

Fabrication of Recycled Soap Bar Machine for Hoteliers

(Fabrikasi Mesin Sabun Kitar Semula untuk Pengusaha Hotel)

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Abstract

Soap bars are often discarded when their size becomes too small to use as it shrinks and causes the size to be reduced. Also, due to hygiene purposes, the soap bars are simply thrown away when it is opened by the hotel's occupant. These practices have caused wastage and the processes of the soap bar in the industry are bad for the ecosystem as there are energy-intense works. Hence, this project is about the fabrication of a recycling soap bar machine for hoteliers. The fabrication works were initially started with the welding process of the rectangular steel frame before the assembly process of the mincer machine and heating element. Soon, the control system for the power supply and heat regulator was installed. We were successful in producing a machine that combines the process of shredding, melting, and molding into one single machine. Besides that, the machine costs only RM603.20 which is much cheaper than the machines available in the market. Finally, this recycled soap bar machine was able to reduce the production times of soap making process by 10 % and the testing results showed the production time was only 30 minutes by the current machine. Hence, this machine will reduce the soap bar's wastage and enable them to be recycled in small-scale production. Nevertheless, this machine can be also utilized for other applications with the same processes such as candle making.

Keywords: recycling, soap bar, heating, shredding.

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INTRODUCTION

Soap is a salt of a fatty acid used in a variety of cleansing and lubricating products. In a domestic setting, soaps are usually used for washing, bathing, and other types of housekeeping. In industry, soaps are used as thickeners, components of some lubricants, and precursors to catalysts. Soaps and detergents are essential to personal and public health. Through their ability to loosen and remove soil from a surface, they contribute to good personal hygiene, reduce the presence of germs that cause infectious diseases, extend the useful life of clothes, tableware, linens, surfaces and furnishings and make our homes and workplaces more pleasant(Web Solutions LLC., 2020).

Soap making process started back many thousands of years. The cold process method is the most popular soap-making process today, while some soap makers use the historical hot process. The benefit cold process for making soap bars is first, to give a creamy feel. Cold process soap made with all-natural ingredients like plant oils and butter creates a creamy lather for deep moisturization. Unlike other soap types, cold process versions penetrate deep into the skin to help minimize dry itchy skin. The benefits of natural soap-making ingredients like coconut oil, shea butter and olive oil can be lost through the heating process in the hot process soap technique. The cold process method ensures these natural ingredients are better preserved. In addition, this process gives a luxurious lather (Burlison, Butcher, Goodwin, Sharp, & Ruder, 2017). However, the cold process also has disadvantages, as the process must be made with sodium hydroxide lye, which can be dangerous when handled incorrectly. In addition, the cold process soap takes about 4-6 weeks to cure. Meanwhile, the hot process allows you to customize every single ingredient, including fixed oils. The additional heat speeds up the saponification process. On the other hand, the disadvantages of the hot process are the thick texture of hot process soap makes some techniques difficult, like layering and swirls. When there are cases the fragrance or essential oil has a low flashpoint, some makers find the higher temperatures can burn off the fragrance and cause it to fade(Burlison et al., 2017).

Typically, the soap bar-making process involves shredding, heating, and molding. The shredding works as a cutter to cut the soap into tiny pieces so that it is easier to melt in the heating process. The heating process with a temperature of around 120°C turns into a saponification reaction (Anne, n.d.). Then the soap is poured into a mold to form the desired shapes. In the market, there are various soap bar machines available for different purposes(Alibaba, n.d.; Small soap machines, n.d.). However, most of the machines are for mass production and have the huge capacity (3000Litres) in industrial usage. Therefore, these machines are bulky as they have large sizes. In addition, the machine itself is very expensive. Therefore, a smaller size with lower volume capacity and a cheaper version of the soap bar machine will be the interest of to this study.

In this modern world, we are trying to protect the planet from degradation through sustainable consumption and production so that it can support the needs of future generations. As aforementioned, soap bar-making is a very energy-intense industry process and alternative methods to encourage the recycling of the soap bar will surely benefit in reducing the production. Similarly, good hygiene practice is essential to ensure healthy lives and promote wellbeing in accordance with United Nations Sustainability Development Goal (SDG) (Johnston, 2016). The recycled soap bar has the potential to be exported to third world countries as it can be sold at a cheaper price. Hence, this will reduce the mortality due to poor hygiene diseases as prevention can be enhanced. On the other hand, recycling soap bars will reduce the energy consumption in the industry and therefore lead to more sustainable, affordable and reliable energy. By considering the abovementioned research gap, this project is an effort to fabricate a soap bar machine to enable recycling of the soap bar for hoteliers and also to produce a cheaper version of the soap bar machine.

METHODOLOGY

The development of this machine is based on a few stages such as design, fabrication, testing and demonstration. The first process is the design process using Autodesk Inventor (Figure 1). Various sketches have been developed based on the literature review conducted and the final design is chosen based on the morphology chart with criteria such as mobility, effectiveness, cost and technical aspect are taken into consideration.

