

THE PERFORMANCE OF JUICER MACHINE ON VEGETABLE MILK PRODUCTION FOR SMALL AND MEDIUM INDUSTRIES

Uli Karyani¹, Panut Mulyono², I Made Miasa³

¹Magister Teknik Sistem, Universitas Gadjah Mada

²Departemen Teknik Kimia, Fakultas Teknik, Universitas Gadjah Mada

³Departemen Teknik Mesin dan Industri, Fakultas Teknik, Universitas Gadjah Mada

*Correspondence : phy.jog@gmail.com

Abstract

The purpose of this research is to make juicer machine to produce vegetable milk for small and medium-scale industries, and the machine has been able to be made with a juicer machine dimensions 90 cm X 40 cm X 114 cm. With ½ HP motor power and motor speed 1420 r / min so as to grind soy beans, green beans and corn with a production capacity of each of the milk is on average 15 liters, 12 liters and 12 liters.

The first study is to design and create a juicer machine to produce vegetable milk based soy bean, green beans and corn by using some filter size is 60 mesh, 80 mesh and 100 mesh to obtain a best filter size for each type of vegetable milk. And organoleptic test to determine the level of preference for vegetable milk and obtained the most preferred type of vegetable milk is soy milk with a 100 mesh filter.

Anti-E.coli test result on vegetable milk as product quality standards, not found any E. coli in each sample tested. While the feasibility of vegetable milk production using a juicer machine is feasible to use in the business of making the three types of vegetable milk because it can give the advantage of 1.20-fold for each unit of the issued capital, the benefits outweigh the effort of making industrial scale vegetable milk usual household. And in terms of the market, producing vegetable milk is still a promising business seen from vegetable milk organoleptic test average of 60% is still loved and considers it important to consume vegetable

History:

Received: August 19, 2015

Accepted: November 25, 2015

First published online:

December 21, 2015

Keywords:

Juicer Machine
Milk Vegetable
SMEs
Feasibility

1. Introduction

Indonesia has a population that is growing by day. Most of the population consists of children, so that the need for protein consumption was increasing. Protein derived from animal such as milk and meat is less desirable now see the price is quite expensive so it can not be accessed by people with low economic returns. Therefore it is natural alternatives sought other food products producing proteins that can be derived from plant/vegetable that has a high protein content and taste are no less tasty with dairy products and meat. One of them with a source of protein from soy milk and green beans as well as a source of carbohydrates from corn.

As for the processing of soybean seeds as raw material for soy milk, soy beans must pass through the milling process. Common way used to grind them are with millstones and soy beans will produce soy porridge, which will then be filtered and squeezed by using a filter cloth to dispose of the waste and obtain soymilk.

The milling process received less satisfactory results besides the results are relatively few, are also still using manpower to grind and squeeze. In addition, milling machine on the market intended for large industry and have not been used for a wide variety of sources of vegetable milk so that in addition to its price milled also too much if used for small industries.

Need to do the planning and creation of a tool milled soy beans, green beans and corn with a maximum capacity of 15 liters called juicer machine with a capacity of 15 liters, so for the same length of time can be obtained extracts of vegetable milk more than the existing manual method.

2. Methodology

Literature Review

Based on the existing references, previous studies have focused on making the tool alone or in the manufacture of products only. This study is focused on the development of a tool grinder vegetable milk and milk products plant that will be able to increase the sale value of the milk plant in this case soy milk, corn milk and milk green beans in small and medium industries. The previous studies on vegetable milk has been developed yet for the means of production has not been developed, whereas vegetable milk production tools now mostly use an electric heater so that would be more burdensome cost of production of small industrial businesses.

Fariyanti (2006), examines the utilization of watermelon seeds to be used as one of the raw materials of vegetable milk as his case in the manufacture of vegetable milk from soybeans or materials commonly called soy milk. The result is a flavorful watermelon seed milk rather unpleasant and less than perfect homogeneity.

In the study conducted Dongoran et al. (2007), who studied how to make soy milk high calcium using bone meal of red snapper. The addition of fish bone meal significant effect on the moisture content and protein.

Meanwhile, the research conducted by Harjoko (2003), produces soy bean grinder machine designed using two millstones are rotated by an electric motor, filter of the hollow filament (wire ram), which is milled out of the machine have been separated between soya and soya dregs through different channels.

