The effect of the angular change

by Achmad Wibolo

ISBN : 978-602-99806-3-9

The effect of the angular change and the rotation of the blade on the thickness of incision on the cocoa skin machine

Achmad Wibolo,[1] I Gede Nyoman Suta Waisnawa[2]
[12]Department of Mechanical Engineering Politeknik Negeri Bali
Bukit Jimbaran P.O. Box 1064 Tuban Badung – Bali
Phone : (0361) 701981, Fax. (0361) 701128

Corresponding author: E-mail address : bolo_pnb@yahoo.com

Abstract. Slicing machine designed in this study is expected to be able to change the size of cacao skin to be thinner so it can be processed into bran. The method of processing the skin of cocoa fruit inti bran is expected to be able to increase the amount of animal feed supply so it can be used not limited to cattle and goats but also for other livestock. The purpose of this research is to realize a machine capable of processing the skin of cocoa fruit that has been only a little can be utilized by community to be processed livestock feed to help supply livestock feed farmers.
Designing technique is a very important basic step undertaken in the design of this cocoa fruit skin slicing machine. The purpose of this designing technique is to get the construction data required in building this slicer. Furthermore, the design process of cocoa skin cutting machine construction with consideration is the main driving force using the motor, slicer knife can be adjusted, ergonomic engine specifications, easy operation, and the machine does not cause noise.
Testing is done by designing various variations of angle and rotation on the slicing knife disc.
Testing on the performance of this cocoa fruit skin cutter machine still has some weaknesses, such as disks and knives steel material replaced with stainless steel to be more hygienic. The test results obtained that the smaller the slicing angle the thickness of the slices the thinner and the lower the rotation of the slicing knife then the slicing process will be longer.
Further research is possible on the vibration direction of the cutting tool and the design of the next machine for the grinding process

Keywords: cocoa fruit, cocoa fruit skin, slicing machine

INTRODUCTION

Feed is one of the most decisive factors in the livestock business. The availability of feed is very fluctuating, abundant in the rainy season and there is a shortage during the dry season. It becomes an obstacle as well as a challenge for farmers to keep feeding with high protein content, cheap and sustainable (Pond, W.G *et al*., 1995). The provision of feed has shifted to the exploration and utilization of non-conventional feed ingredients with low competition value, among others cocoa peel. Utilization of the skin of cocoa fruits as animal feed will provide two main effects, namely the increased availability of feed ingredients and reduce environmental pollution due to the disposal of the skin of cocoa fruit is not good. However in the utilization as animal feed ingredients have the main obstacle that is high content of lignin an low protein (Aregheore, 2000).

Furthermore, it is said that the waste of cacao fruits given directly to livestock will actually decrease the weight of livestock body, because the protein content of cocoa skin is low, while the lignin and cellulose are high. One alternative technology to utilize the skin of cocoa fruit as raw material for animal feed is to turn it into a quality product that is through the process of fermentation. Fermentation can increase the nutritional value and fodder ingredients and inhibit the growth of

ISBN : 978-602-99806-3-9

micro organisms that are not favored. In principle, the processing of food by fermentation is to active the micro organisms needed to form new products different from the raw material (Nguyen *et al*., 2001).

Processing of cocoa fruit skin is done through four stages : slicing, fermentation, drying and grinding. This research is devoted to realize the tool that is able to slice the cocoa fruit skin into a smaller size to facilitate the process of drying and grinding. The method of processing cocoa fruits into bran is expected to be able to increase the amount of animal feed supply so that it can be used not only on cattle and goats but also for other livestock.

MATERIALS AND METHODS

The materials used : Skin fruits of cocoa is a waste agroindustry generated plant cocoa Fruits of cocoa consists of 74% cod, 2% placenta and 24% seeds.Kulit buah kakao adalah merupakan limbah agroindustri yang dihasilkan tanaman kakao. Buah coklat terdiri atas 74 % kulit buah, 2 % plasenta dan 24 % biji.

Tool used : The cocoa skin machine is the result of design and manufacture process and its equipment (Khurmi, R.S *et al*., 2005) (figure 1). The tachometer is used to measure the per minute spin due to the change in diameter of the pulleys from the slicing disk shaft. The design of the slicer used by research. Varnier caliper is used to measure the thickness of the slice material. Stopwatch is used for slicing time during ferfect sliced material.

