

INITIAL DESIGN OF SEMI AUTO SOAP MAKING DEVICE FROM USED COOKING OIL FOR HOME APPLIANCES

N.A. Maidin¹, M.H.A. Rahman¹, M.N. Ahmad¹, S.A.A. Rahman¹,
M.H. Osman¹, M.K. Wahid¹ and M.R. Alkahari²

¹Faculty of Engineering Technology,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya,
76100 Durian Tunggal, Melaka, Malaysia.

²Faculty of Mechanical Engineering,
Universiti Teknikal Malaysia Melaka, Hang Tuah Jaya,
76100 Durian Tunggal, Melaka, Malaysia.

Corresponding Author's Email: nurulain.maidin@utem.edu.my

Article History: Received 16 August 2017; Revised 25 October 2017;
Accepted 10 December 2017

ABSTRACT: This paper presents the comprehensive soap making device that can make soap from used cooking oil. The cooking oil can be converted to soap by using the mixture of used cooking oil, sodium hydroxide (NaOH) pellets, water and scented oil. The experiment was conducted to prove it. By having this right device, it will help users to carry out this converting used cooking oil to become a soap process more easily. They do not need to do this process manually. It can be used at a kitchen in every house. This device designed to raise the awareness the importance of recycling the cooking oil. Surveys has conducted with 50 public respondent, especially house wife. From the survey, it can be concluded that there are many people who dispose the used cooking oil to the place where should not be. The main objective of this paper is to discuss how to design a device to make soap from used cooking oil, to develop a functional prototype of soap making device from used cooking oil for home appliances and also to reduce pollution and increase environmental awareness towards Malaysians.

KEYWORDS: *Used Cooking Oil; Sodium Hydroxide; Soap; Awareness; Prototype*

1.0 INTRODUCTION

Most Malaysians enjoy cooking fried foods. To fry, cooking oil should be used in specific quantities. Cooking oil made from oil extracted from oil palm and vegetables. There are also oils which made from seeds pressed process, which are sunflower seeds, peanut seeds, olive seeds, corn seeds and others. After frying foods, many Malaysians throw away used cooking oil into drains and rivers. The oil can harm the environment. Used cooking oil can produce soap [1-5]. By mixing the used cooking oil with sodium hydroxide palette and water, soap can be produced [6-9]. However, the resulting soap is for general use, for example washing floors and drains. This research will give much benefit to the environment by looking for the device that may reduce the numbers of environmental pollution in Malaysia [10]. This device is ideal to use in kitchens in every home and is able to simplify the process of making soap every day and everywhere, thus it can save the environment and increase environmental awareness for Malaysians [11]. The aim of this research is to develop a comprehensive soap making device that can make soap from used cooking oil.

2.0 MATERIALS AND METHODS

2.1 Customer Requirement

In this stage, survey questionnaire has been done to get a customer need related to this product. Based on survey result, it showed that there are many people; it was 72% of respondents, who disposing the used cooking oil to the unwanted place.

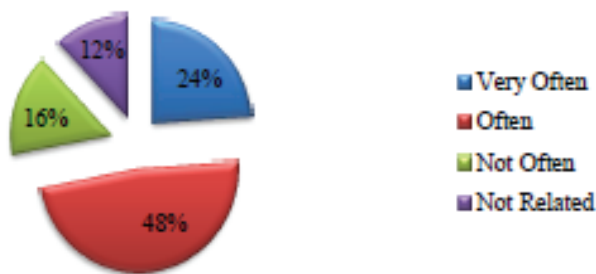


Figure 1: Charts of percentage respondents who disposing the cooking oil to the unwanted place

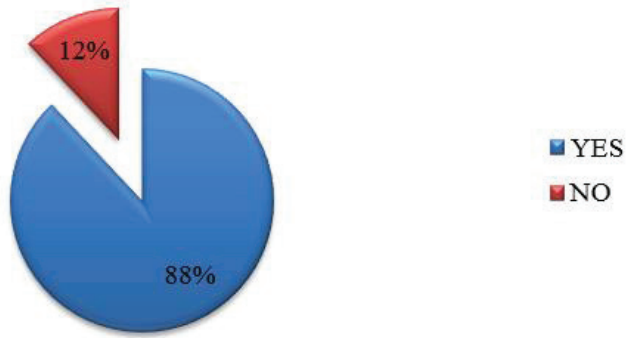


Figure 2: Charts of percentage respondents who know about the soap-making process

The above pie chart shows that as many as 88% of the respondents know about soap-making process. Meanwhile, around 12% does not know about it. Other than that, based on survey result it shows that initial customer needs consideration is user-friendly, functionality, durability and low cost. Quality Function Deployment-QFD is a useful and structured tool that helps to translate both spoken and unspoken customer requirements into key business deliverables [12-15]. At this stage all the information gathered from the survey will transform to business deliverables by using QFD method. After that concept generation stage will take place. Concept generation method is used in order to get the best alternative to produce the best quality and creative product. Other than that, this is the best strategy to start a new product with successful by following customer need.

