing step that takes a lot of time and energy. Coconut peeler machine is aim to increase the quantity of coconut products.

The main components of the machine are two rollers that rotate in opposite directions with each roll having an iron-shaped that serves to tear off the coconut husk. Each roll has the same rotational speed. This machine has dimensions of 98 cm x 51 cm x 95 cm. The length of the roller is 50 cm and the diameter is 4 inches. Engine power is 1 phase electric motor, 1 HP and speed 1400 rpm, speed is reduced by using 1 (one) speed reducer with 1:20 ratio and sprocket and chain with ratio 1: 4. This machine is arranged braking and reversing direction of rotation using contactor.

The blade is made in a serrated manner so that the pressure produced is greater. To prevent Herdian et al. JAAST 3(2): 309-318 (2019) 315 rupture of coconut shell, mounted elbow holder parallel to roller. Meanwhile, to remove the fiber then mounted serrations opposite the blade.

Performance Test The performance test shows the machine capability to dehusk 100 coconut per hour. Following table show the result of performance test: Table 2. Performance test of the machine No Variable Unit Nominal 1 Machine Price Rp (IDR) 10000000 2 End Price Rp (IDR) 1000000 3 Interest rate % 12 4 Work time per day Hours per day 6 5 Work time per year Hours/year 1878 6 Operator wage Rp/hour 12500000 7

Acumulated depretiation of equipment Rp/year 1800000 8 Maintenance cost Rp/hour 1080 9 Energy cost Kwh (Kilowat Hour) 2200 10 Fix cost Rp per hour 2520000 11 Interest rate cost Rp/ year 720000 12 Variable cost Rp/ year 15780 13 Processing cost Rp/piece 23 14 Break event point Piece/year 9084 Several factors affecting engine capacity were type and volume of coconut, skill of operator and speed of RMP roller If added with time operator replace the shell, we can assume total time consume approximately 30 second/piece with RPM about 50.

machine have 1500 watt power, 3 phase. To improve safety, effectiveness and comfort of operator machine added pressure handle on top of this machine. Herdian et al. JAAST 3(2): 309-318 (2019) 316 Economic Analysis The economical analysis of the machine can be calculated using fixed variable cost, fixed cost and number of working hours per year and the effective working capacity of the machine. Folowing table show the result of economic analysis. Figure 2 shows the machine design. Fig 6 .

Flowchart of operational machine Start Turn on the machine If the handle is closed? The roller will rotate Until the dehusker finished If the husk is stuck on roller Turn on the reverse button until no husk on rolller End Yes Yes No No Herdian et al. JAAST 3(2): 309-318 (2019) 317 Fig. 8 . The coconut dehusker machine Based on the above performance test is recommended for future work to reduce acumulation coconut fiber by modification sharp implement with conical and to change the slop of roller to make shell easier rolling.

Herdian et al. JAAST 3(2): 309-318 (2019) 318 References Chauhan, N., & Arya, N. (2018). Coconut fiber: A natural versatile material. International Journal of Chemical Studies, 6(6), 555–561. Chauhan, N., & Arya, N. (2018).

Coconut fiber: A natural versatile material. International Journal of Chemical Studies, 6(6), 555–561. Deokar, K., Malaviya, K., Mistry, K., Chaudhari, P., & Dutta, M. (2017). Design and Manufacturing of Coconut De-Husking, Cutting and Grating Machine. International Journal of Engineering Science and Computing, 7(4), 6571–6574. Jabbar, R. J., Ihsan, S., Gusnedi, P., & Zuladha, A. (2018).

Rancang Bangun Mixer Adonan Kerupuk Tipe Horizontal. Agroteknika, 1(2), 89-98. https://doi.org/10.32530/agtk.v1i2.26 Jacob, J., & Rajesh, K. S. (2012). Design and fabrication of coconut dehusking machine. In 2012 International Conference on Green Technologies (ICGT) (pp. 155–159). IEEE. https://doi.org/10.1109/ICGT.2012.6477964

Ngadiman, N., Kaamin, M., Abd. Kadir, A., Sahat, S., Zaini, A., Nor Zentan, S. R., ... Wan Amran, W. H. A. (2018). Panel Board From Coconut Fibre And Pet Bottle.