Condition : After a survey to the location of the planned application of the tool in Dusun Pempatan Kecamatan Pupuan Tabanan to get cocoa skin as the intial planning, but there are constraints that the cocoa harvest has passed so as not to get wet cocoa skin as a test material. The test material uses cassava as a substitute material assuming cassava hardness with the same cocoa skin, Dimensions of cassava used as a test material with a diameter of 8 cm and a length of 20 cm. The length of cassava is determined to get the time required in slicing until the material is sliced.

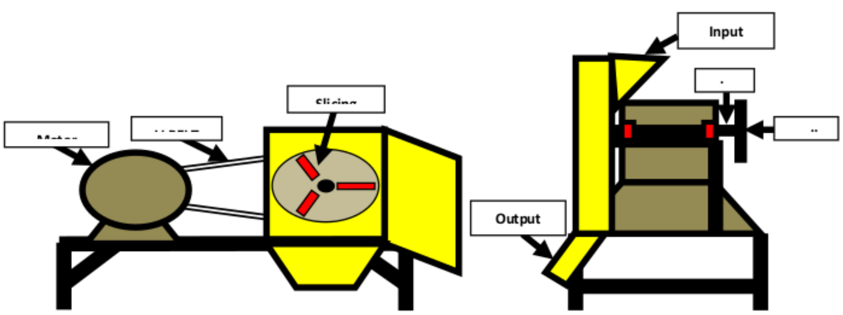


Figure 1. Design slicing machine

Variables that are executed : Changes will be made at the angle of the blade as well as the speed of the incision rotation to determine the thickness of the cocoa skin. The angle change is done three times that is 5^0, 10^0, 15^0 and the change of speed is done by changing the diameter of pulley at knife that is 8 inch, 10 inch and 12 inch.

Procedure : Testing at Mechanical Laboratory Departement of Mechanical Engineering Politeknik Negeri Bali. The machine is turned on and set to idle position (1000 rpm). The machine is left to operate for five minutes to make condition stable. The ingredients are inserted and left untouched by themselves. The slicing time was recorded and the slices were taken randomly for measurement. The measurement results were taken as many as 10 pieces then measured to get the thickness.

ISBN : 978-602-99806-3-9

RESULTS

Based on the calculation of the driving machine using an electric motor, but the anticipation of the unavailability of electricity sources in the location of the application is used motor fuel. The result of manufacture and assembly of slicing machine is shown in figure 2.

Figure 2. Sliced machine designed

Specifications of the machine are designed according to table 1

Table 1. Slicing machine specification

No	Description	Specification
1	Motor Drive	5,5 hp
2	Shaft driven	Ø 25 mm
3	Pillow block	502
4	Material inlet	45°
5	Outlet of materals	45°
6	Disk knife	Ø 400 mm
7	Lenght of knife	150 mm

In accordance with the objectives of the study carried out variations on the movable pulley as in table 2

Table 2. Pulley Rotation Rasio

No	D1	N1	D2	N2
1	3	1000	8	375
2	3	1000	10	300
3	3	1000	12	250

D1 = diameter of the drive pulley (inch)
D2 = diameter of the driven pulley (inch)
N1 = round pulley drive (rpm)
N2 = round pulley driven (rpm)

The slicing knife disk is made of three pieces according to the specified angle variations of 5°, 10° and 15° as show in figure 3.

ISBN : 978-602-99806-3-9

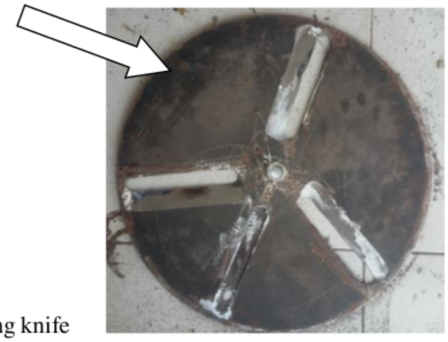


Figure 3. Disc slicing knife

The test is performed to obtain the thickness of the incision as well as the time required for the incision. The dimensions of cassava are selected and cleaned before being put into the hoper. Purpose cleaned to anticipate damage to the slicing knife. When the yam is inserted the stopwatch is activated to get the time of incision of each knife angle and the diameter of the pulley used.