Table 1: Customer requirements consideration

Item	Specification
1. User Friendly	- Safe design - Light weight - Compact design
2. Functionality	- Easy to mix - Easy to operate
3. Durability	- Have good quality
4. Low Cost	- Affordable price

Concept selection is the process of evaluating concept with respect to customer needs and other criteria have been done. Next, compare the relative strengths and weakness of the concept. Lastly, one or more concepts have been selected for further investigation, testing, and development. All these flow must be completed before fabrication

stage. Table 1 resulting based on the survey, most of the respondents satisfied with this product and they really wanted to try this semi-automated device.

2.2 Development of a Design Concept

This product has some compartments to make it user-friendly. The compartments consist of main part, soap drawer, and stirrer. The Main part consists of two open compartment, which is used cooking oil compartment and place to mix's compartment. The main part is the most important parts of this design, as this is a part where all the ingredients needed to make soap will mix. Both opened compartment separated with one piece of Perspex to let the filtering process of used cooking oil do the process alone without mix with other ingredients first. After the filtering process done, the other ingredients will be poured into place to mix's compartment in this semi-automated machine. After that, the mixing process will be done. The material used is Perspex as it is lightweight and see-through. Soap drawer is the bottom part in this semi-automated device. The function of this soap drawer is to keep the soap from it is in liquid substance until it becomes a solid soap. The design is in the drawer to easy the process of removing soap. The material used for this soap drawer same as main part, which is Perspex. The stirrer is also the important part in this product. It is attached to the main part of the product. The function is to stir the used cooking oil, NaOH, water, and scented oil. The egg beater has been used as a stirrer in this product. The material is from stainless steel. Besides that, there is also a handle attached on the stirrer to make the stirrer become easily operated. That handle is made from plastic. Figure 3 shows the conceptual design mechanism of this device.

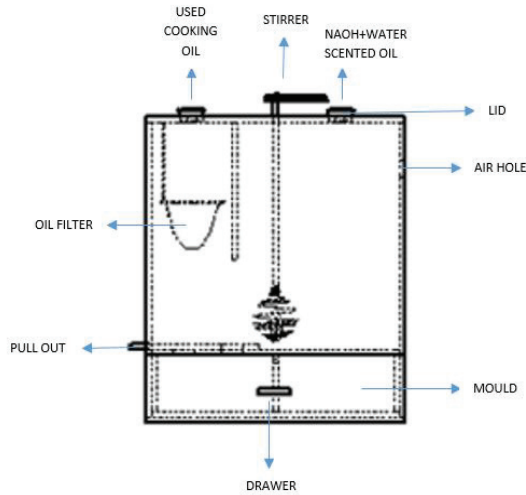


Figure 3: Conceptual Design Sketch

3D CAD Drawings have been done by using SolidWorks 2014. These drawings should be done before the manufacturing process take place. This is to make sure that all parts in this product are manufactured with accurate dimension as shown in Figure 4 and Figure 5. The basic shape of the device is rectangular with 255mm in length, 185mm in width and 290mm in height. In order to define the specification of the device, several items were summarized in Table 2.

Table 2: Specification of semi auto device to make soap from used cooking oil

Item	Specification
1. Dimension (LxWxH)	255x185x290mm
2. Weight	2.4kg
3. Material	Perspex
4. Colour	Transparent
5. Performance	Portable; can be brought anywhere easily
6. Product life span	1 year
7. Maintenance	The oil filter and stir can be pull up for easy clean

