CHAPTER I

INTRODUCTION

1.1 Background

Dental plaque and caries are the most common oral health problem in Indonesia. According to *Riset Kesehatan Dasar* (Riskesdas) (2018), 57.6% Indonesians suffered from dental and oral health problem, with only 10.2% receiving medical treatment. On average, Indonesians at age between 35 to 44 have 7 teeth with dental problem or caries while for children at age between 5-6 the average is 8 teeth or more.

Beside toothpastes and mouthwash product, confectionery products are commonly used as it stays in the mouth for long. Jelly candy with antimicrobial properties can be useful in reducing the number of oral bacteria in teeth before brushing activity. Sugar-free jelly candy may be used for oral health-intended use. A research by Milgrom *et al.* (2008), showed a reduction of cariogenic microorganism in school-going children by habitual consumption of sugar-free gummy bears.

Betel (*Piper betle* L.) is a plant commonly found in Indonesia commonly used in traditional medicines. Betel is usually boiled and drank, or as a component in local-made antiseptic for women private parts. According to Rekha *et al.* (2014) betel leaves have antibacterial activity against many bacteria, including oral bacteria such as *S. mutans.* Some researches on the antimicrobial activity of betel

plant has been done, such as the antibacterial activity of piper betle leaves on *S. mutans* (Deshpande and Kadam, 2013). Another research by Ali *et al*. (2018), on the antimicrobial activity of betel extract using water, 50% ethanol and 95% ethanol solvent to commercial toothpastes which resulted in enhancement of antimicrobial potential in conventional toothpastes against *E. coli, S. aureus, S. mutans, S. salivarius* and *C. albicans.*

By incorporating betel leaves extract into jelly candy, the jelly candy is expected to have antimicrobial characteristic for oral health benefit. Extract were preferred instead of juice, as it would be in a more concentrated form and having specific components, as the leaf consists of 85-90% water which does not contribute in the antibacterial activity of betel (Pradhan *et al*., 2013). By using extract, desired chemical constituents can be obtained. Previous research by Zombade *et al* (2011), mentioned about the antimicrobial components of betel juice were concerning in terms of quantity due to the presence of 90% water in it.

Peppermint (*Mentha piperita*) is commonly used as in confectionary products as flavoring. Besides that, peppermint also demonstrates antimicrobial activity towards oral pathogens. An *in vitro* study by Raghavan *et al.* (2018) is done to show the antimicrobial activity of peppermint towards *S. mutans, A. Actinomycetemcomitans* and *C. albicans*. Peppermint oil is expected to give minty taste and cooling sensation, improving the taste of the betel jelly candy as antimicrobial activity is not the main target.

To recover the phytochemical compound of piper betel leaf and incorporate it to the product, there are many extraction methods that can be used. Maceration is

preferred compared to infusion, percolation and decoction as choice of solvent could determine the type of compound extracted from the samples, where for the other methods mentioned, water is used. Extraction involving heating might damage unstable compounds and usually more suitable for hard plant materials such as roots and barks instead of leaves (Azwanida, 2015). Sequential extraction method is used to ensure the extraction of compounds in plant material according to polarity (Jeyaseelan *et* al., 2012) where in this research different solvents are used in order based on increasing polarity.

Based on a research by Laware (2015), using sequential method save solvent and material, that can be used for multiple extractions and same quality of results. Sequential extraction is also considered to be suitable for extraction of pigments, carotenoids, primary metabolites, phenols, flavonoids, and alkaloids. Many research uses single extraction for betel extract, an example would be by Rusyanti *et al* (2018), where single extraction results in yield ranging from 2-18% depending on the solvent used (water, hexane, and ethanol). Another research using maceration on betel extract is by Yustiantara *et al* (2018) using ethanol and ethyl acetate, resulting in 7% yield and 7.6% respectively.

Type of solvent used and the method may affect the yield of the phytochemical compound. Particular solvents can be used for compounds with certain chemical characteristics and polarities. Some of the commonly used solvents such as ethanol, methanol, acetone, and ethyl acetate are known to be suitable for recovering polyphenols from plant matrices (Do *et al*., 2013). The use of various solvent in extraction can be used to compare the efficacy of each solvent

in extracting phenolic constituents from *P. betle* L. leaves (Ali *et al.*, 2018). The extract obtained was used in the making of jelly candy which is expected to have antimicrobial characteristics towards oral bacteria, specifically *S. mutans*.

2.1 Research Problem

One of the innovations that can be done for jelly candy product is to provide the jelly candy with the ability to give health benefit, especially related with oral health. Betel is a local plant that can be used to produce jelly candy due to its antibacterial activity on many of the oral pathogenic bacteria and yeast as mentioned previously on the research by Ali *et al*. (2018). However, the best concentration of betel leaf extract for jelly candy making that can inhibit *S. mutans* specifically is not yet known and need to be identified. Extraction using different solvent is used to obtain compounds with the lowest MIC and MBC so that only a small amount of the extract is needed. Other than that, the sensory characteristics of betel jelly candy is important as this can be used to see the acceptability of the jelly candy formulation towards panelists.

2.2 Objectives

2.2.1 General Objective

The general objective of this research was to determine the antimicrobial activity of piper betel jelly candy on *Streptococcus mutans.*

2.2.2 Specific Objectives

The specific objectives aimed during this research were:

1. To determine the best solvent used to obtain betel leaf extract in inhibiting *S. mutans* based on the MIC and MBC analyses results.

2. To determine the best concentration of betel leaf extract and peppermint extract as flavoring in inhibiting the growth of *S. mutans* and the production of betel jelly candy.
3. To observe the acceptance of jelly candy made of betel leaf with addition of peppermint oil using sensory tests.
4. To determine effect of betel leaf extract and peppermint extract as flavoring on physical and sensory properties of jelly candy.