Research Methodology

This research was conducted at the Laboratory of Engineering Science Study Center, in Industrial households belonged to Mr. Wijanarko in the village Margoyudan, Seyegan, Sleman, Yogyakarta and in the Laboratory of the University of Gadjah Mada FTP.

The steps of this research is written in Figure 1. below,

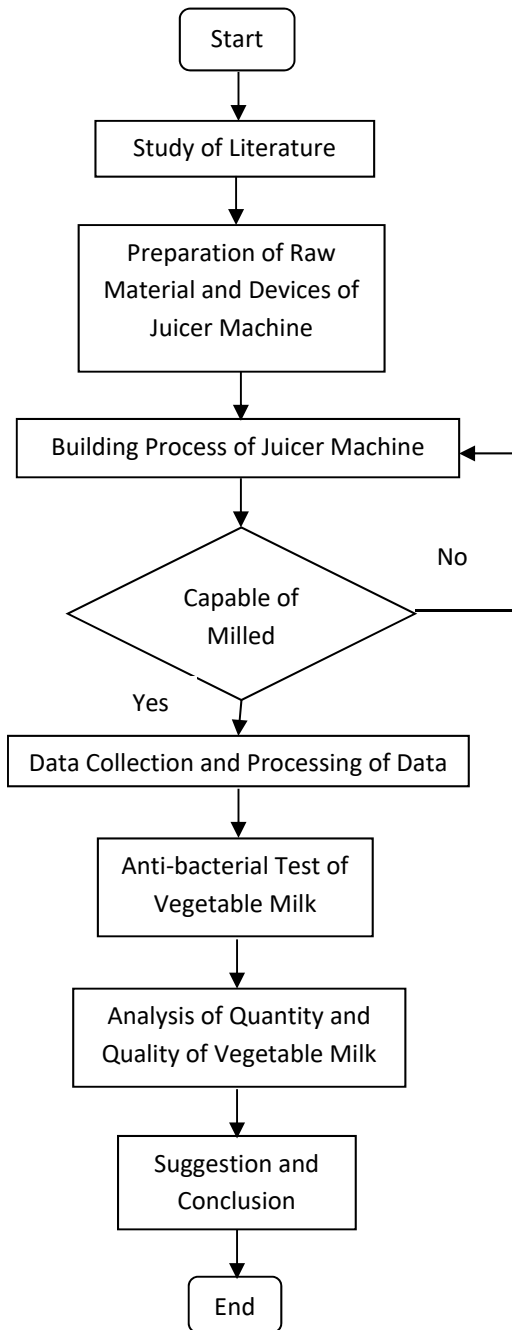


Figure 1. Flowchart of Research Steps

Variables Research :

- a. Variables: Size mesh filter
- b. The dependent variable
 - Operating time juicer machine
 - The quantity (volume, yield)
 - The quality of soy milk (anti-E.coli)
- c. Variable control

- Raw material amount of soybean, green beans and corn
- Juicer Machine

This stage of baseline data collection and as a pretreatment for each commodity raw materials of vegetable milk maker.

- a) Pretreatment:
 - Soaking in hot water for 6 hours for soybean
 - Soaking in hot water for 1 hour for green beans
 - Without immersion for sweet corn
 - Boiling the water temperature <math><100^{\circ}\text{C}</math> or $\pm 60^{\circ}\text{C}</math>$
- b) Destruction:
 - Destroyed or blended with juicer machine for 15 minutes
 - Taken data required
- c) Cooking:
 - Boiled to boiling ($100^{\circ}\text{C}</math>)$

Product Quality Testing :

Vegetable milk product quality testing by testing the amount of microbial *E.coli* and Test correspondent to know the joy level of the vegetable milk produced using a juicer machine.

3. Results and Discussion

In this study, milk production tool for a wide variety of milk-based agricultural commodities or commonly called vegetable milk in this case the use of raw materials such as local soy white, local sweet corn and green beans are easily found throughout the local traditional markets and supermarkets in Indonesia. Figure 2 and Figure 3 below shows the juicer machine tools that have been made in this study.