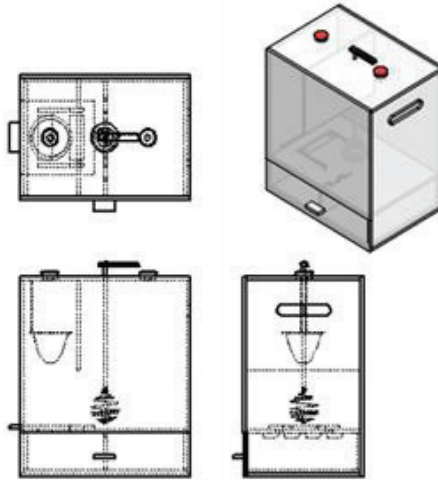


Figure 4: Assembly view of the initial model

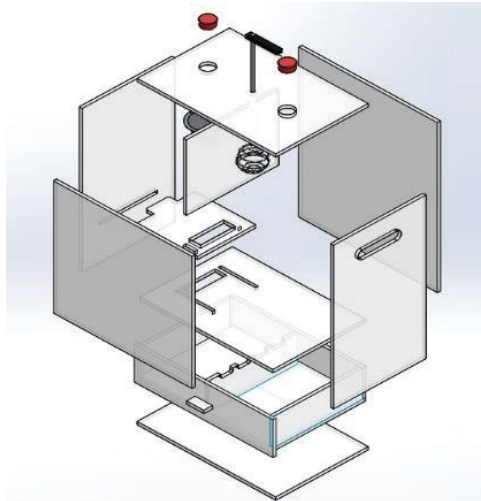


Figure 5: Exploded view of the initial model

3.0 RESULTS AND DISCUSSION

Like the conventional VSM approach for identifying the Kaizen effort opportunities, the extended VSM technique should incorporate the sustainability metrics for visualising the sustainability performances and also identify the improvement opportunities. For analysing the process sustainability using VSM, the functional prototype was fabricated based on the model in order to proof the concept as shown in Figure 6. The major parts are listed in Table 3.

Table 3: Bill of materials

Part Name	Quantity
1. Full body	1
2. Strainer	1
3. Handle	1
4. Lid	2
5. Stirrer	1
6. Hinge	1

The device was tested by adding the main ingredients which are used cooking oil, sodium hydroxide (NaOH) pellets, water and scented oil. The device was designed to be stirred manually by human hand. Pour the used cooking oil through the strainer to filter them before mixed with other ingredients. Mixed together water with NaOH pellets with ratio 1:3. In this experiment, 1kg used cooking oil is used. Water and NaOH pellets measured by normal spoon size with ratio 3:1. The mixture is added through the lid. Then, added scented oil. Mixed all together and stirring the stirrer by handle until the mixture become blended and viscous. Lastly, place the mixture inside the mold at the bottom of the device. For this device, the shape of the mold soap is square as shown in Figure 7.

However, the resulting soap is for general use, for example washing floors, drains, and toilet. This product is an ideal solution to use in kitchens in every home and is able to simplify the process of making soap, thus can save the environment and raise the awareness of the importance of recycling the cooking oil rather than pouring it down into the sink.

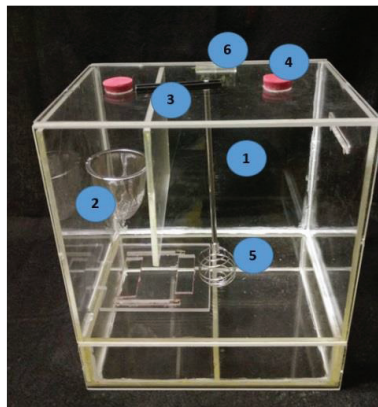


Figure 6: Fabricated semi auto soap making device from used cooking oil for home appliances

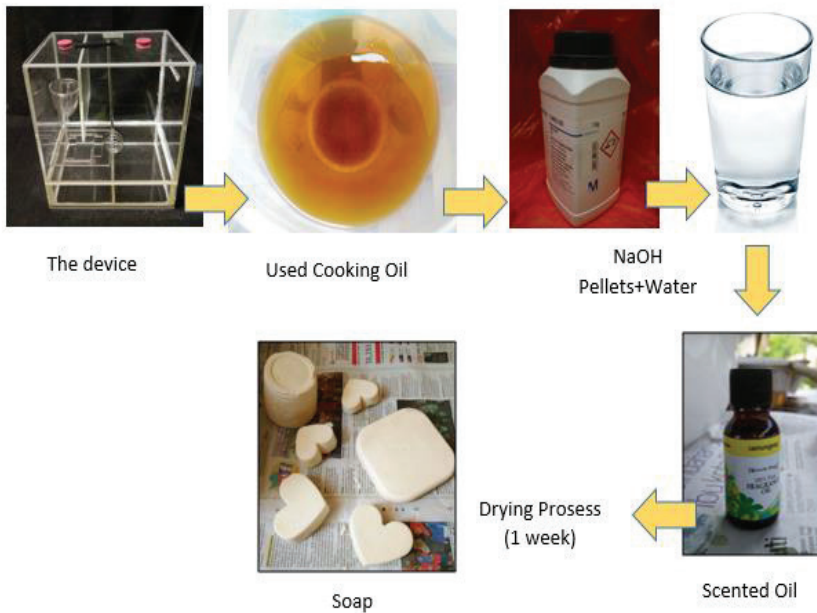


Figure 7: Soap making process by using semi-auto soap making device from used cooking oil for home appliances

