CHAPTER I

INTRODUCTION

1.1 Background

Mango is one of the most major tropical fruits besides pineapples, papaya and avocado. It is grown mostly in Asia, such as Indonesia, Thailand, Philippines, Malaysia, Sri Lanka and eastern part of China (Chakrabarti, 2011). According to Food and Agriculture Organization (2018), the production of mango in Indonesia reached 2,184,399 tons in 2016, with total harvested area of 167,785 hectares. Meanwhile, worldwide production of mango reaches 30.7 million tons by 2010, which accounts almost half of total global tropical fruit production. Mango is a climacteric fruit which produce increased amount of ethylene during ripening. It is very favorable as it is a good source of pro-vitamin A, vitamin C and vitamins B1 and B2 (Litz, 2009).

A single mango fruit comprises of 33-85% edible pulp, 9-40% edible kernel and 7-24% inedible peel (Tiwari *et al*., 2013). In mango processing, part of mango used is only the pulp, while the peel is discarded and become one of pollution sources. Mango peel itself is rich of various bioactive compounds such as polyphenols, carotenoids, dietary fibers, enzymes phytosterols and tocopherol. Thus, the mango peel itself has a good potential of antioxidant properties with antioxidant activity of 31.7±0.99 μM TE/g (Ravani and Joshi, 2013).

Moreover, according to Masibo and He (2008), the total polyphenolic compounds were found higher in the peel compared to the pulp. The major

polyphenols is mangiferin, which was found at the level of 1690.4 mg/kg in peel and 4.4 mg/kg in pulp. These polyphenols are the compounds that are responsible to the antioxidant activity of mango. Another research conducted by Ajila and Rao (2013), the flavonoids present in mango peel were quercetin and kaempferol, which present in the range of 0.101 – 0.392 mg/g.

In this research, type of mango that will be used is *arum manis* mango. According to the research conducted by Putri (2009), arum manis mango has the lowest IC_{50} value compared to other mango such as gedong and dermayu, which are 0.111 mg/g, 0.188 mg/g and 0.289 mg/g respectively.

The antioxidant compounds in mango peel can be extracted by various method, one of them is by using Microwave-Assisted-Extraction (MAE). In this method, the sample is immersed in a solvent and irradiated with the microwave. This method is fast and require low amount of solvent (Eskilsson and Bjorklund, 2000). Moreover, the extraction using MAE for mangosteen peel results that higher anthocyanin content, antioxidant activity, total phenolic content and yield were found by using MAE compared to maceration (Farida and Nisa, 2015). According to Do *et al.* (2014), ethanol is solvent that is safe for human consumption and also a good solvent for phenolic extraction. Moreover, ethanol is also one of the solvent commonly used in microwave extraction as it is polar and has high dielectric constant. Higher dielectric constant result in more energy absorbed and faster solvent heating (Meireles, 2009).

Puree is an intermediate product which has been partially processed and can be used in further processing. Because mango is seasonal, usually it is processed

into purees so that it still can be used when it is not the season (Barrett *et al.*, 2005). Puree is prepared by blended the mango flesh and can be made into various product such as: pulps, purees, jams, jellies and dried fruits (Sinha *et al*., 2012).

The good functionalities of mango peel become a good base of mango peel utilization, which able to reduce the number of mango peel waste in the industry. Extraction using MAE method was found to produce higher yield and total phenolic content compared to maceration. Moreover, the sensory acceptability has inversely proportional relationship with the antioxidant activity, hence, optimization needs to be done. Optimization is done by using Response Surface Methodology (RSM). RSM experimental design is useful for experiment in which the response is influenced by many variables (Myers *et al.*, 2016).

1.2 Research Problem

The utilization of mango in the industry has left high amount of peel wastes. On the other hand, the extract of the mango peel may be added to mango puree in order to increase its functionality as antioxidant. The addition of mango peel extract which is rich in antioxidant has inversely proportional relationship with the sensory properties (color, aroma, taste, aftertaste, and overall evaluation). Hence, the optimum concentration of mango peel extract to be added to mango puree that produce preferable sensory properties also needs to be known.

1.3 Research Objectives

The research objective was categorized into two, which are general and specific objective.

1.3.1 General Objective

The general objective of this research was to optimize the antioxidant activity and sensory properties of mango puree with the addition of mango peel extract.

1.3.2 Specific Objective

The specific objective of this research were:

1. To obtain mango peel extract by using Microwave Assisted Extraction (MAE) method.
2. To optimize the concentration of mango peel extract to make mango puree with preferable sensory properties.
3. To compare the product with optimum antioxidant activity and sensory properties with puree from mango flesh only and unpeeled mangos.