Borneo Akademika *Vol. 4 Special Issue September 2020*, 9 - 18
UiTM Cawangan Sabah

THE CONCEPTUAL IDEA OF RECYCLING USED COOKING OIL MOBILE APPLICATION: A RECOMMENDATION FOR ENVIRONMENT SUSTAINABILITY

(Idea konseptual Aplikasi Mudah Alih Bagi Mengitar Semula Minyak Masak yang Telah Digunakan: Satu Cadangan Bagi Kelestarian Alam Sekitar)

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ABSTRACT

In general, most of the consumers in Malaysia would throw away their cooking oil just after one or two times of usage. Waste of the cooking oil is one of the root causes of water pollution as well as the cause of clogged the sink and drainage system in the residential areas. These situations occur due to bad habits of people to simply throw away used cooking oil that would affect and harm the environment. As the world moves forward to a sustainable city and greener environment, the society need to tackle this bad habit from becoming worse. This paper proposes a conceptual idea on how to educate, promote, create awareness as well as encourage the public to be more responsible in managing and disposing used cooking oil. The objective of this study is also aligned and inspired by the United Nations Sustainable Development Goals SDG 1: No Poverty and SDG 12: Responsible Consumption and Production.

Keywords: waste cooking oil, recycle cooking oil, no poverty, mobile application, quick response code, payment gateway.

1. Introduction

The waste cooking oil (WCO) or also known as used cooking oil (UCO) is defined as outcome of cooking oil from the action of cooking any foods (Namoco, et.al, 2017) either produced by residential sector or commercial sector or both. The WCO is a major concern for waste management as it raises many disposal challenges and potential pollution of water and land resources. To name a few, animal feed, biodegradable soaps and lubricants in smaller portions are among the final products that can be produced from WCO recycling (Namoco Jr. C. S., Comaling V. C., & Buna Jr. C. C., 2017). WCO recycling activity is not a new thing. In other countries and regions such as the EU, Taiwan, and Japan, recycling of WCO has been in practice for decades (Zhang, Y., X. Bao, et al., 2012). Malaysia, on the other hand, is still new in implementing WCO recycling effort although there are so many projects and studies that had been conducted regarding these issues. The study of Mohd Rusli Yacob, Ibrahim Kabir and Alias Radam (2015) revealed that cash rewards are given to promote user participation in the recycling activities. That study also mentioned about pricing policy to control the price of one kg of WCO. Both the awareness level and the environmental sustainability can be saved if consumers are encouraged to dispose their WCO in proper and suitable way, with some rewards. This paper proposes a solution which is a mobile-based application to tackle both the disposal of WCO and cash rewards to the consumers who participate in this program.

2. Problem Statement

The most significant problem that occurs from improper waste management of cooking oil is indeed the environmental issues, particularly in water and land pollution. Not to mention that the cleanliness of the kitchen and overall house's environment are the results of WCO disposal in improper way. This would also have long-term effects not only to the environment but on human health and well-being as well. For water pollution, the oil layer from WCO covers the surface and anticipates the disintegration of oxygen, which in the end would cause a mass extinction of marine organisms (Mohd Rusli Yacob, Ibrahim Kabir, Alias Radam, 2015; Jafari, N., 2010). In addition, the oil and water mixture increase water's chemical oxygen demand (COD) and lead it to be poisonous due to the presence of by-products of oil degradation (Mohd Rusli Yacob, Ibrahim Kabir, Alias Radam, 2015). Overall, this poisonous chemical would affect human health when the human drink water or consume sea-based food. This situation is bound to happen when the sea creatures consume carcinogenic compounds in which it will be returned to human body through the food chain.

