Biobin for Kitchen Waste

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Abstract
The issues of waste management have been discussed around the globe to overcome the problem of high waste generated by people every day. This has been worsening with the area of dumping load becomes limited as the time goes by. This study intended to encourage a self-degradation habit since wastes could be regenerated as renewable products using a better waste management system. Going green means embracing a way of life that helps preserve the environment by reducing, reusing, and recycling items. Going green concept is learning and practicing an environmentally mindful lifestyle that contributes towards protecting the environment and preservation and conservation of the natural resources, habitats, and biodiversity. Using a Biobin also a way of going green, the aim of going green or using Biobin is to reduce pollution and reduce resources consumption and eliminate wastes. Biobin is developed to create a user-friendly bin for degradable wastes storage system. The Biobin is built with tank which fixes with components to enhance the digestion process. This Biobin functions to store the wastes, therefore when digestion reaction happens in the Biobin, the renewable of gas, solid and liquid will be produced. Pre-treatment, crushing, filtration and anaerobic digestion are processes cycle in the Biobin will be analysed. Both liquid and solid products as well as gas produced from the bio bin will be further evaluated for other beneficial usage such as fertilizer and short heating purposes. The sample of biobin has been introduced in this study to promote self waste management at every home. The findings of this study could contribute further recommendations for authorities to focus on enhancing household planning skills and routines when it comes to the food preparation.

Keywords: biobin, renewable, waste management

1.0 Introduction

A waste container or bin is a container used to temporarily store waste that is typically made of metal or plastic. They are frequently used to collect waste in homes, offices, streets, and parks, among other places. Littering is a serious offence in some areas, so Public Waste Containers are the only way to dispose of small waste. It is common practice to use separate bins for collecting wet and dry recyclable or non- recyclable waste. Dustbin, garbage can, and trash can are some examples of common terms. The words "rubbish," "basket," and "bin" are more commonly used in British English, while "trash" and "can" are more commonly used in American English. "Garbage" can refer to both food waste (as opposed to "trash") and municipal solid waste in general. The first household waste bins were introduced in Britain in 1875 to create a regulated system of collection. Biobin is a command-line application

and collapsing method that relies on prior knowledge from a database. It can be used to investigate the natural distribution of rare variants in populations. The consequences of unusual variants are being studied by a number of researchers. Biobin and other collapsing and/or binning methods have become common because they are convenient to use in case- control studies, can use whole-genome data, and allow for the investigation of collective inheritance.

2.0 Problem Statement

People have complained about the bad odour in their household waste bins, which has caused watery garbage to spill out into the bottom of the bin; housewives have complained about the unpleasant odour of nappy or diaper suffocating the entire room; and in most offices or air-conditioned spaces, the odour has disrupted worker focus, causing company management to be concerned about their employees' efficiency. People were expected to throw garbage into ordinary dustbins regardless of whether it was wet or dry waste.

The dustbin emits the thickest, most unpleasant odour because of the combination of these garbage's. There are several problems because of these kitchen waste such as pests that spread diseases, mosquitoes and rats are known to live and breed, and both are known to bear life- threatening diseases. Mosquitoes breed in water-collecting cans and tyres and may spread diseases like malaria and dengue fever. Rats can be found in kitchen waste, where they find food and shelter, and they can spread diseases like leptospirosis and salmonellosis. Furthermore, waste moisture processing is a breeding ground for bacteria. It's bacteria that can spread and expand in the right conditions, such as moisture from appliances and food scraps.

Next, extreme climate change is caused by gases released by decomposing waste climb into the atmosphere, trapping heat. One of the primary causes of the world's drastic weather changes were greenhouse gases. People are witnessing and feeling the harmful effects of greenhouse gases, from incredibly powerful hurricanes and typhoons to sweltering temperatures. Other than that, bad impact on human health also a problem statement. The health of the people who live near contaminated areas may be severely harmed by improper waste disposal. Jobs in these landfills, including waste collection workers and other personnel, are more at risk. Skin irritations, blood infections, breathing complications, growth disorders, and even fertility problems may all be caused by poorly treated wastes.

Figure 2.1: Kitchen Waste Caused by Human

PONTIAN - Longgokan tong misteri di tepi jalan Kampung Parit Pak Intan dekat Pekan Parit Sikom di sini, kembali mencuri tumpuan selepas setahun tular dan dilaporkan akhbar tempatan.

