

# 1. INTRODUCTION

## 1.1. Background

Nowadays, people tend to consume fast food due to their convenience. Generally, fast food restaurants are franchised chains which sell typical food products such as chickens, pizzas, or hamburgers on their list of menu. Fast food restaurants also provide take-away service, so the consumers can bring home the food or they can have them while on the go. Because of the efficiency and the availability, fast food restaurants have now increasingly become part of people's lifestyle. However, the amount of waste generated by fast food restaurants has also increased significantly (Aarnio & Hämäläinen, 2008).

Packaging is used to protect and to preserve food from contamination by unwanted objects and also to distribute food to the customer. There are many different types of packaging materials that are commonly used, such as glass, metal, plastic, paper, and cardboard. The use of each packaging material depends on the nature of the food (Opara & Mditshwa, 2013). Some important considerations for choosing the type of food packaging include the ability to preserve food freshness and quality, to create interesting image, to improve marketing appeal, and to ease distribution and storage (Pasqualino, Meneses, & Castells, 2011). According to WPO (2008), plastic is the second most widely used (30%) packaging material after paper (38%) by consumers globally.

Some reasons why plastics are widely used for food packaging according to Coles et al., (2012) are:

- Plastics are flowable and mouldable under certain conditions.
- Plastics are chemically inert, although not always impermeable.
- Plastics are cost friendly.
- Plastics are lightweight
- Plastics can provide various purposes, such as transparency, heat sealing, resistance, colour, and barrier.

The production of plastic has exceeded almost all materials since 1950. Many types of plastics are produced, but most of them are designed for single use only. Today, life without plastic seems impossible. Lifestyle that depends on plastic results in an increase of plastic waste globally. Only few types of plastic that are biodegradable, and most of them are not. Plastic can be degraded by ultra violet wave (UV), so they will break down into smaller pieces or fragments known as microplastics. This breakdown process takes very long time (Giacovelli, 2018; Geyer et al., 2017).

Each year, more than 400 million tons of plastics are produced, and around 300 million tons of plastic waste were generated in 2015 (Giacovelli, 2018). According to Geyer et al., (2017), in 2015, approximately 6300 million metric tons (MMT) of plastic waste had been produced. Around 79% of plastic waste just sits in landfills or in the environment. Only 12% of plastic waste have been incinerated and 9% has been recycled. In the same year, approximately 8300 million Mt of virgin plastics have been made.

According to Jambeck et al. (2015), China was the largest generator of mismanaged plastic waste, i.e. 8820 MMT each year. While Indonesia was in the second position, disposing 3220 MMT of the mismanaged plastic waste per year, followed by Philippines, Vietnam, Sri Lanka, and Thailand, respectively. China contributes 27.7% of total mismanaged plastic waste in the world, while Indonesia was 10.1%.

In Indonesia, waste management is regulated in Law No. 18/ 2008. According to this law, all cities and district government should change the waste disposal system into waste management system. The intention of changing from waste disposal system into waste management system is to improve public health and environmental quality and to make waste as resources. The city of Semarang has issued a regulation on waste management, i.e. Regional Regulation No. 6/ 2012 (Pramadianto & Widowati, 2016). According to Fikri et al., (2015) the annual population growth rate in Semarang is 1.11%, leading to significant increase of waste volume along with other cities: Bandung, Surabaya, and Tangerang City. In 2015, each day around 4,998.85 m<sup>3</sup> of total

waste generated in Semarang, however only 4,349.00 m<sup>3</sup> can be transported into the final landfill site (Jatibarang).

Only 41.28% of the total waste can be transported to Jatibarang; the rests are burn, buried, dumped on the river or street, and recycled, i.e. 35.59%, 7.97%, 14.01%, and 1.15%, respectively. From all waste that had been transported to Jatibarang landfill, about 35% of the waste will be recycled by PT Narpati and is used as fertilizers. Organic waste is separated from the other 65% of the waste will be processed into methane gas. The inorganic part is not processed further, some are taken by scavengers (Pradana & Subowo, 2017). Food service sector such as fast food restaurant also contribute in disposing plastic waste, especially single use plastics (SUP). There is a need to study the contribution of fast food restaurants in Semarang's waste stream. This study specifically covers the problem of SUP.

## 1.2. Objective

The aims of this study are to estimate: 1. the total SUP generated from fast food restaurants in Semarang; 2. the quantity of SUP waste based on polymer types and food category; 3. the environmental burden of SUP waste expressed as carbon footprint; and 4. to analyze and discuss the possibilities to redesign product in reducing the SUP waste.