CHAPTER I: INTRODUCTION

1.1 Background

Coconut oil (CO) is an edible oil produced from the kernel of mature coconut of a coconut tree (*Cocos nucifera*). As for virgin coconut oil (VCO) specifically, it is obtained from the wet extraction method of coconut oil, with coconut milk as the raw material required for its production. Its production involves the separation of the coconut milk emulsion using various techniques, and unlike refined coconut oil (RCO), VCO is not subjected to further refining, bleaching, and deodorizing processes (Wallace, 2018). VCO is an important commodity with numerous health benefits and applications; for instance, in the food industry, its applications include but are not limited to cooking and frying purposes, confectionery, bakery, dressings, and infant foods. Additionally, VCO is also reputable for its functional, nutritional, and health-promoting benefits, owing to the MCFA present in the oil. The MCFAs possess good digestibility in the human body, as well as antiviral, healing, anti-inflammatory, and antibacterial properties. It can be used to treat minor illnesses, e.g. skin inflammations, GI problems, and minor cuts. Therefore, VCO has garnered major interest recently as a multipurpose health and nutritional supplement (Ghani et al., 2018; Patil & Benjakul, 2018).

There have been many investigations into the production of VCO using various methods, however, the quality of the VCO depends on many factors. These factors include the raw materials and processing parameters. Coconut milk, the raw material for VCO production, is commonly defined as the natural oil-in-water emulsion that is obtained from squeezing or mechanically pressing grated coconut meat with or without the addition of water (Raghavendra & Raghavarao, 2010; Wang et al., 2019). Common uses of coconut milk aside from being the raw ingredient for VCO includes its use as plant-based dairy alternative and culinary ingredients used in various cuisines, especially in Asian countries, in which it enhances the creaminess and adds a unique fragrance (Tangsuphoom & Coupland, 2008; Beegum et al., 2021). As coconut milk is a valuable ingredient for various products and purposes, the composition and quality factors of coconut milk products are regulated in the Codex Alimentarius Standards for Aqueous Coconut Products (CXS 240-2003). In the standard, these quality factors are described as a range of physicochemical characteristics; if these were outside of the range specified by the standard, it could adversely affect the resulting products or processes. These physicochemical characteristics include moisture content, pH value, fat content, total solids, and non-fat solids of the coconut milk.

In similar regards to coconut milk as their raw material, there are several parameters related to the physicochemical properties of VCO that serve as important indicators of their quality. Those properties include but are not limited to its free fatty acid content and iodine value (Ghani et al., 2018). The values for these quality parameters have to conform to the standard previously set by the Asian and Pacific Coconut Community (APCC). However, the physicochemical properties of VCO were discovered to have been affected by the production methods used (Mohammed et al., 2021). One of the methods that had been previously reviewed is the chilling-thawing method. This method destabilizes the oil-water emulsion of coconut milk, in which it is subjected to a chilling-thawing cycle and centrifugation to obtain the oil (Patil & Benjakul, 2018; Agarwal & Bosco, 2017). The chilling-thawing technique had previously shown desirable results in several studies, in terms of both the yield and physicochemical properties of the resulting VCO (Mansor et al., 2012; Mohammed et al., 2021). However, in these previous studies, inconsistencies in the chilling-thawing treatments applied were apparent, particularly in the inclusion of pre-treatments such as centrifugation prior to chilling, and the thawing method used.

Since the quality of VCO is determined by the physicochemical properties, it is therefore important to further investigate how exactly the chilling-thawing method used affected those characteristics. Unfortunately, the effect of variable chilling-thawing conditions on the final quality of VCO is yet to be explored and thus, unknown. In addition to that, the quality of the raw material, i.e. coconut milk, may vary between different samples. Thus, during the production of VCO, it is also necessary to monitor the moisture content and pH value to minimize any potential inconsistencies between batches and treatments. The main purpose of this project is therefore to explore varying chilling-thawing treatment for VCO production to evaluate which condition(s) yields a VCO product with physicochemical properties that are observed to be within the values established in the APCC standard, while monitoring the moisture content and pH value of the coconut milk used for production.

1.2 Objective

The objectives of this project are as follows:

1. To determine the consistency of the moisture content and pH value of the coconut milk used between treatments.
2. To determine the compliance of the moisture content and pH value of the coconut milk to the corresponding Codex Alimentarius standard.
3. To evaluate the effect of varying pre-treatments and thawing methods on the VCO's physicochemical properties, i.e. iodine value and free fatty acids content.
4. To compare the physicochemical properties of the lab-made VCO samples to the corresponding values in the APCC standard.

1.3 Scope

The scope of this study encompasses the following:

1. Monitoring the physicochemical properties of coconut milk (moisture content and pH) used in the experiment and its compliance to the corresponding Codex Alimentarius standard.
2. Performing the chilling-thawing treatment for VCO production from coconut milk.
3. Evaluating the impacts of varying pre-treatments and different thawing methods on the end-quality of the VCO based on its physicochemical properties (iodine value and free fatty acids content).
4. Performing the production of VCO from fresh coconut milk through the chilling-thawing technique and observe its influence on the end-quality of the produced VCO by conducting the analysis on its iodine value and free fatty acids content.
5. Comparing the values of the aforementioned analyses to the VCO quality standard established by the Asian and Pacific Coconut Community (APCC).

1.4 Hypothesis

The hypothesis for the first objective is the following:

H0: The moisture content and pH value of the coconut milk used between treatments will not be statistically different.

H1: The moisture content and pH value of the coconut milk used between treatments will be statistically different.

The hypothesis for the second objective is the following:

H0: The moisture content and pH value of the coconut milk will not be within the range of the corresponding Codex Alimentarius standard.

H1: The moisture content and pH value of the coconut milk will be within the range of the corresponding Codex Alimentarius standard.

The hypothesis for the third objective is the following:

H0: The iodine value and free fatty acids content of the VCO will not be statistically different between varying pre-treatments and thawing methods.

H1: The iodine value and free fatty acids content of the VCO will be statistically different between varying pre-treatments and thawing methods.

The hypothesis for the fourth objective is the following:

H0: The physicochemical properties of the lab-made VCO samples will not be within the range of the corresponding APCC standard.

H1: The physicochemical properties of the lab-made VCO samples will be within the range of the corresponding APCC standard.