Figure 4. Slicing result

The test results from the slicing machine by varying the angle of the knife and the pulley diameter are moved as in table 3, table 4, and table 5.

Figure 5. Measuring the thickness of the slices

ISBN : 978-602-99806-3-9

Table 3. Data of test result with angle of disk 5°

No	Sampel	Knife Angle (°)	Diameter Pulley (in)	Thick Result (mm)	Average Thickness	Time (seconds)
1				0.6		
2				0.8		
3				0.75		
4				0.8		
5	**A**	5	8	0.8	0.71	12
6				0.6		
7				0.8		
8				0.5		
9				0.65		
10				0.8		
11				0.8		
12				0.8		
13				0.6		
14				0.8		
15	**B**	5	10	0.9	0.79	18
16				0.8		
17				0.8		
18				0.65		
19				0.8		
20				0.9		
21				0.8		
22				0.9		
23				0.8		
24				0.8		
25	**C**	5	12	0.6	0.8	23
26				0.8		
27				0.7		
28				0.8		
29				0.9		
30				0.9		

Table 3 shows that at a blade angle of 5° has an effect on the average thickness of the yield of between 0.71 - 0.8 mm. The diameter of the driven pulley affects the slicing time of the material, the larger the pulley the slicing speed will decrease as a result of the lower knife rotation.

Table 4. Data of test result with angle of disk 10°

No	Sampel	Knife Angle (°)	Diameter Pulley (in)	Thick result (mm)	Average Thickness	Time (seconds)
1				1.2		
2				1.4		
3				1.5		
4				1.2		
5	**D**	10	8	1.3	1.37	13
6				1.2		
7				1.6		
8				1.5		
9				1.2		
10				1.6		
11				1.2		
12				1.4		
13				1.5		
14				1.2		
15	**E**	10	10	1.6	1.46	20
16				1.2		
17				1.6		
18				1.5		
19				1.7		
20				1.7		
21				1.3		
22				1.4		
23				1.5		
24				1.4		
25	**F**	10	12	1.5	1.54	24
26				1.6		
27				1.7		
28				1.5		
29				1.8		
30				1.7		

ISBN : 978-602-99806-3-9

Table 4 shows that at a 10° knife angle affects the average thickness of the incision yields from 1.37 to 1.54 mm. The diameter of the driven pulley affects the time of slice of the material, the greater the pulley the slicing speed will decrease due to the lower knife rotation

Table 5. Data of test result with angle of disk 15°

N	Sampe	Knife Angle (	Diameter Pulley	Thick Result (mm	Average Thickness (mm	Time (seconds
1				2.		
2				3.		
3				2.		
4				3.		
5	**G**	1	8	2.	2.9	1
6				2.		
7				2.		
8				3.		
9				3.		
1				3.		
1				3.		
1				3.		
1				3.		
1				3.		
1	**H**	1	1	3.	3.2	2
1				3.		
1				3.		
1				3.		
1				3.		
2				3.		
2				3.		
2				3.		
2				3.		
2				3.		
2	**I**	1	1	3.	3.5	2
2				3.		
2				3.		
2				3.		
2				3.		
3				3.		

Table 5 shows that at a blade angle of 15° has an effect on the average thickness of the incision results between 2.94 - 3.51 mm. The diameter of the driven pulley affects the time of slice of the material, the greater the pulley the slicing speed will decrease due to the lower knife rotation

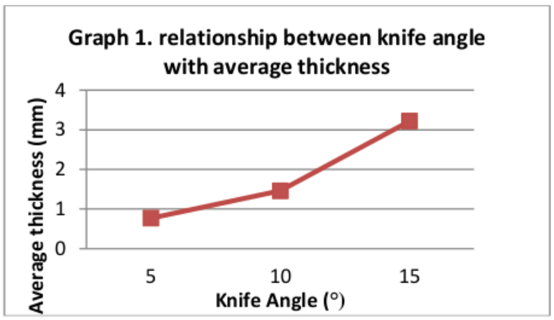
The results of the test of variation to the next round are included in the table and a graph is made to facilitate the discussion.

