UNIVERSITI TEKNIKAL MALAYSIA MELAKA

EXPERIMENTAL INVESTIGATION ON BIODEGRADABLE MATERIAL IN YIELDING FERTILIZER FOR HOME APPLIANCES

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

by

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical and Manufacturing in Automotive (Automotive Technology) (Hons.). The member of the supervisory is as follow:

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ABSTRAK

Projek ini adalah bertujuan untuk mengkaji kebolehsuaian baja yang dihasilkan iaitu Blackstrap Molasses Fertilizer yang menggunakan Blackstrap Molasses, Epsom Salt dan sisa makanan buangan yang diimplikasikan hasil kajian yang dilakukan. Baja ini adalah hasil ubahsuai bagi menambah baik baja sedia ada dari segi persekitaran, masa, kos dan sebagainya. Baja ini berbeza dengan baja yang selainnya kerana ia melibatkan sisa makanan buangan dan beberapa bahan tambahan iaitu Blackstrap Molasses dan Epsom Salt. Dalam menjayakan projek ini, beberapa prosedur dilakukan mengikut carta aliran yang dimulakan dengan mengumpul sisa bahan buangan, mendidih sisa bahan buangan dengan air sehingga sisa makanan hancur, penyejukkan bahan didihan, campuran dengan bahan tambahan (Blackstrap Molasses dan Epsom Salt), produk berjaya dihasilkan dan kemudiannya diteruskan dengan dua jenis ujian iaitu ujian keatas tumbuhan dan Fourier Transform Infrared Spectroscopy (FTiR) dimana hasil ujian tumbuhan menghasilkan tumbuhan dan FTiR menghasilkan data graf yang harus ditafsirkan sendiri oleh pengkaji dengan merujuk graf analisis FTiR atau membaca jurnal. Produk ini memberi kesan keatas penjimatan masa, kos dan persekitaran. Hasil pemerhatian mendapati kandungan Amine C-N, Alkene CC, Phosphorus P-H dan Urea NH yang tinggi di dalam baja yang mempengaruhi kecendurangan tindakbalas pertumbuhan tumbuhan.

ABSTRACT

This project aims to investigate the hand-made properties of Blackstrap Molasses Fertilizer using Blackstrap Molasses, Epsom Salt and food waste which is implicated by the results of the study. This fertilizer is a modified product in order to improve the existing fertilizer in terms of environment, time, costing and so on. The fertilizer contains food waste and some additives ingredients which are Blackstrap Molasses and Epsom Salt. Several procedures were carried out started start with collection of food waste, boiling food waste with water until the food waste was crushed, cooling the food waste and mixing with additives ingredients (Blackstrap Molasses and Epsom Salt). Two types of testing used to test the fertilizer, which are plant testing and the Fourier Transform Infrared Spectroscopy (FTIR). The plant testing produced the plant growth rate and FTIR produced graph data that should be interpreted by referring to the Spectroscopy chart. The results showed that the high content of Amine C-N, Alkene CC, Phosphorus P-H and Urea, NH in the plant affected the degradation of plant growth response.

DEDICATION

A special appreciation, I dedicated this thesis to my lovely mother Norizan bte Ismail and lovely father Salman bin Hj Shariff.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

CFT	-	Compost Free Technology
CO2	-	Carbon Dioxide
Etc.	-	Et Cetera (and other things)
FTIR	-	Fourier Transform Infrared Analysis
Kg	-	Kilogram
K	-	Potassium (Kalium)
Mil.	-	Million
N	-	Nitrogen
NPK	-	Nitrogen, Phosphorus, Potassium (Kalium)
n.d.	-	No date
RM	-	Ringgit Malaysia
UiTM	-	Universiti Teknologi Mara
USA	-	United State of America
UTeM	-	Universiti Teknikal Malaysia, Melaka
BMF	-	Blackstrap Molasses Fertilizer
CF	-	Conventional Fertilizer