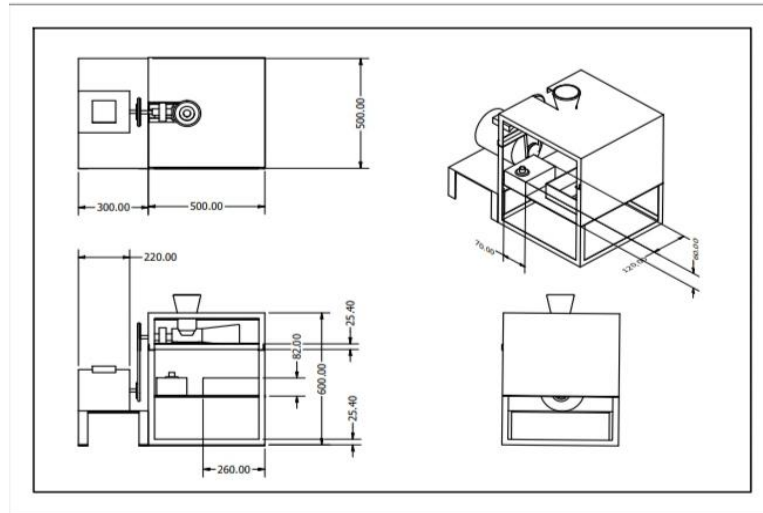


Figure 1. Design using Autodesk Inventor

Subsequently, the fabrication process took place whereas the rectangular main body of the machine using the L angle bar was welded together as shown in Figure 2. Before that, the L angle bar was cut into pieces accordingly to the dimensions by using a miter saw.



Figure 2. Frame fabrication

The main body consists of three layers, as the bottom layer functions as the support. Meanwhile, the second layer or middle layer is where the temperature regulator and heating element are located. The top layer functions to support the shredder machine. In addition, another smaller rectangular frame was fabricated beside the main body to rest the motor. All parts were connected by the welding process as this is to ensure the framework is stable and hardy. After the frameworks were completed, the motor and shredder were assembled and connected by bolts and nuts to ensure they joined securely. A pulley system was utilized to move the shredder automatically (Figure 3).



Figure 3. Pulley system for automatic shredding process

In addition, the shaft component to connect the pulley wheel to the shredder was fabricated using the lathe machine as shown in Figure 4. Finally, to ensure the safety of the machine, the top and side covers were installed by using an acrylic sheet.



Figure 4. Shaft machining

Finally, in this project, we had conducted the pre-testing of the manual process of soap bar process as shown in figure 5. This duration gained will enable us to make a rough comparison of the effectiveness of the machine. The manual process began with the used soap bar was cut into small pieces with a grater (Figure 5(a)). Then, the heating process was performed with a mixture of small pieces of soap and water (Figure 5(b)). Finally, the liquid form was poured into a container to form the desired final shape (Figure 5(c)).

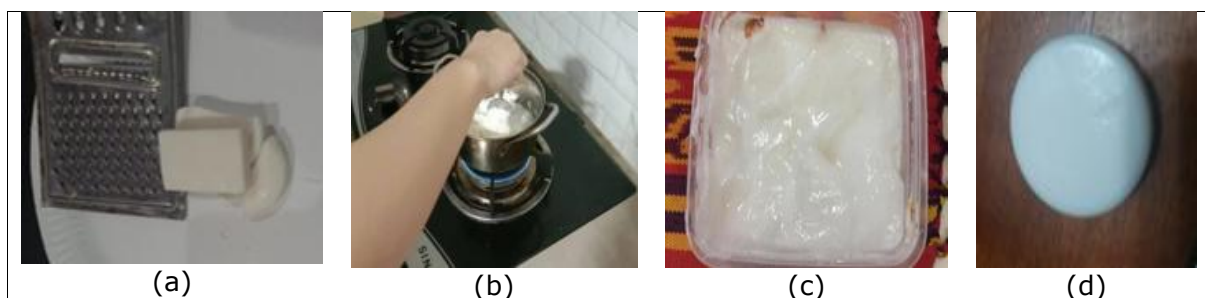


Figure 5. Manual soap bar process; (a) Grater, (b) Cooking, (c) cooling in mold, (d) final product

RESULTS

The completed soap bar machine is shown in figure 6.



Figure 6. Completed machine

The operation of this machine is easy and simple. The machine is initiated by pressing the ON button on the control system to turn on the machine. The motor will then rotate the shredder machine and the used soap bar can now be inserted from the top of the shredder machine to crush it into smaller pieces (Figure 7).

