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Technology**

**PRODUCT DESIGN AND DEVELOPMENT OF ORGANIC
WASTE COMPOSTER**

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**Bachelor of Manufacturing Engineering
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**PRODUCT DESIGN AND DEVELOPMENT OF ORGANIC WASTE
COMPOSTER**

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in fulfilment of the requirement for the degree of Bachelor of Manufacturing
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DEDICATION

Dear Mummy and Ayah, this is for you. It was a long and hard journey, but I made it.

Alhamdulillah !

ABSTRACT

Food wastes are being thrown straight away together with the other trashes and are not being sorted. This causes greenhouse emissions, takes up landfills, causes land toxicity and consumes a lot of money for waste management. Composting wastes is one of the way to reduce the food wastes thrown to the landfills but this method is very complicated to do, consumes time and many more factors. Not many prefer to compost and due to this, wastes, especially food wastes are piling up day by day at the landfills. This project entitled Product Design and Development of Organic Waste Composter is focusing on reducing wastes by developing a prototype that simplify composting technique through method of literature review, product design and development steps, fabrication of the prototype and testing between conventional composting method and the semi-automatic organic waste composter. The objective of this project is to design an organic waste composter for home, to develop a functional prototype of waste composter for home and to compare the best method between conventional composting method and semi-automatic waste composter for home in producing fertilizers. The result for this research showed that The Organic Waste Composter not only faster compared to conventional composting technique but also saves money compared to store bought organic fertilizers. Most Malaysians are really interested to help in taking part to reduce waste and resolves environmental problems according to survey and interviews conducted. The only restriction is that we are lack of technology that can ease the process towards a sustainable waste management.

ABSTRAK

*Sisa makanan dibuang terus dengan sampah lain dan tidak disusun. Ini menyebabkan pelepasan rumah hijau, mengambil tapak pelupusan sampah, menyebabkan ketoksikan tanah dan menggunakan banyak wang untuk pengurusan sisa. Kompos adalah salah satu cara untuk mengurangkan sisa makanan yang dibuang ke tapak pelupusan tetapi kaedah ini sangat rumit untuk dilakukan, menggunakan masa dan banyak lagi faktor. Tidak ramai yang memilih untuk membuat kompos dan kerana ini, sisa, terutamanya sisa makanan bertambah dari hari ke hari di tapak pelupusan sampah. Projek ini bertajuk *Product Design and Development of Organic Waste Composter* memberi tumpuan kepada mengurangkan sisa dengan membangun prototaip yang memudahkan teknik pengkomposan melalui kaedah kajian literatur, rekabentuk produk dan langkah-langkah pembangunan, fabrikasi prototaip dan ujian antara kaedah pengkomposan konvensional dan semi-komposter sisa organik automatik. Objektif projek ini adalah untuk merekabentuk komposter sisa organik untuk rumah, untuk membangunkan prototaipkomposter yang berfungsi untuk rumah dan untuk membandingkan kaedah terbaik antara kaedah pengkomposan konvensional dan automatik dalam menghasilkan baja. Hasil kajian ini menunjukkan bahawa *Organic Waste Composter* bukan sahaja lebih cepat berbanding dengan teknik pengkomposan konvensional tetapi juga menjimatkan wang berbanding dengan membeli baja organik. Kebanyakan rakyat Malaysia benar-benar berminat untuk membantu dalam mengambil bahagian untuk mengurangkan sisa dan menyelesaikan masalah alam sekitar mengikut kaji selidik dan wawancara yang dijalankan. Satu-satunya sekatan adalah kita kekurangan teknologi yang dapat memudahkan proses ke arah pengurusan sisa yang mampan.*

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LIST OF ABBREVIATIONS

BOM	-	Bill of Materials
CAD	-	Computer Aided Design
CAM	-	Computer Aided Manufacturing
CH ₄	-	Methane Gas
CNC	-	Computer Numerical Control
CO ₂	-	Carbon Dioxide
EFB	-	Empty Fruit Bunch
FAO	-	Food and Agriculture Organization
GHG	-	Green House Gas
GWP	-	Global Warming Potential
MSW	-	Municipal Solid Waste
NSD	-	New Service Development
RM	-	Ringgit Malaysia
SNSD	-	Sustainable New Service Development

CHAPTER 1

INTRODUCTION

1.1 Background

Compost is a natural process. It is a breakdown of raw organic materials such as leaves, manure and food wastes that are then converted to stable soil-like humic material. Composting is an ancient era undertaken on a ramification of degrees, from domestic to industrial. As landfills attain their capability and ban acceptance of organic wastes, composting is one of the way. Furthermore, the end product of compost is a valuable soil resource that can be use in agricultural, silvicultural and horticultural (Cooperband, 2010).

According to Cromell (2010), there are two classes of microorganisms which is the one that consume and the one that decompose organic matter. The one that consume organic matter are those that need air which referred as aerobic and the one that decompose organic matter are those that do not need air which referred as anaerobic. Most people who do composting rely on aerobic which is an aboveground decomposition. It is the simplest technique because all that is needed is a hill of organic materials.