CHAPTER 1

INTRODUCTION

1.0 Background of Study

Fertilizer is a natural substance that is used to enhance plant growth and fertility. Fertilizers may enhance water retention and filter any excess liquid in order to enhance soil effectiveness. Fertilizers offer three major macronutrients which is potassium, phosphorus, and nitrogen. Plants need a lot of that stuff. NPK needs to be available on the plant in the right ratio to ensure a good balance of carbohydrates, protein and fats. Fertilizers may also add secondary nutrients such as sulphur, magnesium, and calcium to the soil or growing media (Birgit, B., 2017). According to Birgit, there are different types of fertilizers that can be used on specific plants to promote the plant growth, such as coffee grounds, commonly used for plants that thrive on acidic substances, for example roses and tomatoes. When using coffee grounds, it is important to water the soil afterwards to promote absorption. Eggshells are also used as fertilizing agents for produce like peppers and tomatoes. High percentage of calcium may help prevent rot while boosting the plant's growth. Aged manure and compost are by far the most popular fertilizers used with just about any type of plant. Somehow, it depends on the plant itself. Organic fertilizers are made by mixing natural ingredients, which is naturally high in N or P or K or all of them, and that also contain trace elements. Chicken poo or blood and bone meal or fish extract and things like that. They contain the NPK in varying ratios, and some trace elements. However, it is possible to get the balance wrong, if there is less knowledge on what exactly is in the bag and what exactly the plants need (Birgit, B., 2017).

Food waste is part of food loss and refers to discarding of potentially usable food. Both edible and inedible foods may be considered garbage and finally been wasted (FAO, 2014). Edible foods are considered inedible when the quality reduced until they become unhealthy or noxious. Food quality reduction occurs from rotting as a consequence of overproduction, storage problems, or improper preparation. Food waste also occurs through food use that returns little nutritional value, like over-processing and overconsumption. Edible foods are also wasted when cultural or individual preferences deem food undesirable. Societies with abundant food supplies often consider reusing leftover foods as inconvenient, while less food-rich societies regard food reuse as imperative. Each year, an estimated one-third of all food produced for human consumption is lost or wasted world-wide (FAO, 2014). Food and Agriculture Organisation (FAO) estimates indicate that the per capita food waste at consumer level in Europe and North-America is 95-115 kg/year while in sub-Saharan Africa and South/Southeast Asia is 6-11 kg/year. (FAO, 2011).

Since food waste contribute to the landfill pollution in the world, some have discovered on how to reduce the pollution. Instead of throwing away the food waste which may lead to the pollution, the food waste can be used as a fertilizer through some process. Different countries and companies comes with different methodology, depending on the environment, suitability and the ease of the process.

Somehow in order to convert the food waste into fertilizer, some investigation need to be done to avoid any waste, pollution or harm in any perspective. Different food waste have to go through different processes. Not all type of food waste can be used as a fertilizer. Food waste such as food packaging, bones or other animal-based waste have to be removed. This type of food waste will only attract the attendance of pests which would harm the plants.

There are few methods have been discovered such as food processing using a machine which may process the food waste within 24 hours, use heat and enzyme, use additional stuff such as Bokashi powder or Barkeley, food residue are recycle and transform to liquid fertilizer, using harvester (discovered by WISErg, a company in Washington U.S.), using digester system with microorganism, layering and mixing by using some additional stuff to increase the speed of composting process and lastly worm composting.

1.1 Problem Statement

Fertilizer are now sold everywhere in the country. However, there is still pro and cons of the fertilizer. Some of the fertilizer might be high cost, some of the fertilizer might not suitable for some of the plants. To use food waste as a fertilizer will somehow cut the cost instead of reduce the pollution. Some of the fertilizer sold out there are more expensive. For savings, the production of self-generating fertilizer is generated with the hope of saving more money.

Other than that, fertilizers sold are also feared inadequate to plant sowing. So, a fertilizer using organic matter is produced using additives ingredient, which is Blackstrap Molasses and Epsom salt.

1.2 Purpose of study

To study different methods of fertilizer besides Bokashi and Barkeley which is suitable to be used in Malaysia. Many factor need to be emphasize, including cost, temperature and the time consumption. As for cost, try to minimize the cost so it is

economic for the consumer. Temperature is also one of the important factor since different country comes with different environment. Ensure the state of change of weather, the humidity, and the plant condition itself. Study the time consumption or time taken for the food waste to turn out to be fertilizer for the selected method.

1.3 Objective of study

- To determine the suitability/effectiveness of Blackstrap Molasses as additional item in fertilizer made from food waste.
- To study the effect of nitrogen and carbon content in fertilizer, from food waste, towards the plant thrived.
- To study the effect of Blackstrap Molasses for plant in daily used besides Bokashi and Barkeley

At the end of the study, discovery should be complete and able to decide if Blackstrap Molasses are suitable to be used in Malaysia and fulfil the suitability of the requirement. Besides for health use, Blackstrap Molasses is also good for plant as it contain a lot of nutrient which is carbon, iron, sulphur, potash, calcium, manganese, potassium, copper and magnesium. Besides feeding beneficial bacteria, it may also keep the soil and plant healthy.

