

# Study on Composition and Generation of Food Waste in Makanan Ringan Mas Industry

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**Abstract.** Food waste management is a major problem for most food premises in Malaysia. This study was conducted at one of the Small Medium Industries (SMIs) called Makanan Ringan Mas Industry that is located in Parit Kuari Darat, Parit Raja, Johor. This premise generates food waste almost every day including processed food waste (chips and coconut candy) and raw food waste (banana peels, tapioca peels, breadfruit peels and grated coconut). The objective of the study was to determine the waste generation and composition of food waste generated by the premise. Food waste collected from the premise once a week and tested for moisture content and density. The results demonstrated that Makanan Ringan Mas Industry generated more raw food waste compared to processed food waste. Banana peels recorded the highest amount at 27.15kg per month compared to other food waste. To conclude, banana peels were found to be the highest component in the food waste composition by Makanan Ringan Mas Industry whereas breadfruit peels were found to be the lowest.

## 1 Introduction

Waste generation and management have become an issue in most developing countries. Increasing solid waste generation has had a negative impact on human health and the natural environment. Furthermore, the increasing human population and economic growth in developing countries have also contributed to waste generation diversity [1]. In Malaysia, organic waste is the highest amount of waste generated, which is 50% by weight [2].

Organic waste includes kitchen waste, food leftovers, rotten fruit, vegetables and peels, straw and hay, leaves and garden trimmings, crop residues, rags, papers, animal excreta, bone and leather [3]. 60% of organic waste are usually generated by households [4] and this waste is disposed at landfills. The degradation of organic matter without oxygen in landfills will produce acids that affect other waste thus creating toxic pollutants known as leachate. Leachate will seep through ground water and contribute to ground water pollution [5].

Furthermore, the success in managing waste is a strong indicator of the ability of the authority within the city to work together to solve major urban environment problems. In

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this research, Makanan Ringan Mas Industry is one of the industries that focuses on food production. From the observation, this industry mainly generates food waste. The problem faced by SMIs is improper waste management. Waste dumping into the ditch as well as open burning adds to atmospheric and hydrologic pollution load and gives a negative impact to the environment.

This paper highlights the amount of solid waste generated by Makanan Ringan Mas Industry at Parit Kuari Darat in eight months. Overall, food waste generation is something that needs to be monitored because improper disposal is the major source of surface and ground water contamination as well as air pollution.

## **2 Literature reviews**

Solid waste can be defined as materials that are unwanted such as household garbage, food waste, yard waste and demolition or construction debris. In general, domestic waste generated are food waste, paper, cardboard and plastics. On the other hand, commercial waste mainly consists of wood, glass, hazardous waste, e-waste whereas agricultural waste usually consists of husks, cotton-stalks, coconut-shell waste from agricultural activities [6]. Generation of municipal solid waste in Malaysia is increasing due to human population growth, rapid urbanization, economic growth and its multicultural society [7]. Waste can be defined as any crap materials or other unwanted surplus or rejected products that arise from human activities [8].

In Malaysia, solid waste management is under the responsibility of the public sector [9]. It can be divided into three zones which are Southern Zone by SWM Environment Sdn Bhd. (Johor, Melaka and Negeri Sembilan), Northern Zone by Environment Idaman (Kedah and Perlis) and Central and Eastern zone by Alam Flora (Wilayah Persekutuan Kuala Lumpur/Putrajaya and Pahang).

Currently, human population contributes to the highest amount of municipal solid waste [10, 11]. It is reported that the composition of waste generation by Kuala Lumpur as the capital city of Malaysia with high population is food waste (57%), followed by mix paper (17%) mix plastic (15%) and other [12]. Most studies in the cities of developing countries showed that the solid waste composition is high in organic materials and contains less metal and plastic.

Other literature, by Mohan et al. [13], revealed that solid waste composition in Kathmandu, Nepal consists of about 71% organic materials, 12% plastic, 7.5% papers, 5% construction waste and 1% hazardous waste. Another study in Tulsipur, Nepal showed that household waste generation is made up of 46% organic wastes, 11% construction debris, 10% plastics, 7% glass, 6 paper, 5% metals and 5% rubber and leather [14]. On the other hand, a study in China showed that solid wastes consist of 57% organic waste [15]. Furthermore, Farouhar and Hristovski [16] who studied waste generation in Kabul, Afghanistan also found that about 70% of waste generated is organic materials. Moreover, data from previous research mostly also concluded that organic waste is the main waste generated compared to other types of waste. In addition, according to EWWR [17], food waste can be defined as any food; inedible parts of food; removed from the food supply chain to be recovered or disposed. It found that household waste had the highest production of food waste (42%), followed by manufacturing (39%), food services (14%) and wholesale and retail (5%).