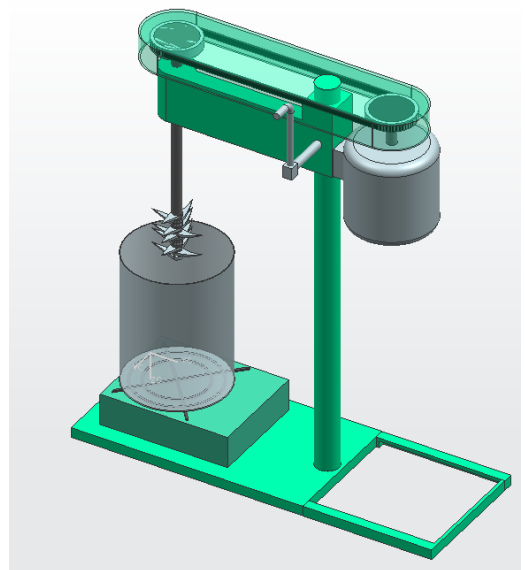


Figure 2. Design of Juicer Machine



Figure 3. Photo of Juicer Machine

Working Test Tool:

Once the milk vegetable juicer machine tool is made, then to know the work of the tool then performed a number of tests. Here are the details of the tests performed in this study.

The tools are used:

1. Digital scales
2. Scales frog
3. Measuring cups
4. The container of water
5. Containers oven
6. Oven

Materials used:

1. Local white soy
2. Green beans locally
3. Local sweet corn

Working Procedure Testing:

a. Yield:

Mass of raw material without soaking the reduced mass of dry pulp divided by the dry mass multiplied by 100%.

$$\eta = \left(\frac{Bk - Ba}{Bk} \right) \times 100\% \quad \dots\dots\dots (1)$$

Note : η = yield (%)
 Ba = dry weight of pulp (kg)
 Bk = dry weight of the material (kg)

b. Tank capacity:

Milling time-filtering is the time required for one-time screening or milling process at the same time it takes from the first mill to mill the results obtained simultaneously filtering. By knowing the time required for the process of grinding and screening takes place,

it can be determined from the tank capacity juicer machine, using the following equation:

$$KP = \frac{Bo}{t} \quad \dots\dots\dots (2)$$

Note: KP = tank capacity production (ml / min)
 Bo = milling and screening results (ml)
 t = (minute)

The first experimental design is by making tool based on the situation in the community who are still in need. This research was conducted in order to produce milk maker especially its vegetable soy milk, corn milk and milk green beans with a maximum production capacity of 15 liters of vegetable milk. Vegetable milk maker is called a juicer machine with a tank volume of 20 liters with tank 40 cm high and 30 cm diameter tank, as well as the dimensions of the tool / machine juicer 90 cm X 40 cm X 114 cm.

The second in a series of experimental design of this study is to determine the composition of the raw materials. Then the product of three ingredients that have been known recipe testing of the machine work. Then obtained tank capacity and yield per minute engine generated in each sample filter of dairy products itself, as shown in Figure 4 and Figure 5 below:

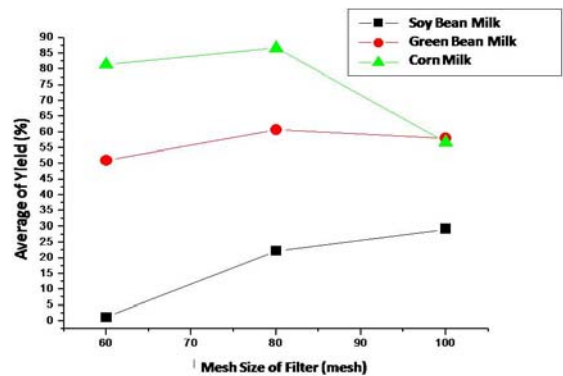


Figure 4. Yield of each product from filter of juicer machine

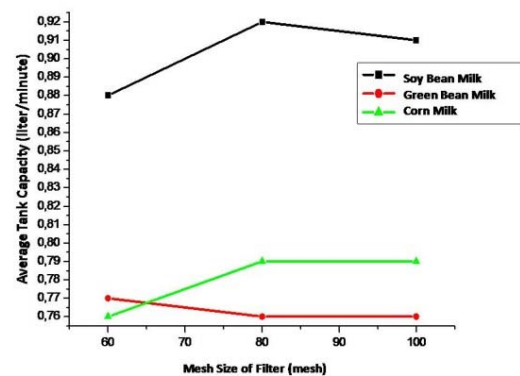


Figure 5. Tank capacity per minute of juicer machine

Judging from the graph above, it can be seen that the highest average yield for soybean milk obtained on the hole size of 100 mesh filter that is 35%, for green bean milk at 80 mesh size filter that is 65% and for milk corn on the size of 80 mesh filter is 85%. The yield here is used to determine the size of the filter that generate most of the solids from vegetable milk that has been made.