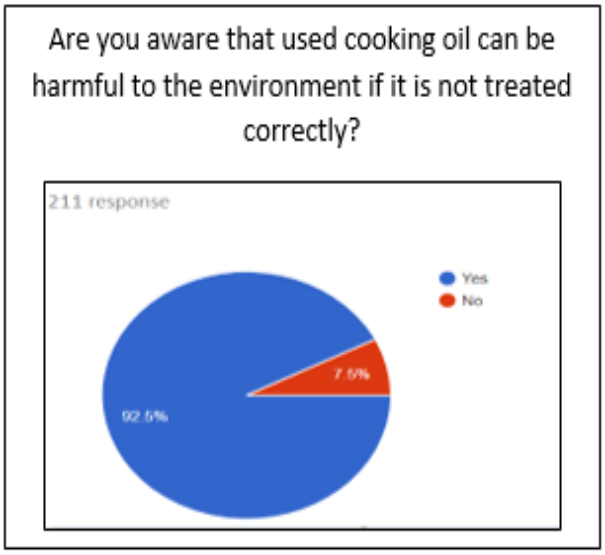

Figure 1: Awareness level on WCO's negative impact to the environment

All of the above-mentioned situations are caused by the habit of the human who are ignorant of the effect that their habit of throwing away WCO into the sink will flow into the drain, river and finally will reach into the ocean. This issue does not only happen because of lack of awareness of WCO disposal management but it is rather because they are not sure how they can correctly dispose the used cooking oil. In this paper, the online survey results show that 92.5% of the participants are well aware that WCO is harmful to the environment if not disposed in a suitable way (Figure 1). Nevertheless, most of them are not sure how to dispose the WCO and also do not know the existence of the WCO recycle center. The survey findings also show that 84.2% of the participants find difficulty to search for the recycle center (Figure 2).

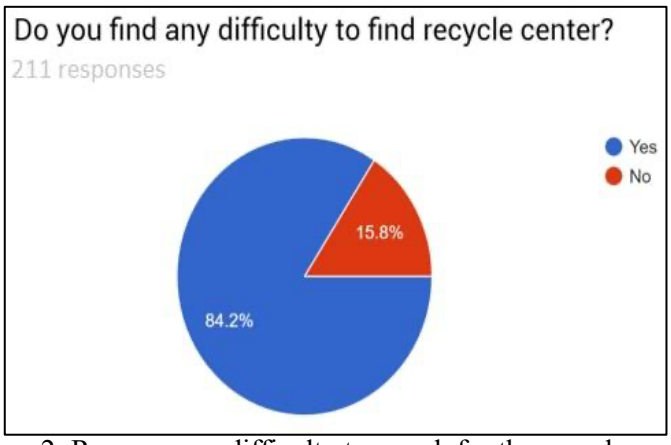

Figure 2: Response on difficulty to search for the recycle center

Another matter related to the WCO's negative impact is the cost for maintenance work including the piping system cleaning process. In 2016, the Klang Municipal Council (MPK) had spent close to RM6 million that year alone on cleaning water pipes and drains clogged by used oil being poured down the kitchen sink (Ismail M. & K. Saadoun, 2015).

For these aforementioned reasons, this research came out with consumer-oriented mobile application solution that can tackle both consumers and environmental issues. With this mobile-based application solution being implemented, this paper aims that the initial objectives which are aligned with Sustainable Development Goals No. 1 "No Poverty" and Sustainable Development Goals No. 12 "Responsible Consumption and Production" could be achieved.

3. Literature Review

Although the major oil pollution is caused by general shipping and manufacturing activities in the sea environment (Ismail M. & K. Saadoun, 2015), the effect of WCO to the environment also needs to be taken into serious consideration. This bad situation will turn to worse scenario if most of the households practice throwing their WCO into the sink and drain. A study in 2013 found that 60% of the household in Penang throw their WCO where it eventually ends up into the drain (Aizyl Azlee, 2018). On another note, energy generation by using waste is considered one method of waste management that brings the benefit of energy recovery (Singhabhandhu & Tezuka, 2010). Therefore, the usage of WCO for bio-fuel production is seen as beneficial in the area of food safety. More importantly, recycling the WCO also contributes as an alternative and safe energy supply. However, as at current, there is also the problem of lack of waste cooking oil as feedstock to produce bio-fuel as it is reported that the WCO is also reprocessed illegally for secondary use (Liu et al., 2018).

On the surface, many would think that throwing the WCO will only affect the cleanliness of surroundings. However, the ingredients of WCO cause many chemical reactions to the environment as well as bringing many adverse effects not only on cleanliness and environmental issues but for human health and well-being. Basically, cooking oil is made of carbon, hydrogen, and oxygen, which further combined during manufacturing process to form triglyceride, which is an ester chemically made from three fatty acids and one glycerol as shown in Figure 3 (Gunstone, F.D., 2013).