ISBN : 978-602-99806-3-9

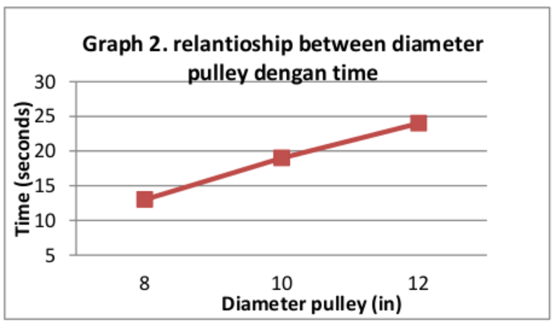
Table 6 Test results data with angle variations and pulley diameters are driven

No	Sampel	Knife Angle (°)	Diameter Pulley (in)	Average Thickness (mm)	Time (seconds)
1	A	5	8	0.71	12
2	B	5	10	0.79	18
3	C	5	12	0.80	23
4	D	10	8	1.37	13
5	E	10	10	1.46	20
6	F	10	12	1.54	24
7	G	15	8	2.94	15
8	H	15	10	3.22	20
9	I	15	12	3.51	24

Furthermore, from table 6, a graph explaining the relationship between the angle of the knife to the thickness of the slice and the relationship between the diameter of the pulley against the time of incision.



From the graph 1 can be explained that the variation of the slicing angle affects the thickness of the result of incision. The smaller the angle of the knife then the thinning result, otherwise the greater the angle of the knife then resulting thicker.



ISBN : 978-602-99806-3-9

Graph 2 can be explained that the smaller the pulley diameter the faster the slicing time is required, the larger the pulley diameter the longer the slicing time of the material until the whole sliced out.

CONCLUSIONS

Slicing machine designed to be able to perform the process of slicing the material as needed. The thickness of the incision results is influenced by the angle of the knife made on the slicer and the time of incision is affected by diameter of the driven pulley. The smaller the slicer angle the thickness of the result will be smaller and the langer the diameter of the pulley driven then the slicing time is longer.

DAFTAR PUSTAKA

[1] Aregheore, E.M. 2000. Crop residues and agroindustrial byproduct in four Pacific Island countries: availability, utilization and potential value in ruminant nutrition. Asian – Aust. J. of Anim. Sci. 13 (Supplement B): 266-269.

[2] Khurmi, R.S, J.K. Gupta. 2005. Textbook Of Machine Design. Eurasia Publishing House (PVT.) LTD. Ram Nagar, New Delhi – 110 055.

[3] Nguyen, X.T., C.X. Dan, L.V. Ly, & F. Sundstol. 1998. Effect of urea concentration, moisture content and duration of treatment on chemical composition of alkali treated rice straw. LIvest. Res. Rural. Devel. 10 (1). http://www. cipav.org.co/lrrd10/1/trac101.htm

[4] Pond, W.G., D.C. Church & K.R. Pond. 1995. Basic Animal Nutrition and Feeding. 4th ed. John Willey and Sons, Canada

[5] Reddy, K Venkata. 2008.Textbook Of Engineering Drawing. Second Edition. BS Publications. 4-4-309, Giriraj Lane, Sultan Bazar, Hyderabad - 500 095 - A. P.

The effect of the angular change

ORIGINALITY REPORT

11%	8%	8%	6%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	text-id.123dok.com Internet Source	3%
2	I K E H Wiryanta, I M A Adiaksa. "Experimental and numerical investigation of thermal radiator performances as a source of heat energy in design of dryer simulation", Journal of Physics: Conference Series, 2018 Publication	3%
3	scholar.unand.ac.id Internet Source	1%
4	digilib.unila.ac.id Internet Source	1%
5	download.garuda.ristekdikti.go.id Internet Source	1%
6	engineering.fuoye.edu.ng Internet Source	1%
7	Submitted to The University of the South Pacific Student Paper	1%

8	Submitted to Sheffield Hallam University Student Paper	1%
9	www.suaire.sua.ac.tz Internet Source	<1%
10	www2.mdpi.com Internet Source	<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		