



الجامعة  
UNIVERSITI  
TEKNOLOGI  
MARA

Cawangan Terengganu  
Kampus Bukit Besi

**NURUL SYAMIMIE BINTI SAIRATULAMRI  
(2020852288)**

**PROJECT TITLE:**

**A COMPARATIVE STUDY OF THE COMPOSTING OF  
DIFFERENT ORGANIC WASTES USING BLACK SOLDIER FLY  
LARVAE (HERMETIA ILLUCENS)**

**SUPERVISOR: NORZILA BINTI MOHD**

**SCHOOL OF CHEMICAL ENGINEERING  
COLLEGE OF ENGINEERING**

**2023**

## ABSTRACT

Urbanization and the rapid growth of the world population have increased the demand for organic waste treatment and food production. Organic waste, including food waste, is primarily disposed of by landfill, incineration, and anaerobic digestion. However, more sustained treatment is required. Treatment of organic waste with Black Soldier Fly (*Hermetia illucens*) (BSFL) larvae is an environmentally friendly and cost-effective method that is gaining popularity worldwide. BSFL has an excellent ability to reduce various wastes while providing animal and human feeds and organic fertilizers with high nutritional content such as oil and protein. In this study, we present the results of a study on the treatment of food waste and its bioconversion efficiency by larvae of the black soldier fly (*Hermetia illucens*). This was done on four different parameters, including impact on different types of food waste, impact on different amounts of food waste, impact on different amounts of BSFL, impact on single and mixed food waste. It is based on perspectives on BSFL growth and optimal rearing conditions during the waste treatment process are provided. Each sample was analyzed in the laboratory to observe factors that affect the efficiency of BSFL in converting food waste into organic fertilizer.

# TABLE OF CONTENTS

	<b>Page</b>
<b>AUTHOR'S DECLARATION</b>	<b>2</b>
<b>ABSTRACT</b>	<b>3</b>
<b>TABLE OF CONTENTS</b>	<b>4</b>
<b>CHAPTER ONE BACKGROUND</b>	<b>5</b>
1.1 Introduction	5
1.2 Literature Review	6-9
1.3 Problem Statement	10
1.4 Objective	11
1.5 Scope of Study	11
<b>CHAPTER TWO METHODOLOGY</b>	<b>12</b>
2.1 Introduction	12-13
2.2 Materials	13-14
2.3 Method/synthesis	15-17
<b>CHAPTER THREE RESULT AND DISCUSSION</b>	<b>18</b>
3.1 Data Analysis	18
3.1.1 Characteristic of Raw Food Waste	18
3.1.2 The Growth Development of BSF larvae	19
3.1.3 Characteristic of BSF Larvae After the Treatment	20-21
3.1.4 Characteristic of BSF Compost	22-24
<b>CHAPTER FOUR CONCLUSION AND RECOMMENDATION</b>	<b>25</b>
4.1 Conclusion	25
4.2 Recommendation	25
<b>REFERENCES</b>	<b>26-29</b>

# CHAPTER ONE

## BACKGROUND

### 1.1 Introduction

The black soldier fly (BSF), *Hermetia illucens* Linnaeus, is a large Stratiomyidae fly (13–20 mm in size) found worldwide but is thought to have originated in the Americas. Commonly found in tropical and temperate regions around the world. Although adapted primarily to these areas, they can tolerate extreme temperatures except when spawning and are generally considered more beneficial than pests, or no digestive system. Therefore, they do not bite or sting and do not feed during their short lifespans. Since they only eat as larvae, they are not associated with disease transmission. BSF larvae (BSFL) voraciously feed on various organic wastes, breaking down nutrients back into the soil. Additionally, BSFLs are an alternative protein source for aquaculture, animal feed, animal feed, and human consumption. Black soldier flies are often associated with nature and livestock, usually around decaying organic matter such as animal waste and plants. Because the BSF larvae consume decaying matter, they have been used in commercial swine and poultry facilities to reduce livestock manure.

## **1.2 Literature Review**

### **1.2.1 Solid Waste Management**

As the world population grows, especially in urban areas, urban health concerns are growing (Aksoy, E.; San, 2019). Various waste reduction techniques such as Lean, Total Quality Management, and Six Sigma have been presented to reduce and minimize waste (Qayyum, S.; Ullah, 2021). Solid waste in the form of litter, litter and litter dumped daily by people in urban and rural areas is known as municipal solid waste (MSW). About 1.3 billion tonnes of municipal waste are generated worldwide each year, expected to rise to 2.2 billion tonnes by 2025, and more than a third of this municipal waste is not collected. n (Hoorweg, D., 2022). Increasing global urbanization, poor municipal waste management, and resource scarcity worldwide contribute to the increase in municipal solid waste (Eskandari, M, 2021). The Phnom Penh municipality in Cambodia alone generates 0.74 kg of waste per person per day (Seng, B.; Kaneko, H., 2021). The World Bank claims that urban solid waste will reach 3.4 billion tonnes by 2050 (Ghosh, S.K, 2020). About 70% of municipal waste goes to landfills, 19% of waste is recycled and 11% is used to generate energy. From the current world population, 7.6 billion people (USCB, 2020), about 3.5 billion people without basic garbage collection services (Catarinucci, L. 2019).