E3S Web of Conferences, 34, 01014. https://doi.org/10.1051/e3sconf/20183401014 Nurmeji, Lisman, F., Yuni, Syahriza, R., Nurtam, M. R., Djinis, M. E., Irzal, & Amrizal. (2019). Rancang Bangun Alat Pemipil Jagung Sederhana. Agroteknika, 2(1), 11- 19. https://doi.org/10.32530/agtk.v2i1.30 Prayogi, G., Wahyudy, R., Yogaswara, S., & Primayuldi, T. (2018). Rancang Bangun Mesin Pengupas Tempurung Kelapa. Agroteknika, 1(2), 77-88. https://doi.org/10.32530/agtk.v1i2.24 Putera, P., Intan, A.,

Mustaqim, F., & Ramadhan, P. (2019). Rancang Bangun Mesin Pengupas Sabut Kelapa. Agroteknika, 2(1), 31–40. https://doi.org/10.32530/agtk.v2i1.31 Widananto, H., & Purnomo, H. (2013). Rancangan Mesin Pengupas Sabut Kelapa Berbasis Ergonomi Partisipatori. In IENACO (pp. 1–8). Womsiwor, O., Nurmaini, N., Zikri, A., Hendra, H., Amrizal, A., Yudistira, Y., & Batubara, F. (2018). Rancang Bangun Mesin Pengupas Dan Pencuci Singkong Tipe Horizontal.

Journal of Applied Agricultural Science and Technology, 2(2), 11-19. https://doi.org/10.32530/jaast.v2i2.40

INTERNET SOURCES:

<1% - https://doaj.org/article/1d76f557a43d4a10ba43f39fe0646b66
<1% - https://opensource.stackexchange.com/questions/10394/can-i-use-documentation-licensed-under-cc-by-sa-4-0-in-an-application
2% - https://www.semanticscholar.org/paper/Design-and-fabrication-of-coconut-dehusking-machine-Jacob-Kumar/903d9d53445eb4ac849881b1eefd4a0ec17e3133/figure/4
<1% - https://www.ijert.org/coconut-dehusking-machine
1% - https://garuda.kemdikbud.go.id/documents/detail/1231538
<1% - https://dir.indiamart.com/impcat/electric-motors.html?q-13054172-power=2-hp
1% - https://www.semanticscholar.org/paper/Development-of-Coconut-Dehusker-Machine-for-Small-Herdian-Novita/3c843cbe848b5edd71b9c37f0a61b4c2d48e7aa9
<1% - https://www.academia.edu/53460314/Design_and_Performance_Test_of_Rubber_Grinding_Machine
<1% - https://www.bartleby.com/questions-and-answers/figure-1-shows-the-operation-of-a-g

arlic-press.-the-lower-part-of-the-press-is-held-steady-and-the-u/69e3e370-1bc3-4b17
-ba2a-b9eb7a46969e

<1% -
https://testbook.com/question-answer/two-cars-are-moving-in-the-opposite-direction-
with--60111a110b801ccd66ec77c5

<1% - https://www.youtube.com/watch?v=zD8jdVFV3MI

<1% -
https://www.merdeka.com/teknologi/beberapa-produk-gojek-ada-yang-sudah-bep.htm
l

<1% -
https://physics.stackexchange.com/questions/247428/why-do-two-rolls-with-the-same-
mass-but-different-moments-of-inertia-roll-differ

<1% - https://www.fao.org/3/T0579E/t0579e05.htm

<1% -
https://journals.sagepub.com/doi/10.1177/20552076231167255?icid=int.sj-full-text.simil
ar-articles.3

1% - https://www.chemijournal.com/archives/2018/vol6issue6/PartJ/6-5-135-808.pdf

<1% - https://ijesc.org/

<1% - https://garuda.kemdikbud.go.id/journal/view/15745

1% - https://ieeexplore.ieee.org/xpl/articleDetails.jsp?reload=true&arnumber=6477964

1% - https://sci-hub.se/10.1051/e3sconf/20183401014

<1% -
https://www.e3s-conferences.org/articles/e3sconf/abs/2020/02/contents/contents.html

<1% - https://www.jaast.org/index.php/jaast