## 3 Methodology

### 3.1 Sampling area

The study was carried out in one of the SMIs in Parit Raja which is Makanan Ringan Mas Industry in Parit Kuari Darat (Fig. 1). It is located about 13.5 km from Universiti Tun Hussein Onn Malaysia (UTHM). This industry operates 24 hours a day and the production depends on the customer demands. The industry is one of medium scale industries that focuses on food production such as variety of chips, *dodol*, coconut candy and others.



**Fig. 1.** Makanan Ringan Mas Industry location.

### 3.2 Sampling method

#### 3.2.1 Collection, composition and classification

The waste collection was carried out once a week, for a period of 8 months. The waste was collected from the industry by car and unloaded at the Micropollutant Research Centre (MPRC) Laboratory. The waste generated is mainly organic material; food waste. The food waste was divided into processed food waste and raw food waste. Processed food waste are chips and coconut candy while raw food waste are tapioca peel, banana peel and grated coconut.

#### 3.2.2 Physical Characteristics

Density, particle size and moisture content are some of the main physical characteristics of waste [18, 19]. Moisture content and density are two physical characteristics that were tested.

##### i. Moisture content:

The moisture sample for each waste was taken by dividing it into 1000g each and recorded as wet weight of the sample. Then, the wet sample was dried to a constant weight at a temperature at 105°C using an oven at the Geotechnic Laboratory, UTHM. The sample was allowed to be cooled and then the weight was measured and recorded as dry weight of the

sample. The moisture content of each type of waste was calculated according to Equation (1) [20] and expressed in percentage (%).

$$\text{Moisture Content (\%)} = \frac{\text{wet sample (g)} - \text{dry sample (g)}}{\text{wet sample (g)}} \quad (1)$$

ii. Density:

Food waste collected from the industry was filled in an a cylindrical container. The container was stamped 3 times in order to fill the spaces in the container with the food waste. The density was calculated according to Equation (2)[21].

$$\text{Density (kg/m}^3\text{)} = \frac{\text{weight (kg)}}{\text{volume (m}^3\text{)}} \quad (2)$$

## 4 Result And Discussion

### 4.1 Food Waste Generation in Small and Medium Industries (SMIs)

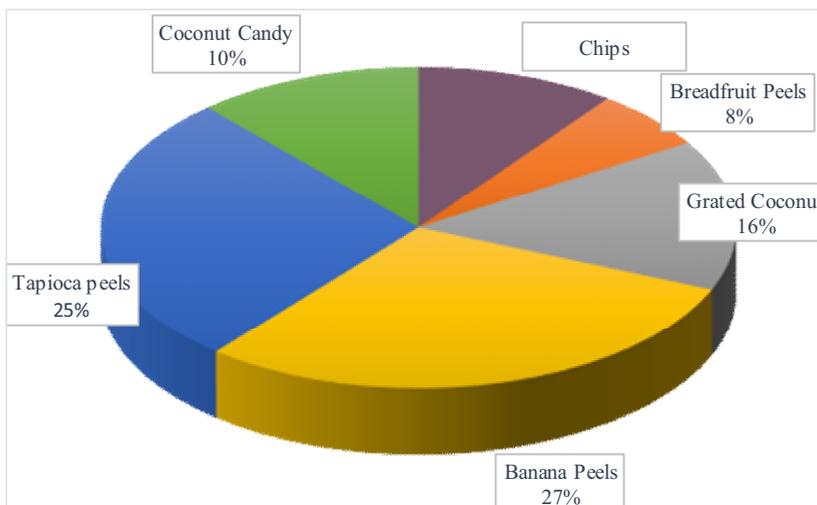
The quantity and rate of food waste generation in the industry were estimated. The mass-based compositions of the characterized food waste in the SMI studied, namely Makanan Ringan Mas Industry, are presented below.

#### 4.1.1 Composition of Food waste from the SMIs

The results from the food waste collection for 8 months comprised the values of the mass-based composition of food waste generated by the industry. The total quantity of waste generated from the industry and the percentage composition of the wastes are presented in Table 1 and Fig. 2 respectively. Fig. 2 revealed that banana peel waste was the highest proportion of waste generated (27%) from the industry. Tapioca peels made up the second highest proportion (25%) of the wastes followed by grated coconut (16%). Banana and tapioca peels made up highest amount of overall waste as the consumption of bananas and tapioca in the industry is more than other types of food. The industry runs a chips business focusing mainly on banana and tapioca chips. Therefore, banana and tapioca peels are the major types of waste generated by this industry. Other food waste generated includes; chips 14%, coconut candy 10%, and breadfruit peels 8%. Although breadfruit is also used in the industry as an ingredient for making chips, it is not always available and in season. Thus, the amount of breadfruit peels generated is limited. The total quantity of waste generated from Makanan Ringan Mas Industry is estimated at 101.82 kg/month and the total density of the food waste is 32303.04 kg/m<sup>3</sup> per month.