Penularan berita tong misteri itu, dikaitkan kebimbangan orang ramai dalam tempoh pencemaran bahan toksik di Pasir Gudang.

Sinar Harian semalam, melakukan tinjauan bersama penduduk kampung dan wakil Adun Pulai Sebatang ke lokasi stor penyimpanan tersebut.

Hasil tinjauan mendapati, masih terdapat tong-tong putih dilonggok di dalam kawasan stor yang jelas kelihatan dari luar.

Imam Masjid Kampung Parit Pak Intan, Abdul Majid Sapak berkata, dia tidak terkejut dengan penularan longgokan tong misteri di media sosial itu.

Katanya ini kerana, masalah itu belum diselesaikan meskipun mendakwa lawatan agensi terlibat seperti Jabatan Alam Sekitar sudah pun dilakukan.

"Penduduk diberitahu tong itu mengandungi baja. Bahan baja, kami tidak tahu mungkin bahaya untuk kesihatan. Tetapi tengok pokok-pokok di sekeliling layu," katanya.

Beliau berharap agar penularan berita tong misteri itu akan membuka mata pihak berkuasa untuk mengambil tindakan lebih tegas kepada pemilik stor.

"Penduduk mahu stor berkenaan dipindahkan ke lokasi lain. Tidak sesuai dibuka di kawasan kampung lebih-lebih dekat dengan kebun dan ladang yang jadi tempat penduduk mencari rezeki," katanya.

Setiausaha Majlis Pengurusan Komuniti Kampung, Abdul Rashid Taib, 45, berharap ia diselesaikan dengan stor terbabit diarah berpindah.

Figure 2.2: The Condition of The Abandoned Barrels (Nor Azura, 2019)

According to the Sinar Harian newspaper, on 15 March 2019, by Nor Azura Md Amin in the Pontian area, it was found that there was a pile of mysterious barrels that became the concern of the locals by the roadside of Kampung Parit Pak Intan. What worries the residents is the recent occurrence of toxic pollution in Pasir Gudang.The results of the daily ray survey and also the locals together with the Pulai Sebatang Assemblyman's representative found that the barrels were still there. In addition, the Imam of the Kampung Parit Pak Intan Mosque, Abdul Majid Sapak, said the problem had occurred before and was still unresolved even though the Nature Department had already made a tour. The thing that was told by the locals was that the barrel contained manure, but what worried the trees there was withering, and it was

not sure if the manure was safe for them. With the spread of the news of the mysterious barrels, he hoped that the authorities would open their eyes and take appropriate action against those who are not responsible for managing the barrels. This is because the residential area is not suitable, especially close to the orchards and farms that are the source of livelihood. locals. The secretary of the Village Community Management Mosque, Abdul Rashid Taib, 45, hoped that the barrels would be removed and settle properly.

Figure 2.3: The Food Waste is The Cause of Global Warming (Nadia, 2016)

Based on a Berita Harian newspaper clipping on 1 May 2021 by Nadia Hamid in Kuala Lumpur, found that food waste is the cause of global warming. The Solid Waste Management and Public Cleansing Survey (SWCorp) states that Malaysians waste about 3000 tonnes or three million kilograms of food waste every day during the month of Ramadan. This has led to the worsening global warming situation and climate phenomena facing the world today. This global warming occurs when the visible and ineffective food waste actually fails to be decomposed within a certain period. This situation causes an increase in demand for landfills and requires a wider area, including around the city, and increases the cost of disposing of food waste and solid waste. Datin Paduka Che Asmah Ibrahim is the Director of Green Technology Corporation Malaysia. She said the situation could threaten the environment, cause pollution, increase global temperatures, mitigate climate change and disrupt weather schedules, such as rain and storms, around the world. Her message is that the disposal of expired food waste can be recycled as dishwashing products or organic flooring.

3.0 Objective

The objective of this study is:

I. To develop a Biobin that utilises domestic waste into organic fertilisers for commercial use.
II. To produce a sustainable and energy saving process in disposing and decomposing domestic waste.