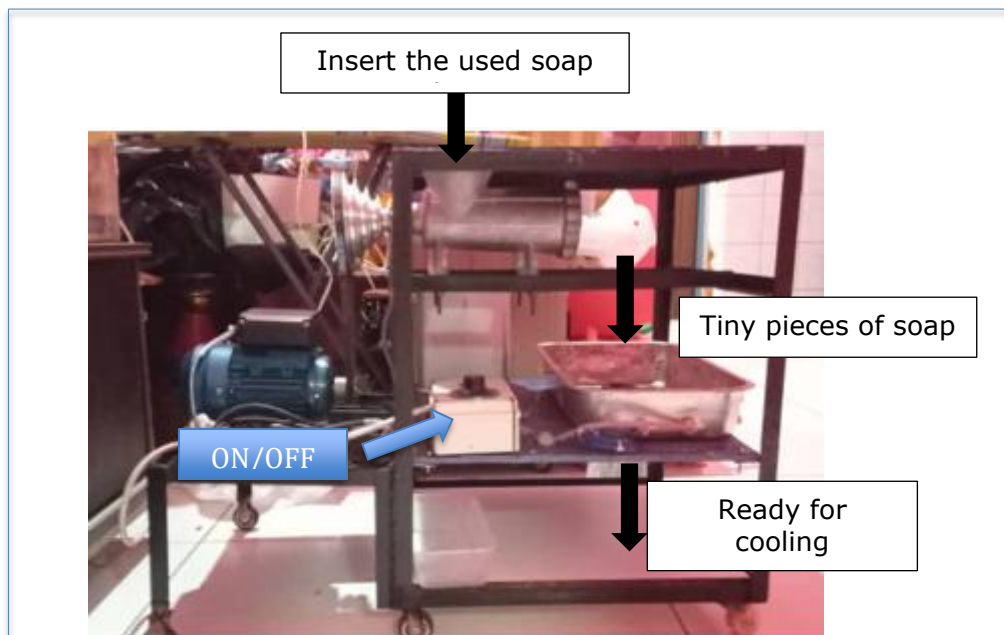


Figure 7. Operation of the machine

Next, the tiny pieces will drop to the container where the heater element is located (Figure 8).



Figure 8. After the shredding process

Subsequently, water will be added to the tiny pieces of the soap bar and the heating process will occur. The main purpose of the heating process is to turn the solid bar into a liquid form. The duration of the heating process will depend on the volume of tiny pieces of the soap bar and the outcome is determined by the stage of liquidity (Figure 9). Finally, the liquid state of soap is poured into the mold to enable the drying process as the soap bar is consolidated (Figure 10).



Figure 9. Heating process



Figure 10. Final recycles soap bar

To evaluate the effectiveness of the machine, a comparison between three machines that are available in the market was made. As can be seen from table 1, this machine has a lighter weight with a lower capacity. In addition, the machine cost is much cheaper than

those available in the market. Hence, this machine is suitable for small and medium enterprises (SME) and small-scale production such as the local recycling processes. In addition, the machine needs only 30 minutes from shredding to mold process as compared to the manual method as tested in the pre-testing process.

Table 1. Comparison of three different soap bar machines

Type of soap bar machine	Toilet Soap Machine	Soap Poddler Machine	Recycle Soap Bar Machine
Image			
Source	(IndiaMART InterMESH, 2020)	(Alibaba, 2020)	-
Weight	3000kg	5500 kg	15 kg
Capacity	3000kg	1000 kg	600g per piece
Cost	RM 49 468.30	RM 83 140.00	RM 603.20
Percentage Comparison (%) of cost	98.78	99.27	

The total cost of this machine is approximately RM 603.20 (Table 2). The recommended selling price for this machine is RM 900.00 which is considered very affordable and the cost of buying is easily turnover with small production selling only.

Table 2. Actual cost

NO	ITEM	QUANTITY	COST/ITEM (RM)	AMOUNT (RM)
1	Aluminium Flat Sheet	8m X 3m	RM5.50	RM44.00
2	L Angle Bar	1	RM25.00	RM25.00
3	L Bracket 50mm	4	RM1.90	RM7.60
4	L Bracket 80mm	2	RM1.30	RM2.60
5	Screw	1 packet	RM4.00	RM4.00
6	Meat Mincer (manual)	1	RM125.00	RM1250.00
7	Coupling FCL 100	1	RM70.00	RM70.00
8	U Shape Stainless Steel Heater	1	RM40.00 disc% RM5	RM35.00
9	Aluminium Motor	1	RM280.00 disc% RM15	RM265.00
10	Belting	1	RM25.00	RM25.00
Total			RM603.20	

CONCLUSION

In the conclusion, the fabrication of recycling soap bar machine has achieved its objectives. The first objective was to fabricate a recycle soap bar machine and the machine was

successfully designed, fabricated and tested. Then, the second objective was to have a cheaper machine and as a result, this machine is relatively cheaper compared to those currently available in the market. The machine can also be utilized for other's purposes when the processes are related such as candle making process.

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