The above graph also illustrates that the manufacture of soy milk and corn milk tank capacity is best filtration using filter size of 80 mesh, it is possible to filter the size of 100 mesh filter holes covered very green bean extract is more subtle, while the bean milk the best green on the filter size of 60 mesh, possibly because of a wet green beans easily be smooth to be destroyed so that the dregs of green beans to cover the hole filters.

Know also the average tank capacity of the juicer machine that for every minute process can produce 0.92 liters of soy milk, milk 0.77 liters to 0.79 liters of green beans and corn to milk, while on average the capacity tank untuk all vegetable milk production was 0.82 liters per minute.

Based on the anti-bacterial test in this case the content of *E. coli* test on each sample vegetable milk obtained no differences on all three is zero *E. coli* contamination in the samples as shown in Table 1, this is possible because the sample was heated up to first up to 80 ° C and then marketed for later consumption.

Table 1. Result of Analysis Anti-Bacterial *E.Coli*

No.	Sample Code	Analysis Result
		<i>E.Coli</i> (Cfu/ml)
1.	Soy Bean Milk	0
2.	Green Bean Milk	0
3.	Corn Milk	0

Product organoleptic tests carried out on 10 respondents are not trained with the description of the respondents 82% of respondents consume vegetable milk 1-2 times a week, the remaining 18% consume every day.

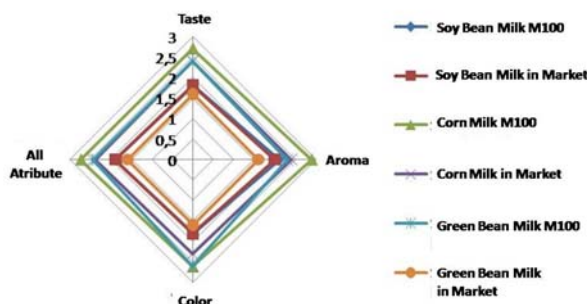


Figure 6. Graph of cobwebs a vegetable milk

Figure 6 shows the position of each sample according to the respondent's assessment is based on the respective attributes. The closer of the center coordinates of the cobwebs, means the value is the better or more diminati.dari chart above most preferred is still a green bean milk products market, followed by the market soy

milk, soy milk followed M100 (juicer machine), followed by corn milk market, then the milk green kacang M100 and M100 corn milk is the least preferred.

Business Feasibility Analysis :

a. Feasibility analysis based on the technical and technological aspects

Based on data extraction and production capacity obtained regarding juicer machine tools that have been made, found that the highest production capacity is obtained when producing soy milk is a maximum of 14 liters with a maximum water for basic material production is 15 liters, and the milk yield of green beans and corn respectively -masing is an average of 12 liters.

b. Feasibility analysis based on market and marketing aspects

Based on questionnaire data from the respondents as a potential target market, obtained information that the public ± 60% is still considered important vegetable consumption of milk, especially milk for personal health public body itself. And this means it is still wide open for the development of vegetable milk, by way of direct distribution to better achieve the intended target market.

c. Feasibility analysis based on the financial aspects

Analysis of the feasibility of making vegetable milk by using a juicer machine with a tank capacity of production ± 0.82 liters / minute for a long time each process is 15 minutes and the capacity of ± 15 liters of water per process with vegetable milk yield average of ± 14 liters for soy milk, and ± 12 liters of milk green beans and corn ± 12 liters of milk. Analysis of the feasibility of making vegetable milk by using a juicer machine is obtained as shown in Table 2, Table 3 and Table 4 below,

Table 2. Cost of investments vegetable milk using a juicer machine tool

No.	Description	Unit	Unity	Price (Rp)	Cost (Rp)
1	Juicer machine	1	Unit	7.500.000	7.500.000
2	Stove Rinnai 2 furnaces	2	Unit	700.000	1.400.000
3	Gas tube 3 kg	4	Piece	150.000	600.000
4	A large pot	3	Piece	100.000	300.000
5	A deep bucket	3	Piece	20.000	60.000
6	Scoop	3	Piece	5.000	30.000
7	Funnel	3	Piece	10.000	20.000
8	Filter cloth	2x2	m ²	8.000	32.000
9	Mixer	3	Piece	5.000	15.000
10	Plastic kettles	3	Piece	25.000	75.000
Total Cost of Investment					10.032.000