1.4 Significant of study

The study is being investigate in order to ensure if the method chose is relevant in order to reduce the pollution on the environment caused by food waste. If the investigation is complete and achieve the objective, pollution can be reduce and people can even cut cost on fertilizer by producing a fertilizer using food waste.

1.5 Scope of study

The usage of food waste as fertilizer are rarely used in the world nowadays. The study is about using food waste as fertilizer with some additive ingredients which is Blackstrap molasses and Epsom Salt that are chosen for this project. Blackstrap Molasses are made of maximum extraction of sugar from raw sugar cane. It feeds beneficial bacteria which keep the soil and plants healthy. It also contains essential vitamins and mineral which is good for plant. For every 100gm of Blackstrap Molasses consists of 1464mgs potassium and 31mgs phosphorus. Potassium and phosphorus are part of nutrient needed by plant which is NPK where P stands for Phosphorus and K stands for Potassium. Epsom Salt are made of hydrated magnesium sulphate (magnesium and sulphur) which is important for plant growth. Magnesium allows the plants to better take in valuable nutrients, like nitrogen and phosphorus. Magnesium greatly improves a plant's ability to produce flowers and fruits. It is relevant to use Epsom Salt for plants since it may help to improve flower blooming and enhance the plant's green colour together with helping the plants grow bushier. It also helps in creation of chlorophyll, which is vital for photosynthesis. If the soil becomes depleted of magnesium, Epsom Salt may help. In order to ensure if it is suitable to be used, some testing will be held which is through FTIR method and direct testing on the plant in a given period of time. The FTIR testing will be done in Universiti Teknikal Malaysia Melaka (UTeM) while plant testing will done once the fertilizer is ready to be used. Testing will be done on random type of plant with assumption 2-4 week time.

Somehow the process of making fertilizer will be done at home which is much way easier since to boil the food waste and water require much longer time. Other

process will be done at the lab in UTeM since there is complete equipment and apparatus provided.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

Fertilizer is a natural substance that is used to enhance plant growth and fertility. Fertilizers may enhance water retention and filter any excess liquid, hence enhancing soil effectiveness. Fertilizers offer three major macronutrients which is NPK, where N stands for Nitrogen, P stands for Phosphorus and K stands for Potassium (Kalium in other language) (Birgit, B., 2017). Food waste is part of food loss and refers to discarding of potentially usable food. Since food waste contribute to the landfill pollution in the world, some have discovered on how to reduce the pollution. Instead of throwing away the food waste which may lead to the pollution, the food waste can be used as a fertilizer through some process (FAO, 2011). Different countries and companies comes with different methodology, depending on the environment, suitability and the ease of the process. Somehow in order to convert the food waste into fertilizer, some investigation need to be done to avoid any waste, pollution or harm in any perspective. Different food waste have to go through different processes. Not all type of food waste can be used as a fertilizer. Food waste such as food packaging, bones or other animal-based waste have to be remove since it will only attract the attendance of pests which would harm the plants (FAO, 2011).

2.1 Make Own Fertilizer from Garbage

A compost was set far from home and far from stuffs that may attract the animal attendance. Compost naturally attracts animals. A 1 inch straw was used to line the bottom of the compost bin. Set a compost container in the kitchen to collect viable green waste such as egg shells and used coffee grounds for compost pile. Items that won't compost such as food in a pack, animal bones or other animal-based waste have to be avoid. The waste is then being chop to a smaller pieces. (Andrews, A.J., n.d.)

Collect the viable brown waste from the yard and garden and add to compost bin. Plant-based waste such as plant trimmings, grass clippings, and leaves works well in a compost pile but have to be chop into a smaller pieces. Composted the thorny wood and branches separate from other plant-based waste since it may take time and slow the compost rate of other waste. All the items was added after they decompose after one or two years. Fresh manure contain a large amount of nitrogen that allow compost hot faster and shorten the time for decomposition of the whole pile (Andrews, A.J., n.d.).

Next, the compost have to be water lightly until just moist all the times in order to maintain the environment conducive. Mixed well the compost heap using a long-handled fork or shovel and keep close the lid. Once a week, use the compost thermometer to check the internal temperature of compost pile. Temperature should be from 140º F to 160º F for good.

There are two types of fertilizer which is natural organic fertilizer and synthetic fertilizer. Synthetic fertilizer may release nutrients faster than the organic fertilizer, and even less cost. Four things needed to make nutrient rich compost which is water, air, carbon and nitrogen.