

# **Chapter 1**

## **Introduction**

The chapter 1 consisted of 3 sub-chapters, namely background, objective, and hypothesis. In the background of the study, the trend of cheese and cheese products (sauce), research problems, and research gaps were further discussed.

### **1.1 Background**

Cheese's versatility as itself and in combination with other products to provide additional flavor and texture has earned itself place as one of highly consumed products in the food industry (El-mahdi et al., 2014). Most of the people consumed cheese due to its nutrient composition (protein, calcium, and others), flexibility, and highly varied types which provide different flavour, texture, and eye-catching colour with preference is built around creamy and savoury flavoured cheese (Adli & Novel, 2025; Chen et al., 2016). This is reflected in the continuous market growth of cheese in Indonesia as stated by Statista (2025), the market is expected to grow annually by 6.40% (compound annual growth rate (CAGR) 2025-2030). According to Riandani & Irfan (2022), the cheese industry in Indonesia is led by several companies, namely PT Kraft Ultrajaya (Kraft), PT Mulia Boga Raya (Prochiz), and PT Megmilk Snow Brand Indonesia (MEG Keju). Cheese sauce, as one of the types of cheese products in Indonesia, also contributes to the market growth which is influenced by social media, especially from Western and Korean culinary styles, which persuade people to try and buy the product (Yudhistira & Lestari, 2024). Products' simplicity and portability contributed positively, and due to that, a lot of cafe and food chain restaurants introduce cheese flavor as one of their menu, such as the Richeese factory which is known as a fried chicken restaurant with cheese sauce (Cahyani et al., 2024; Yanuarsyah & Hemanuadi, 2024).

The cheese sauce itself is made of an oil-in-water (O/W) emulsion with a relatively high moisture content (Kůrová et al., 2022). According to *Standar Nasional Indonesia (SNI) 4473 (2018)*, emulsified sauce is a sauce, gravies, and dressings based on oil or fat emulsions in water. As an emulsion is made from the combination of two immiscible liquid phases, it is unstable and will separate into different layers depending on the density difference (Akbari & Nour, 2018). One of the crucial factors in an emulsion is the pH because change in pH can lead to decrease in viscosity, affect the organoleptic properties, and emulsion destabilization, such as flocculation, coalescence, and phase separation (Hasenhuettl, 2019; Kunitsa et al., 2025; Liu et al., 2024). Most of the previous study developed cheese sauce with pH ranging from 5.65-5.90 (Desouky et al., 2019; Hassan et al., 2015), however the sauce developed in this study has a target pH around 4 to obtain similar sharp, sour, and tangy flavour of mayonnaise which usually has pH ranging around 3.7-4.6 (Xiong et al., 2000). In addition, lower pH can help to reduce microbial activity, prolong shelf life, and enhance the product stability as creaming rate can be reduced (Taslikh et al., 2021). During the sauce production, starch is usually being used to thicken with its hydrophilic structure (Szafrańska & Sołowiej, 2020). However, in acidic pH, the starch is prone to retrograde which leads to break down of the structure that is needed to trap the oil droplets, causing the sauce to becomes less viscous, oil droplets can move freely, and emulsion stability decreases which leads to phase separation (Li et al., 2024; Zhao et al., 2018).

In this study, the stability of sauce emulsion was enhanced by the combination of different stabilizer types and emulsifier concentrations to evaluate the effect at acidic pH. Applying emulsifiers was done to reduce the interfacial tension between the water and oil, along with to prevent droplet coalescence (Nadeem et al., 2022). Meanwhile, addition of different stabilizers were conducted to further enhance the emulsion stability by restricting the droplet movement with the increase in viscosity (Li et al., 2024). Nevertheless, the usage of surfactant or stabilizer alone was not enough because phase separation still happens due to various shear forces, temperature change, and storage condition (Nadeem et al., 2022). The synergistic effects of stabilizer and emulsifier combination can

enhance the product stability, such as through electrostatic and/or steric stabilization (Hasenhuettl, 2019).

There were several previous studies that were conducted regarding different stabilizers usage in cheese sauce manufacture with pH around 5, such as xanthan gum, guar gum, pectin, K-carrageenan, and sodium alginate (Hassan et al., 2015) along with different ratio of cornstarch (El-mahdi et al., 2014) and dietary fibers (Szafrańska et al., 2021). Besides that, there was also a previous study about the effect of homogenization towards cheese sauce added with K-carrageenan and furcellaran (Kůrová et al., 2022). Despite that, there was no previous study that observed the effect of emulsifiers and stabilizers addition into cheese sauce yet. Therefore, the combination of different stabilizer types and emulsifier concentrations towards physicochemical and sensorial properties were observed in this study.

## 1.2 Objective

The aim of this study was to evaluate the effect of different stabilizer types and emulsifier concentrations in cheese sauce formulation toward consistency, emulsion stability, pH, and sensorial properties.

## 1.3 Hypothesis

In this study, the hypothesis will be:

***H0 (null hypothesis):*** There is no significant difference in the application of different stabilizer types and emulsifier concentrations towards the consistency, emulsion stability, pH, and sensory analysis.

***H1 (alternative hypothesis):*** There is a significant difference in the application of different stabilizer types and emulsifier concentrations towards the consistency, emulsion stability, pH, and sensory analysis.