Table 3. The operational costs of vegetable milk using a juicer machine

No.	Description	Unit	Unity	Price(Rp)	Cost (Rp)
1	Labor	4	People	1.000.000	4.000.000
2	Gas	15	Tube	20.000	300.000
3	Electricity costs	1	Month	100.000	100.000
4	Soy bean	45	kg	9.000	405.000
5	Sweet corn	45	kg	5.000	225.000
6	Green beans	45	kg	12.000	540.000
7	Sugar	111	kg	10.000	1.110.000
8	Plastic packaging			100.000	100.000
9	Transportation	30	Days	15.000	450.000
10	Tax market	30	Days	3.000	90.000
Total Cost Operational / Month					7.320.000

Table 4. Calculation of the advantages of using the juicer machine by designed

No.	Description	Unit	Unity	Price (Rp)	Cost (Rp)
1	Vegetable milk production per month (30 days)	5.850	packs	1500	8.775.000
2	Operating Costs				7.320.000
Advantages / Month					1.455.000
Advantages / Year					17.460.000

a. Benefit-Cost Ratio (BCR)

$$BCR = \frac{8.775.000}{7.320.000} = 1,20$$

BCR figures show 1.20 (BCR > 1), means that the business of making vegetable milk of small and medium scale industry is feasible, where each unit issued capital will be obtained the results as much as 1.20 times.

b. Break Event Point (BEP)

$$BEP (Production) = \frac{7.320.000}{1.500} = 4880$$

$$BEP (Price) = \frac{7.320.000}{5.850} = 1251,28$$

BEP calculation results (production) above shows that the business of making vegetable milk will break even if it is able to sell the number of 4,880 packs of vegetable milk production and the selling price of vegetable milk Rp 1,251 / wrap.

c. Payback Period

$$PBP = \frac{10.032.000}{17.460.000} \times 1 \text{ tahun} = 0,57 \text{ tahun}$$

The length of time it takes to return the total investment is within ± 0.57 years or ± 6 months.

d. Return on Investment (ROI)

$$ROI = \frac{1.455.000}{10.032.000} \times 100\% = 14,50\%$$

Based on the results of the ROI calculation above, it appears that any financing undertaken by Rp 100.00 will be obtained profit of Rp 14.50.

Based on feasibility analysis calculations using a juicer machine can be concluded that, in the business of making vegetable milk of small and medium scale industries using a juicer machine feasible to do with gains of 1.20-fold for each unit of the issued capital. Long investment returns earned by ordinary blender machine faster, because a sizable investment tool. However, after the capital back then the benefits of each lunar month is greater than regular blender. So, overall, the business of making vegetable milk using a juicer machine feasible.

4. Conclusion

This research aims to make vegetable milk juicer machine tool for small and medium-scale industries, and the machine has been able to be made with a juicer machine dimensions 90 cm X 40 cm X 114 cm. With $\frac{1}{2}$ HP motor power and motor speed 1420 r / min so as to grind soy beans, green beans and corn with a production capacity of each of the milk is on average 15 liters, 12 liters and 12 liters

In the anti-*E.coli* test result on vegetable milk looks absence of *E. coli* in each sample tested. While the feasibility of milk production plant using a juicer machine is feasible to use in the business of making the three types of vegetable milk because it can give the advantage of 1.20-fold for each unit of the issued capital, the benefits outweigh the effort of making industrial scale vegetable milk usual household. And in terms of the market, remains a promising business seen from the A-level test of the vegetable milk an average of 60% is still loved and considers it important to consume vegetable milk.

References

- Dongoran, N., Kustiyah, L., Marliyati, S.A., 2007, *Making Soy Milk High Calcium with Fish Bone Meal Addition of Red Snapper (Lutjanus sanguineus)*, Media Nutrition and Family: LIPI.
- Fariyanti, A., 2006, *Making Milk of Watermelon Seed*, Faculty of Engineering: UNNES, Semarang.
- Harjoko, H., 2003, *Planning mill machinery and extractor of Soybean Seeds accompanied by a separation mechanism Juice Results Soybean Seeds*, PETRA Christian University