**Table 1.** Composition of Food waste from the SMIs.

Food waste	Total Quantity of Food waste (kg/month)	Total Food Waste Density (kg/m <sup>3</sup> )/month
Chips	14.02	4054.64
Coconut Candy	10.05	7384.63
Grated Coconut	16.86	6929.39
Banana Peels	27.15	6929.39
Tapioca Peels	25.46	6692.92
Breadfruit Peels	8.28	2791.07
<b>Total</b>	<b>101.82</b>	<b>32303.04</b>

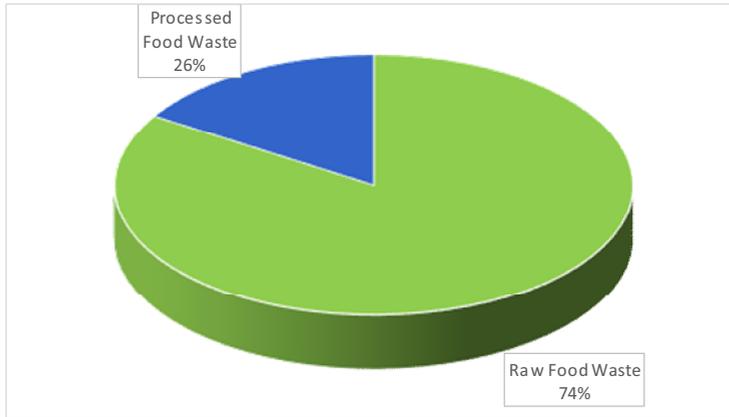
**Fig. 2.** Composition of Food waste from the SMIs.

#### 4.1.2 Composition of Different Types of Food Waste

Table 2 shows the composition of the food waste between raw food waste (grated coconut, banana peels, tapioca peels and breadfruit peels) and processed food waste (chips and coconut candy). Raw food waste is produced from the fruit peeling process in the production of chips and is also known as unavoidable food waste. On the other hand, processed food waste is waste that results from the food packaging process where food with defects will be thrown away and become waste. This is also known as avoidable food waste. In this study, the total quantity of raw food waste is 77.75 kg/month with total a density of 20863.77 kg/m<sup>3</sup> per month, while total quantity of processed food waste is 24.07 kg/month with a total density of 11439.27 kg/m<sup>3</sup> per month. The results from Fig. 3 show that the total percentage of raw food waste is 74% which is higher than the processed food waste which is only 26%.

**Table 2.** Composition of Different Types of Food Waste by the SMIs.

Types of Food waste	Total Quantity of Waste (kg/month)	Total Waste Density (kg/m <sup>3</sup> )/month
Raw Food waste	77.75	20863.77
Processed Food waste	24.07	11439.27
<b>Total</b>	<b>104.9</b>	<b>32303.04</b>



**Fig. 3.** Composition of Different Types of Food waste.

**4.1.3 Moisture content of food waste from SMIs**

Table 3 show the percentage of moisture content of food waste produced by the industries. Raw food waste such as grated coconut, banana peels, tapioca peels and breadfruit peels have a higher moisture content percentage compared to processed food waste such as chips and coconut candy. Banana peel has the highest moisture content at 86.04%, while chips have the lowest moisture content at 0.82%. From the results, we can see that the moisture content in the waste can also affect the total quantity of the food waste itself.

**Table 3.** Moisture content of food waste.

Food Waste	Moisture content (%)
Chips	0.82
Coconut Candy	5.90
Grated Coconut	53.42
Banana Peels	86.04
Tapioca Peels	83.00
Breadfruit Peels	83.50

## 5 Summary

Overall, the intention of this study was to estimate the food waste generated from Makanan Ringan Mas industry that is one of the small and medium industries (SMIs) in Parit Raja, Johor. The food waste produced by the industry are chips, coconut candy, grated coconut, banana peels, tapioca peels and breadfruit peels. From the results, the highest amount of food waste produced by Makanan Ringan Mas Industry consisted of banana peels and tapioca peels which are in the raw food waste category. The results also showed that the total quantity of food waste is 101.82 kg per month with a total density of 32303.04 kg/m<sup>3</sup> per month. Banana peels, breadfruit peels and tapioca peels have the highest moisture content compared to others which are also in the raw food waste category. The food waste generation from the industry should be managed to prevent improper disposal methods. Other than that, alternative low cost disposal methods should be encouraged as organic waste could be used again as fertilizers. This will help protect our environment and extend the lifespan of landfills.

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