

The Management of Waste Cooking Oil: A Preliminary Survey

Hanisah K^{a,b}, Kumar S^a, Tajul AY^{a*}

^a Food Technology Division, School of Industrial Technology, Universiti Sains Malaysia, Pulau Pinang, 11800, Penang, Malaysia

^b Ecobiomaterial Research Laboratory, School of Biological Sciences, Universiti Sains Malaysia, 11800, Penang, Malaysia

* Corresponding author: taris@usm.my

ABSTRACT: A survey of waste cooking oil (WCO) management among the community of Teluk Bahang, Penang, Malaysia was conducted. Three questions were given to 30 participants, which were randomly chosen regardless of gender or occupation. 70% of the respondents were females and among them, 50% were housewives. It was found that 27% of the participants consumed 2-5 kg of oil per month. The survey revealed that 17% of respondents discarded the WCO into dustbin while another 7% and 60% discarded the WCO onto soil and into drainage system, respectively. The remaining 16% sold the WCO and/or consumed it completely in their cooking. In terms of health awareness, it was found that 57% of the respondents used the WCO 2-3 times before disposing it, while 13% of the respondents used the WCO until depletion. As a conclusion, our preliminary study shows that the respondents are lack-awareness about proper WCO management. Therefore it is necessary to conduct a workshop to explain about the proper management of WCO.

Keywords: community; environment; health; management; waste cooking oil

Introduction

In a modern society, oil is commonly used for the preparation of food. In today's world, oil-frying method is widely used due to the contribution of good taste, attractive colour and better presentation of the food. As this method becomes increasingly popular, accumulation of waste generated from cooking oil also increases. It was reported that WCO is widely produced all over the world (Kulkarni and Dalai, 2005). EU produces approximately 700,000-1,000,000 tonnes WCO annually, inclusive of the oils from snack food and French fries. It was estimated that there were 40,000 tonnes per year of WCO produced in Asia countries such as China, Malaysia, Indonesia, Thailand, Hong Kong, India, etc. (Razali, 2005)

Improper waste management of cooking oil leads to discharge of WCO to environment and this will cause environmental pollution particularly land and water pollution. In water, oil layer covers the surface and prevents the dissolution of oxygen, thus causing a mass extinction of marine biota. Besides, the mixture of oil and water increases the chemical oxygen demand (COD) of water and causes it to be poisonous due to the presence of oil degradation by-products. Carcinogenic compounds are absorbed by the sea creatures and returned to human through food chain (Kulkarni and Dalai, 2006; Jafari, 2010; Marjadi and Dharaiya, 2010).

In addition, the repeated usage of WCO is hazardous to consumers because the fried oil forms toxic compounds such as peroxides, aldehyde and polymer through several reactions such as thermolytic, hydrolysis, and oxidation (Kulkarni and Dalai, 2006). Thermolytic reaction occurs when there is no oxygen at high temperatures above 180 °C. This reaction forms by-

products of alkanes, alkenes, lower fatty acids, symmetric ketones, oxopropyl esters, CO and CO₂ which are produced from non-oxidative decomposition of saturated fatty acids (Nawar, 1984; Kulkarni and Dalai, 2006). Meanwhile, unsaturated compounds such as dehydromers, saturated dimers, and polycyclic are produced through thermolytic reaction (Nawar, 1984).

Hydrolytic reaction occurs in conditions of water presence from the food entering the oil and the water molecules cause hydrolysis of triglycerides into free fatty acids (FFA), glycerol, monoglycerides and diglycerides (Mittelbach and Enzelsberger, 1999). The product of hydrolysis can be measured from the presence of monoglycerides and diglycerides in the oil (Guesta *et al.*, 1993). Generally, polar content is used as a parameter to measure the quality of oil. Fresh cooking oil has lower polar contents within the range of 0.4-6.4 mg/100 g, while after 40 sets of frying process the polar fraction increases >25%. EU countries have standardized the number of polar content at <25% for the oil that can be consumed and above this level, the oil must be discarded. It is worth noting that addition of fresh cooking oil to WCO could minimize the thermo-oxidative and hydrolytic changes (Bastida and Muniz, 2001).

Oxidation of oil occurs when frying process is done in an open air. The free oxygen molecules react with unsaturated fatty acids *via* typical free radical mechanisms. Then, hydroperoxides as the primary products are formed due to oxygen attack that produces many other compounds with conjugated diene groups. The alkoxy radical, which is formed *via* scission of O-O bond of the hydroperoxides, further produces aldehydes, hydrocarbons, semi-aldehydes and acids. In excess oxygen, alkoxy and peroxy radicals form dimeric and oligomeric compounds (Nawar, 1984; Kulkarni and Dalai, 2006). Most of these by-products are carcinogenic. It was reported that EU banned the consumption of re-used WCO as animal feedstock due to the carcinogenic compounds that may return to human cycle through food chain (Cvengros and Cvengrosova, 2004).