4.0 CONCLUSION

Many Malaysians throw away used cooking oil into drains and rivers. This oil can harm the environment and let the pollution happened. Lack of awareness that used a cooking oil can be recycled to produce soap. By mixing the used cooking oil with NaOH and water, soap can be produced. To facilitate this process, the device was created to make this soap easily, which named Semi Auto Soap Making Device from Used Cooking Oil for Home Appliances. The aim of this project is to create a device to make soap from used cooking oil. As the result is obtained, the product is successfully completed. Besides that, based on the aim of this project which to find out the best design for this soap-making machine, there is some procedure have been done. The questionnaire survey has been distributed by using surveymonkey.com and also by hand. With the 50 respondents who are willing to answer this questionnaire survey, the customer need was obtained. Therefore, some concepts have been designed before the best design has been chosen. The difficulties during designing occurred while considered on how to mix all the ingredients, and also how to drain the soap mixture into the soap drawer. Finally, this

product has been successfully produced and it is based on the customer needs. For the future work, the machine can be suggested to develop it as a fully automated machine. There is no need to stir it by using human energy, which means simply press a button and the stirrer will move itself to stir the mixed. The user just needs to act as an observer and let the machine operated by itself and at the same time, they can do their own job. Apart from that, the material used can also change to the better material which more hardy and durable.

ACKNOWLEDGMENTS

We wish to express our gratitude to Universiti Teknikal Malaysia Melaka (UTeM) and special appreciation and gratitude to Centre of Research and Innovation Management (CRIM) and to Faculty of Engineering Technology to be specific Department of Manufacturing from UTeM for giving the fully cooperation and funding this project under the following research grant scheme: PJP/2015/FTK(11A)/S01416.

REFERENCES

- [1] A. Alsultan, A. Mijan and Y. H. Taufiq-Yap, "Preparation of activated carbon from walnut shell doped la and Ca catalyst for biodiesel production from waste cooking oil", *Material Science Forum*, vol. 840, pp. 348-352, 2016.
- [2] A. Talebian-Kiakalaieh, N. Amin and H. Mazaheri, "A review on novel processes of biodiesel production from waste cooking oil", *Applied Energy*, vol. 104, pp. 683-710, 2013. (NAS)
- [3] S. Koguleshun, P. Fei-Ling, S. Jaafar and C. Chia, "Synthesis of oil palm empty fruit bunch (EFB) derived solid acid catalyst for esterification of waste cooking oils", *Sains Malaysiana*, vol. 44, no. 11, pp. 1573-1577, 2015.
- [4] A. I. Tropecêlo, C. S. Caetano, M. Caiado and J. E. Castanheiro, "Biodiesel production from waste cooking oil over sulfonated catalysts", *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, vol. 38, no. 2, pp. 174-182, 2016.

- [5] H. Rosa, A. I. Tropecêlo and C. S. Caetano and J. E. Castanheiro, "Valorization of waste cooking oil into biodiesel over an anionic resin as catalyst", *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, vol. 37, no. 21, pp. 2309-2316, 2015.
- [6] G. Park. (2010). Homemade soap from used cooking oil [Online]. Available: [http://ecop.pbworks.com/w/page/18520618/Homemade soap from used cooking oil 0809](http://ecop.pbworks.com/w/page/18520618/Homemade%20soap%20from%20used%20cooking%20oil%200809)
- [7] Tiffany. (2012). Cold process soap making for beginners [Online]. Available: <http://offbeatandinspired.com/2012/09/14/cold-process-soap-making-for-beginners>
- [8] K.R. Janardhanan, (2014). Soaps and detergents [Online]. Available: <http://admin.umt.edu.pk/Media/Site/STD/FileManager/OsamaArticle/8.pdf>
- [9] N. Vishnu, "Detergent and soap" U.S. Environmental Protection Agency, Fifth Edition of AP-42, pp. 5-8. 2014.
- [10] G. Rubera, D. Chandrasekaran and A. Ordanini, "Open innovation, product portfolio innovativeness and firm performance: the dual role of new product development capabilities", *Journal of the Academy of Marketing Science*, vol. 44, no. 2, 2016.
- [11] M. Zulkarnain. (2009). Apa itu 5r [Online]. Available: <https://www.scribd.com/doc/21962638/Apa-Itu-5r-Complete#scribd>
- [12] I. Gremyr and H. Raharjo, "Quality function deployment in healthcare: A literature review and case study", *International Journal of Health Care Quality Assurance*, vol. 26, no. 2, pp. 135-146, 2013.
- [13] Y.Z. Mehrjerdi, "Quality function deployment and its extensions", *International Journal of Quality & Reliability Management*, vol. 27, no. 6, pp. 616-640, 2010.
- [14] H. Chang and D. Kim, "A quality function deployment framework", *Healthcare Informatics Research Journals*, vol. 16, no. 1, pp. 6-14, 2010.
- [15] G. Katz, "Quality Function Deployment and the House of Quality", in *The PDMA ToolBook 3 for New Product Development*, John Wiley & Sons, Inc., pp. 41-69, 2008.