4.0 Literature Review

4.1 System Biobin

A portable digester has been used to promote the digestion of kitchen waste which used cow manure, it demonstrates high energy saving in the biobin system (Iqbal et al., 2014). In addition, a better equipment and adjustment condition in the biobin may increase the efficiency of the system. A small scale of anaerobic digester for schools and restaurant to compost food waste has been research. After a collection of food wastes, its degradation process will be optimized through anaerobic digester, then followed by aerobic composting after biogas has been produced (Meegoda et al., 2018). This biogas is used for recovering biogas for their energy needs. Some important components for designing of a biobin system is, it should address process chain in the biobin such as kind of biowaste collection, pretreatment, transformation process and product chain for further utilization of the product. Pretreatment is promoting the efficiency of digestion system. The degradability of feedstock will promote high yield of biogas. However, if non-degradable material in the biobin, it will disturb the liquid flow in the biobin system.

4.2 Renewable Energy

Renewable energy is useful energy that is collected from renewable resources, which are naturally replenished on a human timescale, including carbon neutral sources like sunlight, wind, rain, tides, waves, and geothermal heat (Dhanalakshmi Sridevi et al., 2015). Kitchen waste, which is most the wastes are unused food, kind of biodegradable waste. These wastes turn to be a renewable energy by using Anaerobic digester. Anaerobic digester is useful tool to process waste which can reduce the load on landfill as organic food waste can be diverted from the landfill to generate renewable energy of biogas. Food waste collected can be sorted and segregated from impurities before it is shredded and broken down to form bioliquid. After proper mixing of the biolique, it is then prepared to be fed into the aerobic digester. The digester produces biogas, which is used to create power and heat.

4.3 Products of Biobin

4.3.1 Solid Fertilizer

Solid fertilizers are compounds that may be applied to soil or plants to give nutrients and sustain development. Solid fertilisers are fertilisers that are naturally generated and include carbon (C). Mineral sources, all animal waste, including meat processing waste, manure, slurry, and guano, plant-based fertilisers, such as compost, and biosolids are examples of common solid

fertilisers. There is also additional abiotic non-chemical, fertiliser technologies that fulfil the Principles of Organic Agriculture, which decides if a fertiliser may be utilised for commercial organic agriculture.

4.3.2 Liquid Fertilizer

Liquid fertilizers are the fertilizers that contain nutrients and vitamins for plants in liquid form. You can use them by sprinkling or pouring directly to the roots of plants. Liquid fertilizers can be prepared by fermenting kitchen waste, worm casting, grass clippings, coffee grounds depicted in Figure 2.1 (Unnisa, 2015).

Figure 4.1: Steps involved in the preparation of liquid fertilizer and pulp from food waste and toxicity test (Unnisa, 2015).

4.3.3 Biogas

Biogas produces from biobin system or digester is a renewable and valuable energy source which has high calorific value. It is also can be used for various purposes, similarly to the natural gas from petroleum. In contrast, biogas energy is produced via microbial process in which organic kitchen waste is decomposed into valuable product like gas and slurry. Hence biogas is the most eco-friendly substitute for petroleum energy. Biogas is primarily mixture of Methane (CH_4), Carbon dioxide (CO_2), and other gases like Ammonia (NH_3), Hydrogen Sulphide (H_2S), Nitrogen (N), Hydrogen (H), and Oxygen (O_2). This biogas production is a useful method as a function of waste disposal system, preventing the potential pollution to the environment and spreading pathogens and disease-causing bacteria. Production of biogas is also helpful for the environment cleanliness by reducing degradable solid waste into the ground.

Table 4.1: Composition of biogas

Component	Concentration (by volume)
Methane (CH_4)	55-60%
Carbon Dioxide (CO_2)	35-40%
Water (H_20)	2-7%
Hydrogen Sulphide(H_2S)	20-20.000 ppm (2%)
Ammonia (NH_3)	0-0.05%
Nitrogen(N)	0-2%
Oxygen (0_2)	0-2%
Hydrogen (H)	0-1%

5.0 METHODOLOGY

5.1 Biobin design

A sample of digestion bin has been designed to produce a Biobin to encourage waste management system at home. The Biobin was fixed with bearings, tube was inserted for connection gas and ball valve to control flow of liquid fertilizer. Besides that, a drawer was created for solid fertilizer collecting. At the bottom of the Biobin, the wheels were attached to stabilized and easy to move. A crusher is also fixed inside the Biobin to enable pretreatment processing.