Although WCO is known to be a carcinogenic element, it can be used as value-added products such as biodiesel, lubricants, biopolymers or soap. Many local communities are not aware of the danger. Due to the lack of knowledge of WCO management, a step must be taken into consideration to overcome it. Thus, a survey was taken in a community in Teluk Bahang, Pulau Pinang to determine the awareness of the community towards WCO management. The survey process also resulted in the explanation about the hazardous effects of WCO to human health and the environment.

Materials and methods

Open-ended questions were given to 30 participants of Teluk Bahang, Pulau Pinang, Malaysia community to observe the attitude of the respondents towards the awareness of WCO management. Personal information such as the race, gender, and occupation of participants was recorded for further information. The questions include 1) the volume of WCO consumed per month by a family 2) the type of packaging that were bought for the household usage 3) the frequencies of the oil being used, and 4) the disposal method. Survey was done by face-to-face interview.

Results and discussion

Prior to interview, personal details of participants were recorded, **Table 1**. It was found that, most of Teluk Bahang community were housewives and running food businesses, which was 50% and 40%, respectively.

Table 1: The personal profile of the participants

Demographics	Categories	Frequency (N)	Percentage (%)
Gender	Male	7	23
	Female	23	77
Occupation	Housewife	15	50
	Food business	12	40
	Others (etc. working)	3	10
Marital status	Single	1	3
	Married	29	97

Food businesses such as banana fritters, ‘nasi lemak’ and ‘nasi kandar’ restaurants are popular professions in Teluk Bahang. Whilst for others, 10% of the proportion includes fisherman, government workers, etc. Other majority participants were married women as it was the working day in which the survey was conducted.

The awareness and knowledge on the toxicity of WCO was tested against the community through this survey. **Figure 1** shows the volume of WCO produced monthly using frying method.

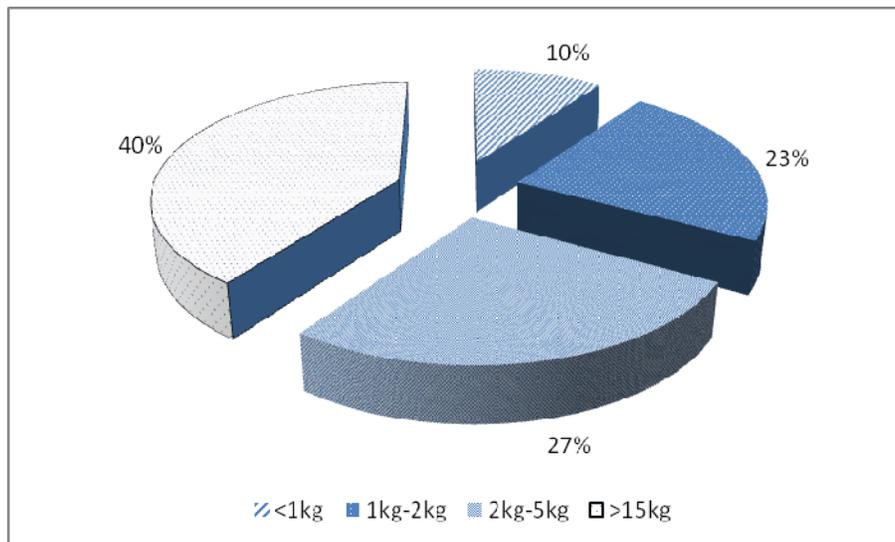


Figure 1: The production of WCO in Teluk Bahang

The volume of more than 15 kg with frequency of 12 people contributed from the food business participants were collected, while the balance came from housewives and others. The volume production by housewives and others are variety as it is not a fix occurrence of frying process compared to food business. The volume of WCO production was influenced by the number of the house members and the economy level of the family, which the survey found out that approximately 7% of the families have the meal at restaurants instead of at home. In total, approximately 400 kg to 500 kg of WCO was produced by the 30 participants of Teluk Bahang community in a month.

There are 97% of the candidates utilized the cooking oil in the bottle compared to the plastic bag pack, which the survey found out that the community was aware of the source of oil products and concerns regarding the validity of halal since majority of the participants are Muslims. Most members re-used the WCO for 1 to 3 times amount up to 30% population, **Figure 2**. This indirectly shows that the ratio of awareness is limited among the participants, as the balance of 70% is not given knowledge regarding the toxicity of the WCO.

