CHAPTER 1: INTRODUCTION

1.1. Research Background

Virgin coconut oil (VCO) is an oil extracted from fresh and mature coconut employing either mechanical or natural, without being subjected to refined, bleached, and deodorized (RBD) (Dumancas et al., 2016). Unlike cooking oils containing long-chain fatty acid (LCFA), the fatty acid composition of VCO is predominantly composed of medium-chain fatty acid (MCFA), with mainly lauric acid (12:0) making up to 48%; As a matter of fact, coconut oil is the foremost natural lauric acid source. The consumption of VCO offers plenty of health benefits. This results from the contained phenolic compounds and tocopherol possessing antioxidative activity. Additionally, lauric acid also possesses several biological properties, such as anti-inflammatory, antibacterial, and antiviral effects (Ghani et al., 2018). Altogether with other MCFA making, VCO is frequently attributed to nutraceutical benefits and functional food.

In general, VCO is commonly produced through two means: dry and wet production. The differences are in the ingredients, the refining process (Pathirana, 2021). In dry production, VCO is made of dried coconut kernels, from which VCO should undergo a refined, bleached, and deodorized (RBD) process. Contrarily, wet production uses coconut milk, and the resulting oil neglects the RBD process. Due to the absence of RBD, the coconut milk used must be in a fresh condition to deliver good quality VCO. The quality of coconut milk is determined by several parameters, including but not limited to moisture content and pH value that have been standardized by Codex standard, whose eligibility is a maximum of 87.3 and a minimum of 5.9, respectively. The use of spoiled coconut milk outside of this range might reduce the quality of resulting VCO, therefore the monitoring of those quality standards is required.

One wet production that is widely conducted is enzymatic production (Rohyami et al., 2022). This technique employs protease enzymes (i.e., papain enzymes) to destabilize protein emulsion which acts as an interfacial barrier between oil and water by breaking down the peptide bond. Therefore, the separation between two phases (oil phase and water phase) occurs, and the oil can be collected. Papain enzyme, derived from the papaya fruit (Carica papaya), is one widely used protease enzyme since its crude form is more extensively found commercially than the other enzymes. Papain activity is affected by various factors, including temperature and concentration (Robinson, 2015). Varying these variables potentially exerts influence on VCO quality in the end product.

The quality of VCO is strongly acknowledged and strictly regulated as it affects shelf life and sensorial attributes. The quality itself is firmly determined by physicochemical properties whose parameters have been standardized by the Asian and Pacific Coconut Community (APCC) and must be adhered to in the final product. The standardized parameters include chemical properties, such as free

fatty acid (FFA) and iodine value (IV). The eligible VCO to the APCC standard must have FFA and IV in a maximum of 0.2% and a range of 4.1-11g I_2/ 100 g oil, respectively.

In previous studies (Mansor et al., 2012; Mohammed et al., 2021; Perdani, Pulungan, & Karimah, 2019; Rohyami et al., 2022; Winarti, Jariyah, & Purnomo, 2012), enzymatic production has shown its potential to be a promising method as the resulting VCO has shown a desirable yield. However, there was still a remaining knowledge gap in these studies regarding the details of the quality. Besides that, the methodologies on the documented studies implemented enzymatic VCO production was inconsistent, such as in the centrifugation method, papain concentration, and incubation condition. Knowledge gap was also found on the effect of monitoring the quality of raw material coconut milk between treatments, which might be a contributing factor to potential inconsistencies and contamination on the resulting VCO. As well as, there was a knowledge gap on the effect of incubation temperature of papain on VCO's quality, where heat is one of influencing factors that might promote deterioration in oil quality.

Hence, the interest of this research is to implement varying papain-assisted VCO production conditions to evaluate the effect on chemical properties (FFA & IV) of the resulting VCO quality in compliance with APCC standard, while monitoring the moisture content and pH value of the raw material coconut milk for each production.

1.2. Objective

1. To determine the consistency of the moisture content and pH value of the coconut milk between treatments.
2. To determine the compliance of the moisture content and pH value of the coconut milk to the Codex standard.
3. To evaluate the effect of papain enzyme incubation temperature on the VCO's chemical properties (FFA and IV).
4. To evaluate the effect of varying papain concentration on the VCO's chemical properties (FFA and IV).
5. To determine the compliance of the chemical properties (FFA and IV) of VCO samples to the APCC standard.

1.3. Scope

1. Investigate the consistency of moisture content and pH value of coconut milk.
2. Confirm the compliance of moisture content and pH value of coconut milk to Codex standard.

3. Implement production of VCO using different incubation temperatures.
4. Investigate the following chemical properties in the end-product of VCO produced by different temperatures:
    - Free fatty acid (FFA)
    - Iodine value (IV)
5. Implement enzymatic production of VCO using various papain enzyme concentrations.
6. Investigate the following chemical properties in the end-product of VCO produced by different concentrations:
    - Free fatty acid (FFA)
    - Iodine value (IV)
7. Confirm the compliance of chemical properties (free fatty acid and iodine value) in all VCO samples with the APCC Standard.

1.4. Hypothesis

Hypothesis is determined as follows:

Hypothesis 1

H_0: The moisture content and pH value of coconut milk will not be significantly different between treatments

H_1: The moisture content and pH value of coconut milk will be significantly different between treatments

Hypothesis 2

H_0: The moisture content and pH value of the coconut milk will not be outside the range of the corresponding Codex standard

H_1: The moisture content and pH value of the coconut milk will be outside the range of the corresponding Codex standard

Hypothesis 3

H_0: The use of different incubation temperature will not significantly affect the chemical properties (FFA & IV)

H_1: The use of different incubation temperature will significantly affect the chemical properties (FFA & IV)

Hypothesis 4

H_0: The use of different papain enzyme concentrations will not significantly affect the chemical properties (FFA & IV)

H_1: The use of different papain enzyme concentrations will significantly affect the chemical properties (FFA & IV)

Hypothesis 5

H_0: The chemical properties (FFA & IV) of the VCO samples will not be outside the range of the corresponding APCC standard

H_1: The chemical properties (FFA & IV) of the VCO samples will be outside the range of the corresponding APCC standard