5.2 Anaerobic process

The step by step complete process is defined. Initially the collected kitchen waste such as onion peel, banana peel, potato peel, leaves, eggshells, and etc are dumped into Biobin which consists of crusher that will crush the kitchen waste. The reason is to make process is smoother and less time consuming to generate a biogas, solid fertilizer and liquid fertilizer. Once the significant amount of waste is gathered in Biobin, the process of anaerobic digestion starts. The process is very precise we must completely seal the Biobin. The Biobin have one inlet and three outlets. These inlet and outlets relate to tube and valves. The input relates to funnel which narrow the kitchen waste to crusher and the waste will go through sieve for filtration process. The liquid fertilizer from kitchen waste will be filtered from the solid kitchen waste and go through the bottom of the Biobin.The liquid fertilizer can be collected through the outlet which have ball valve. After 30 days, solid fertilizer can be collected in the drawer. Hydrolysis takes place through complex organic molecules which are disintegrated into amino acids, simple sugars and fatty acids by adding hydroxyl groups. Acidogenic bacteria further break it down into volatile fatty acids producing carbon dioxide, ammonia and hydrogen sulphide as by products. This is process is called acidogenesis. Then, in acetogenesis, the simple molecules obtained from acidogenesis are further digested by bacteria known as acetogens to produce hydrogen, carbon dioxide and acetic acid. Biogas is produced by bacteria through the bio degradation of organic material under anaerobic conditions. Natural generation of biogas is an important part of bio-geochemical carbon cycle. It can be used both in rural and urban areas. Add silica gel, to prevent bad odour. Finally, three products forms from the biobin which are solid fertiliser, liquid fertiliser and biogas.

5.3 Component of Biobin

These images were drawn by using Autodesk inventor drawing. All these components needed to invent a perfect biobin with versatile functions. Ball bearing used to reduce friction while rotating the handle. Next, funnel used for guiding waste into a small opening so that the food waste does not scatter around. Gear used to transfer motion and torque between the crusher and handle. Besides, wheels used to reduce friction while moving so that biobin can move easily. Ball valve used to control flow of liquid fertilizer and methane gas. Sieve used to filter the substances after crushed. Crusher used to crush food waste from big substances into small substances. The Figure 3.1 and 3.2 was drawn by using Autodesk Inventor Drawing. Figure 3.1 displays the main component installed in the biobin as to promote the digestion processes to produce biogas and liquid fertilizer from kitchen wastes.

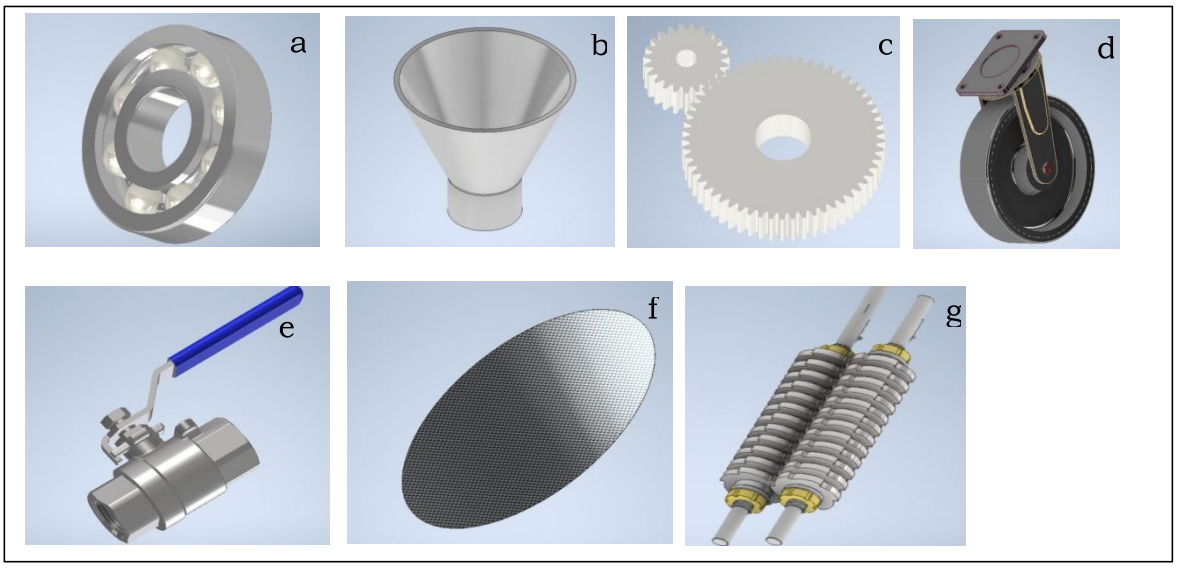

Figure 5.1 Illustrating the main components of: a**.** ball bearing, b. funnel, c. gear, d. wheel, e. ball valve, f. sieve, and g. crusher installed inside the Biobin.