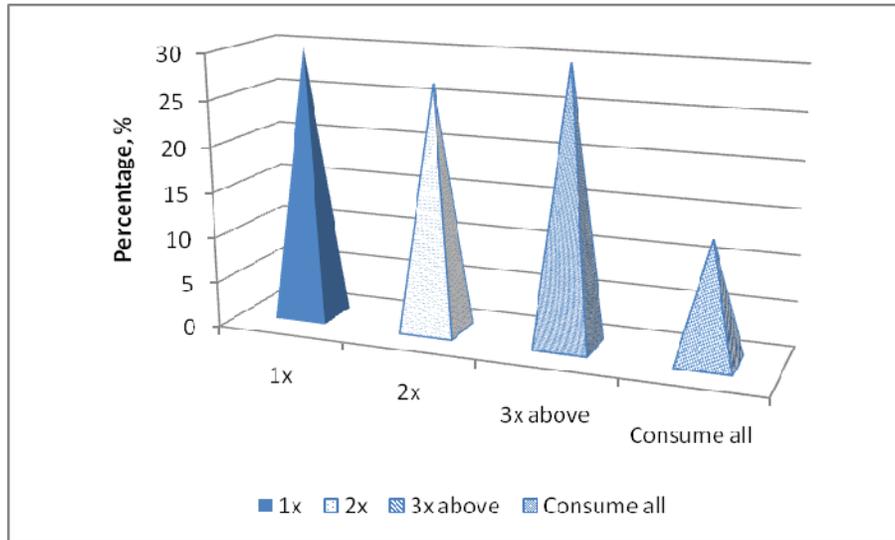


Figure 2: Repeated usage of WCO in Teluk Bahang

Frequent repeated usage of WCO could be due to the lack of information about the danger or with reason of reducing the living cost. Health issues are more important to be concerned as the formation of carcinogenic by-products from the heated oil could cause fatal diseases. Nawar (1984) reported that the oil deterioration form the thermolytic reaction occurred as fast as 1 hour at 180 °C of frying. Thus, it is advisable to consume fried oil for only once as the formation of by-products is rapid and vigorous (Nawar, 1984).

Crucial actions need to be taken because the frequency of discarding WCO into the drainage and river are superior with amount of 60% over 30 participants, **Figure 3**.

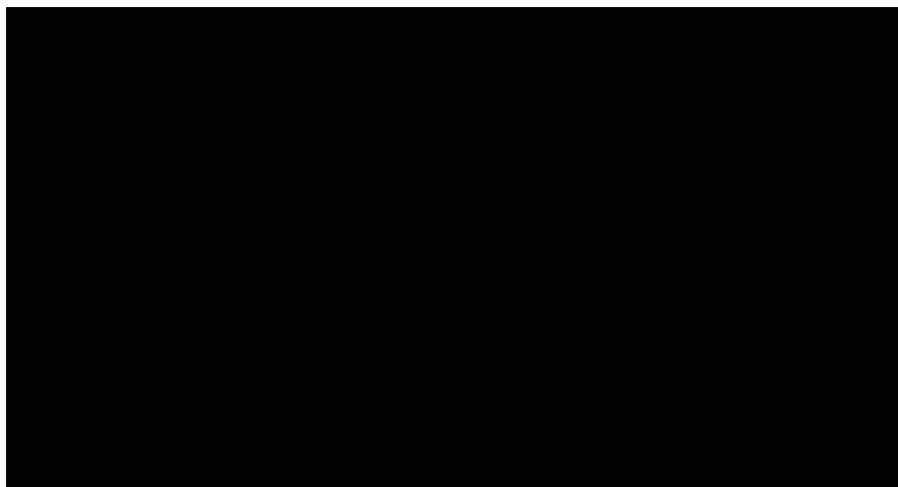


Figure 3: Disposal methods of WCO in Teluk Bahang

The cold temperature of water causes the oil to solidified and further clog the drainage system, which indirectly pollutes the water-bodies (Kulkarni and Dalai, 2006). The disposal of WCO onto the soil could change the colour of the soil, convert the pH of the soil to alkaline and deplete the nutrients such as carbon and nitrogen (Marjadi and Dharaiya, 2010). Whilst, many food business participants consumed the WCO completely by mixing the WCO together with curry or any gravy in order to be economical wise. This method is not encouraged as the carcinogenic compound of the oil deterioration will precipitate in the human body and affect to health in long term such as cancer, high blood pressure, and other diseases (Murakoshi *et al.*, 1989). The most suggested method is by disposing the WCO into dustbin, which is represented by 17% of the participants, whilst 3% of the member sells the WCO to oil purification manufacture with price of RM 1 per 5 kg. Based from the overall questions, it is shown that Malaysia needs to initiate a good impact program regarding the danger of WCO as limited knowledge was transferred through the media or readings.

Conclusion

In conclusion, more exposure towards the community is needed since lack of knowledge and awareness was observed. Rapid method of the knowledge transfer is important as the improper WCO management has become the custom of the community. The awareness can be fostered beginning from the high-school students to the parents' level. The toxicity awareness of WCO should be started with the assistance of medical doctors and campaign by hospitals. Further survey should be done in order to achieve more significant result of the questionnaire.

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