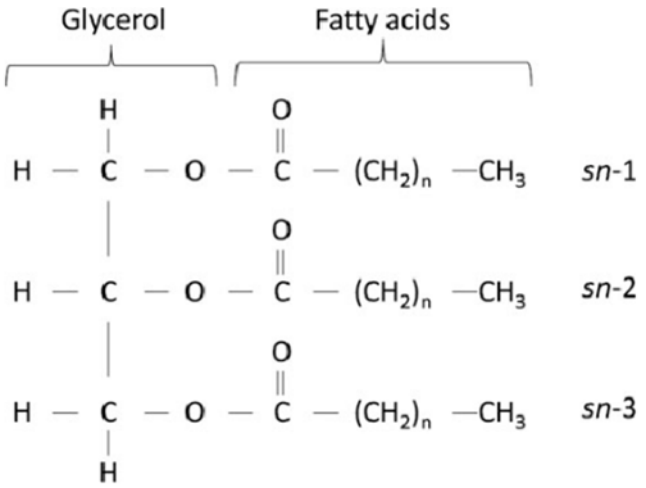

Figure 3: Triglyceride (TAG) Molecule Structure

Throughout food preparation and cooking processes, due to chemical reactions, which are hydrolysis, thermal degradation, oxidation and polymerization, changes in physical and chemical can occur in cooking oil properties (Panadare, D.C., Rathod, V.K., 2015). As a result, WCO contains many free fatty acids, resulting in poor odor and oxidation of metal and concrete components. Most notably, it is listed as one of the municipal wastes (similar to industrial and commercial waste) because it can cause serious issues in human health as well as environmental problems.

4. Research Methodology

Online surveys were conducted to 211 participants mostly from Klang Valley, Malaysia to observe the school of thought, attitude as well as actions of the participants on their awareness of WCO disposal management. Personal data were gathered such as age, gender, working status and others for additional information.

The questions include but not limited to 1) total of WCO produced per month by a household, 2) awareness level of WCO's negative impact on the environment, 3) frequencies to reuse cooking oil before dispose, 4) the disposal method (throwing or recycling) and 5) what motivate consumer to dispose WCO by using recycling methods. Basically, the questions are divided into four (4) sections which include 1) personal details, 2) awareness level, 3) consumption of WCO and 4) recycling section. The researchers also conducted face-to-face interview sessions to the commercial sector such as restaurants, hotel (kitchen), food stall, food court etc. The surveys were conducted in a few selected food chains and restaurants in Kuala Lumpur area to determine the disposal methods of used cooking oil.

This research also refers to the study by Mohd Rusli Yacob, Ibrahim Kabir, Alias Radam (2015) that ran face-to-face interview to the 360 households in Petaling district.

5. RESULTS AND FINDINGS

Based on our research, there are two (2) types of cooking oil consumers which are residential sector and commercial sector. As indicated by Figure 1 below, most of the commercial sectors

already have their WCO recycling management program in place. For this category, both the collection and recycling activities are being run by a private company. Due to the fact that the residential area does not have any specific method to dispose their WCO, it is believed that they are the suitable target consumers to use the proposed mobile-based application. Another point that the researchers think significant to this target group is that the households are willing to accept the recycling of WCO (Mohd Rusli Yacob, Ibrahim Kabir, Alias Radam, 2015). From 211 participants during the online survey, 80% of them agreed to start recycling WCO if they get rewards, especially in the form of cash.

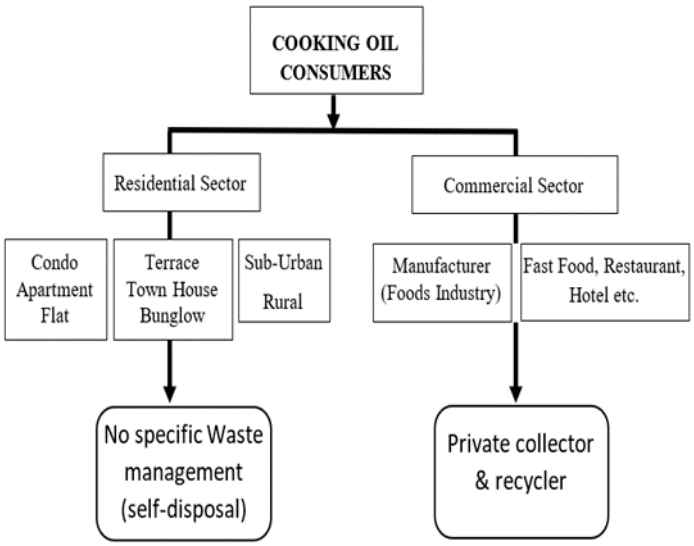

Figure 4: Details of cooking oil consumers

The solution that this research proposes can be operated with the five (5) simple steps as follow:
Download the application from Application Store or Play Store.
Locate nearest recycle center from your resident.
Visit the recycle center. Scan the QR Code available on the recycle tank to start operating the tank.
Fill in the recycle tank with used cooking oil. Complete the operation and the system will calculate the weight of the oil filled in the tank.
All participants are entitled to get paid where the amount will be credited directly into personal account through online transaction.