Aerobic composting is over-the-ground treating the composting environments, regardless of either it happens in an unsupported pile or in a container that have air circulation. For any length of time, aerobic decomposers work quicker and more productively than anaerobic when there is a lot of air, giving completed compost on a faster timetable. Nevertheless, as living things drain the supply of oxygen from the current spaces and pores between parts of organic matter, the decomposition process rate

decreases. To keep the process at the most ultimate speed, enhance some kind of air circulation can assist to amid your underlying heap development.

Anaerobic decomposition is organisms which work in the absence of oxygen. Most anaerobic happens underground. Organic matter were filled in a hole and seals it with soil. Anaerobic decomposition does not need oxygen. Anaerobic organisms work at slower rates and it is impractical to monitor their progress without digging into the hole and poking around. Anaerobic organisms release smelly gas as a side effects of their exertions. Due to colder conditions, plant pathogens and weed seeds will not die. Even with these disadvantages, anaerobic composting is the best way to go in situations, for instance to dispose of a one-time load of wet, smelly wastes, extensive pile of organic matter such as plant leaves and to improve soil fertility and structure of the garden bed.

1.2 Problem Statement

Food wastes are being thrown straight away together with the other trashes and are not being sorted. This causes greenhouse emissions, takes up landfills, causes land toxicity and consumes a lot of money for waste management. The greenhouse emissions is due to methane gases from the decomposition of food wastes. It is more potent than carbon dioxide and chlorofluorocarbon that causes global warming and changes the climate. Due to the increasing amount of food wastes, new landfill sites have to be open which causes more land have to be taken up. Trees have to be cut down for this new site. Governments also have to pay a lot of money for the landfills. Composting food wastes is one of the way to reduce the food wastes thrown to the landfills but this method is very complicated to do because it consumes time and many more factors. Not many prefer to compost food and due to this, wastes, especially food wastes are piling up day by day at the landfills.

1.3 Objective

To provide an alternative solution to reduce wastes, it is necessary to perform the work study that are needed to be precise and accurate so that an improvement of current home composter can be obtained. The objective of this research is:

- i. To design a waste composter for home use.
- ii. To develop a functional prototype of waste composter for home.
- iii. To compare the best method between conventional composting method and semi-automatic waste composter for home in producing fertilizers.

1.4 Scope

The scope of this project will be designing food waste composter for home. Thus, research on the project will be focusing on the best design for home to compost food wastes. The design also is targeted to reduce the time consumption of producing fertilizers when using conventional composting technique. It is simple to use by people of all ages and safe to be placed inside the house. Through research from literature reviews, surveys, comparisons between other similar products and idea generation, concepts of the composter will be generated.

The project will then cover for designing food waste composter by using SolidWork. After finalizing the best concept by following product design and development steps, a three-dimensional model will be produced by using Computer Aided Design (CAD) software to have an overall view of how the product will look like, its specifications and also to assist for manufacturing processes later.

After the 3D modelling process, the project will be fabricate home composter by an appropriate method, technique and manufacturing process such as metal forming processes. Lastly, the project will cover testing between conventional composting method

with the semi-automatic organic waste composter to compare the difference between the time consumption to produce fertilizers and the quality of the fertilizer.

1.5 Expected Results

The expected result of this project is to come out with a design of organic waste composter for home use and able to reduce wastes thrown in landfills in Malaysia. The design is user friendly, easy to use and safe to the users and also safe to be placed inside the house. A functional prototype of the composter will able to be produced for a better view and to simulate the use of it. The composter is targeted to be able to be commercialized in every household in Malaysia. The organic waste composter also is expected to be better than the conventional composter technique where it takes more than two weeks to produce fertilisers and take many complicated steps to do it. The designated organic waste composter is targeted to be having an aesthetic look to be place inside the house, compact, easy to use and consume less time to produce the fertilisers.

1.6 Organization

Chapter 1: Introduction

This chapter will introduce about the project. It contains introduction, problem statements, objective, and scope of the project, expected results and the organization of the report.

Chapter 2: Literature Review

This chapter shows results about the studies and research that relevant to the project.

Chapter 3: Methodology

This chapter will show the project methodology used in this project.

Chapter 4: Results and Discussion

This chapter will state out and discuss the results that will be obtained from the research.

Chapter 5: Conclusion and Recommendation

This chapter will conclude and summarize the project and the major conclusion of the project.

CHAPTER 2

LITERATURE REVIEW

2.1 Food Waste

2.1.1 Source of Food Waste

For thousands of years, economies were circular economies. According to Mauch (2016), not many waste was created previously in 19th century. Households created very minimum garbage because the leftover food was cooked again or fed to farm animals. Things that are no longer can be used become toys for children, durable goods were passed down to generations and broken items were repaired. Food and animal wastes were used as organic fertilizer, straw was reused in building structures, fiery ashes were utilized to fertilize soils and to control pests. Dog poo was even served a function in the tanning leather process.

Food waste comprises different groups of products such as food losses from agricultural production, processing of food, wholesale and retail trade, restaurants, caterers and private households. In general the definitions include the purpose of food intended to be consumed by humans (Brancoli, 2016). The main source of the global food waste is the purchase of food by consumers, restaurants, and caterers that is left uneaten. The average amount of food waste in the institutionalized catering is slightly over 20%. This figure includes preparation waste, service waste and plate waste. Industry averages for the following areas are 4.3%, 10.4% and 5.4% respectively (Häyhtiö, Harjanne and Rajakangas, 2017).