6.0 Results and Discussion

The Biobin has been assembled to enable digestion process to generate a renewable energy for disposal system at home. The digestion process take place for 14 days using unused food from kitchen. The biogas produced was connected to pipeline for collection in a provided gas-tank. This Biobin is made from light metal, movable and able to store about 3L wastes at time. Figure 6.2 shows a complete assemble of biobin components that it should be designed to generate biogas from kitchen wastes.

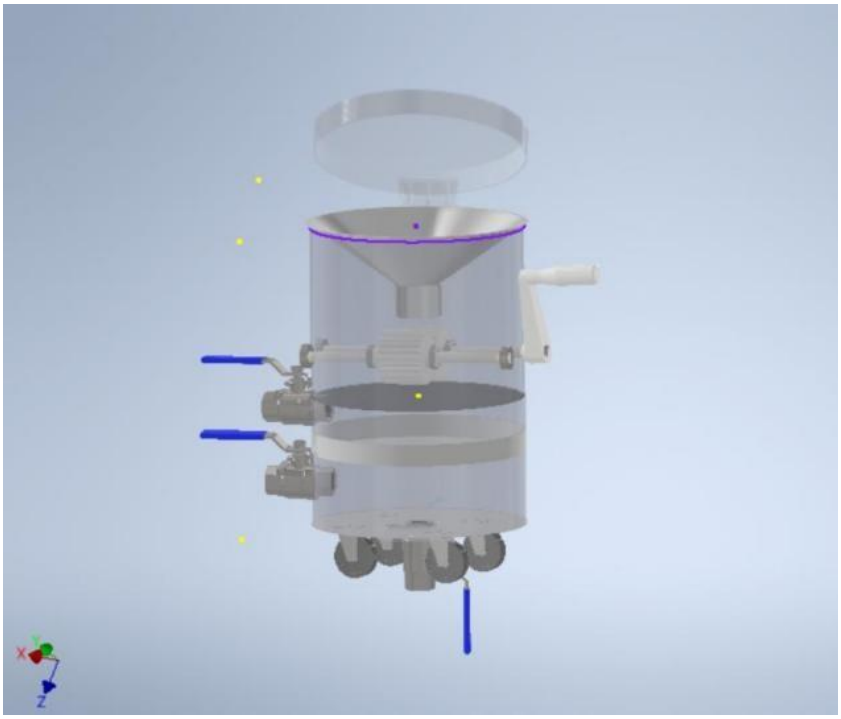

Figure 6.2 Complete components of Biobin

7.0 Conclusion

This study is intended to develop a biobin that utilizes domestic waste into organic fertilizers for commercial use and produce a sustainable, free energy-saving process by disposing and decomposing method of domestic wastes. Therefore, this design of biobin can help the environment such as reduce bad odours, climate change while human can prevent health problems. This concept of biobin design is an effective solution for managing food and organic waste instead of dumped in the ground which is limited and endangering other species. On top of that, it can help housewives make their own composting system such as fertilizer and biogas, instead of throwing away to the garbage. In addition, this study is to encourage a self- degradation habit since wastes could be regenerated as renewable products using a better waste management system such as bio- storage system. The biobin is developed to create a user-friendly for degradable wastes storage, such as tank which fixes with components to enhance the digestion process. Chemicals or any microbes can be applied, making it the easiest and most cost effective on digestion of organic or bio wastes. Its functions of waste keeping, followed by digestion processes, may produce a renewable energy of biogas as well as fertilizer (solid and liquid) product from the biobin. The main components of pre-treatment, crushing, filtration and anaerobic digestion are compulsory in a biobin development. Both liquid and solid products as well as biogas produced are beneficial for fertilizer and short heating purposes. The idea of this study could solve the increasing waste disposal every day, eventually dump into the ground which leads to vast pollution. Furthermore, wastes can be recyclable by providing a proper biobin waste disposal system.

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