CHAPTER I

INTRODUCTION

1.1 Background

Wine is an alcoholic beverage made by fermenting grape juice using *Saccharomyces cerevisiae* as the starter culture. The yeast strain will ferment sugars in the fruit juice and convert it into alcohol and carbon dioxide, giving wine its characteristic flavor (Carrau *et al.,* 2008). There are two fermentation processes: primary and secondary fermentation. Primary fermentation occurs for 5-14 days. The secondary fermentation or also called maturation, may take another 5 to 10 days (Saranraj, Sivasakthivelan, & Naveen, 2017). On average, the alcoholic content of wine ranges from 9-14% and has been widely consumed for both pleasure and health benefits (Bakker & Clarke, 2011). Starting from 2016, wine has been a commonly discussed alcoholic beverage in Indonesia as it also takes part in religious ceremonies (Kom, Novela, & Scherly, 2016). The growing interest in wine has an impact in terms of the sales, giving an opportunity to wine retailers. Hence, wine development can be an alternative to reconstruct the economic condition of a certain region in Indonesia.

In wine making, some of the factors that should be paid attention to are the sugar, acid content, and the inoculum for the fermentation. The sugar content and acid content are the main properties that most fruit growers and winemakers are paying attention to as it indicates the ripeness of the fruits (Jordão, Vilela, & Cosme, 2015). As for the inoculum, different wine producers will use different types of strains, viability, and concentrations depending on their desired wine properties. The fermentation rate is one of the main parameters affected by different inoculum concentrations. Higher concentrations will result in a higher fermentation rate. Several studies have been conducted on the effects of yeast viability on the physicochemical properties of wine. However, very few have discussed the effects of inoculum towards the wine product's physicochemical properties.

Commonly, wine is made of grapes. However, other fruits such as strawberry, peach, cherries, and even mango can also be used to make wine (Swami, Thakor, & Divate, 2014; Dias *et al.,* 2007; Lin *et al.* 2018). Meaning that there are no limitations to what ingredients can be used to make wine, including Black Sapote. *Diospyros digyna* or also known as Black Sapote is considered as an exotic fruit, originating from Central America and South Mexico (Yahia *et al.,* 2011). Black sapote has a very thin pericarp and the diameter is ranging from 5-8 cm. As it matures, the sugar content also increases hence affecting the sweetness of the fruit itself. Depending on the ripeness level, the fruit has a high

pH value of 6.5-6.7 in comparison to other fruits, is highly perishable as it contains 80% moisture, with the carbohydrate contents of 12-15% (Moo-Huchin *et al.,* 2014; Janick & Paull, 2008). Black sapote is one of the important sources of calcium (18-47 mg/100 g) and vitamins such as C, E and A. Hence, contributing to the high antioxidant activity it possesses.

Despite that, black sapote consumption rate is still very low as it is deemed as an uncommon fruit. Thus, many are wasted (Jiménez-González & Guerrero-Beltrán, 2021). Given the fact that the fruit is highly perishable, black sapote does not have a long shelf life. The production of black sapote in Mexico has reached a total of 15000 tons per year worth a total of $201,050/ton or around Rp 2,783,624,805/ton. Commonly, black sapote is made into desserts such as ice cream, jam and fruit preserve due to its sweet taste (Lim, 2011). However, with these types of desserts, the black coloration of black sapote is considered as unappetizing (Jiménez-González & Guerrero-Beltrán, 2021). Moreover, with a high price point for the fruit itself, it would highly affect the production cost and the selling price of said dessert to be a little higher than the other products of the same category. Higher prices than the competition might lead to a decrease in sales. Therefore, another effort should have been made to increase the utilization & consumption of black sapote, for example by processing it into food or beverage products with added value that is also worth the production cost such as wine.

Since black sapote is a climacteric fruit, it is usually harvested when still unripe and then it is allowed to ripen for about 10 days. If black sapote wine is to be massively produced, there would be a high demand for the fruit. Whereas in the perspective of industry, waiting for a large amount of fruits to mature for 10 days with uniform properties, might not be categorized as time efficient as it not only can limit the commercialization process, but also seem unachievable without treatment (Asif, 2012). With accelerated ripening, the high demand of fruits can be met, and transportation hurdles can be controlled (Orisa, Usoroh, & Ujong, 2020). Therefore, calcium carbide is commonly used to speed up the ripening process. Calcium carbide is an artificial ripening agent that produces acetylene, which is an analogue of ethylene. According to Shaeda, Sarva, & Emilia (2018), acetylene has the same ripening attributes as ethylene gas. However, no study has been conducted to see the effect of using calcium carbide on black sapote fruit's physicochemical properties.

Therefore, this project aims to compare the effect of natural versus controlled ripening using calcium carbide on black sapote fruit's physicochemical properties and utilize Black Sapote as an ingredient for wine to increase the consumption rate and economical value. Yeast concentration in the fruit juice will also be adjusted as variables (0%, 0.5%, and 1%) which later will be subjected to physicochemical analysis.

1.2 Objectives

The objective of the research is to understand the potential of black sapote to be further processed into wine. The specific objectives are as follows:

1. To evaluate and compare the psychochemical characteristic of ripe black sapote fruits between natural and accelerated ripening using calcium carbide.
2. To evaluate the effect of different inoculum concentration during seven days of fermentation on the physicochemical characteristics of black sapote wine made from accelerated ripened fruit.

1.3 Research Scope

The scope of work of this research is:

1. Sample preparation which includes raw materials collection, preparation of the consumables, and making the fruit juice, and followed by a fermentation process to make the wine.
2. Analyze the physicochemical characteristics (titratable acidity, total soluble solids, pH, hardness, and moisture content) of ripe black sapote fruits ripen using natural ripening process for 18 days and accelerated ripening using calcium carbide for 6 days. These parameters were also compared to the standard matrix of ripe black sapote fruits according to the reference paper.
3. Analyze the effect of different inoculum concentrations during wine fermentation. Inoculum concentrations are 0% as the control group, 0.5%, and 1% (w/w). Physicochemical analysis will also be done on the wine, that includes titratable acidity, total soluble solids, pH.

1.4 Hypothesis

The hypothesis for this experiment is:

1. $\mathbf{H_0}$ = different ripening methods of black sapote fruits does not give a significant difference in terms of the physicochemical properties.

   $\mathbf{H_a}$ = different ripening methods of black sapote fruits give a significant difference in terms of the physicochemical properties.
2. $\mathbf{H_0}$ = black sapote wine produced with different inoculum concentration will not give significantly different physicochemical properties.

   $\mathbf{H_a}$ = black sapote wine produced with different inoculum concentration will give significantly different physicochemical properties.

1.5 Importance of Study

The importance of this study is to:

1. Provide understanding regarding the utilization of Black Sapote in the food industry to improve its economic value.
2. Contribute to the development and advancement of the food processing industry, especially preservation methods for black sapote fruits.