Figure 5: Overall process on how to use the system

The following are the elaborations on the Oil-Waste Cycle Mobile Application user interfaces:
Landing Screen (Main User Interface)
This is the first screen when the mobile application is launched after successfully being installed in a smartphone.
It will show the application logo and the name of the application which is the Oil-Waste Cycle. The logo is inspired from used cooking oil with green leaves and green background which represent the natural element.

Figure 6: Landing Screen (Main User Interface)

User registration and log-in screen
To use the system, user needs to log-in.
If the user does not have an account, the user is required to sign up by providing personal details.

This is required due to security reasons as only registered users can use the recycle tank provided at the recycle center.
It also enables tracking and managing the payment into the user's personal account once the transaction is completed.

Figure 7: Registration and Log-in Screen

Find, locate and scan QR Code at the recycle center
One of the functions of this application is to allow a user to find and locate the nearest recycle center available based on their current location.
It can also be used as a GPS to guide the user to travel to the selected recycle center.
Scan the QR Code available on the recycle tank to start operating the tank.

Figure 8: Locate Us Screen and QR Scan Code

Payment Transaction System

When a user registered in step B above, he/she is required to provide his/her bank account details for the payment and reward system.

This is not a compulsory step when one is in the registration phase, but when the user needs to convert from e-wallet into cash, he/she is required to provide bank details. Otherwise, the transaction would not succeed.

All the used cooking oil will be bought by the merchant (recycling company) based on the weight of used cooking oil.

Figure 9: Payment Transaction System

Oil Recycle Centre System
Every recycle center will be allocated with a tank. The function is to store all used cooking oil. The tank has 3 different types:
Recycle tank- user will use this tank to fill their used cooking oil.
Main tank- to store all the accepted oil from the recycle tank.
Flushed tank- to store rejected oil or contaminated oil which are mixed with water or other materials.
Used oil in the main tank will be emptied and brought to the appointed factory for processing.

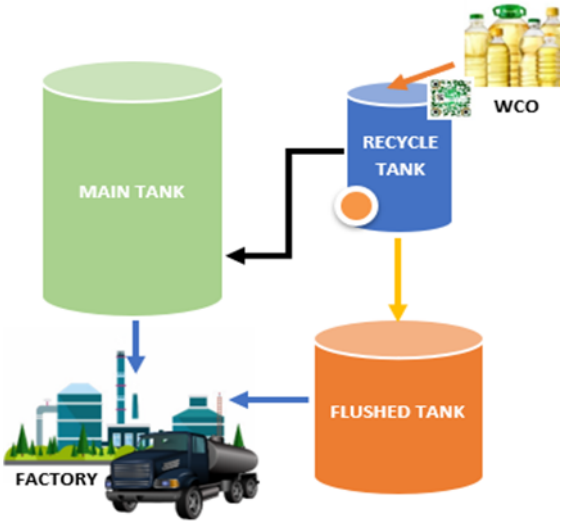

Figure 10: WCO Recycle Centre System

6. DISCUSSION AND CONCLUSION

In conclusion, this study attempted to identify and provide solutions to the main challenges encountered by households in the WCO recycling program. Due to lack of knowledge in the disposal of WCO, the result of this paper found that more exposure is needed to educate the community. Based on this study, cash incentive is the main factor to motivate consumer's participation in WCO recycling program. Another factor that the respondents put into consideration is the location of recycling facilities where the preferable location is to be within 5 km range from the residence. Rapid knowledge transfer on this issue is important as the improper management of the WCO has become the norm in the community.

It is hoped that this Oil-Waste Recycle mobile application will initiate the public in gaining proper knowledge of waste cooking oil (WCO) disposal. Apart from utilizing the application, the community can also generate some side income. The idea of developing this application is also seen as an important factor in improving cleanliness, sustainability of the environment and healthier lifestyle in the community.

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