

# CHAPTER 1

## INTRODUCTION

### 1.1 Research Background

The egg is known as part of poultry product and counted as one of the most common foods consumed in the world. The availability of egg is almost ready every because hens are capable of producing at least one egg each day and meaning that the poultry industry should have at least thousands of hens under the industry expenditure. Moreover, the egg is highly nutritious and contains a high amount of macromolecules such as fats and protein and several essential micronutrients such as vitamin A, vitamin D, folate, B12, iron, phosphorus, zinc, iodine and selenium (Nys, Bain Immerseel, 2011). According to Gray and Griffin (2009), fats takes up to 12% of the total weight in 100 g of the egg without the shell while protein takes up to 13% respectively. The two macromolecule is essential as an energy source and required for the human body as part of daily nutrition intake. There are several food consumers that more prefer to consume egg as his or her primary source of animal product such as bodybuilders and semi-vegetarian.

The egg is consumed through personalized cooking or used in the making of complex food such as noodle, bakery product, mayonnaise, etc. (Nys, Bain Immerseel, 2011). However, since the egg is a highly perishable food, most eggs are processed into a new kind of product using egg as one of the ingredients. As mentioned above, the egg contains a high amount of fats and protein, and this nutrient is essential not only for the human body but also for a foodborne pathogen such as Salmonella. Additionally, water takes up to 75% of the total weight, and food product that initially has a moderate amount of water content is susceptible to be contaminated by foodborne bacteria (Nys, Bain Immerseel, 2011). Although the chance of contamination is not high and immediate as other product that has more than 90% of water, a contaminated egg can become fatal for the human that unknowingly consumed it (Nys, Bain Immerseel, 2011).

Aside from the major nutrient mentioned above, the egg also contains several vitamins such as vitamin A, B6, B12 and D along with minor mineral component. The nutrition provided by the egg makes the product become very easily perishable and targeted by a foodborne pathogen such as Salmonella or Escherichia coli. Although eggshell covered the inside component of the egg, the shell has pores that allow pathogen that is airborne get into the egg. Some egg company washes their egg to clean the shell and reduce the number of the pathogen present on the shell. Although cleaning the eggshell before selling it to the market improve the quality by its physical condition, the egg has to be in the refrigerator during storage time to prevent bacterial contamination. It is more useful to pay attention to the storage condition compared to before washing the egg. The washing technique may cause enlargement of egg pores; thus, making it susceptible to be contaminated with the common foodborne pathogen (Immerseel, Nys & Bain, 2014).

Currently, problems regarding egg safety have been discussed for the past years. There is still an outbreak incident for eggs in the past. Recent news in the United States of America (USA) showed there is more than 200 million egg are recalled from the supermarket, such as Walmart and Food Lion, due to the contamination of Salmonella. At least per year, 1.2 million people are infected by Salmonellosis, leading to 23,000 hospitalizations and approximately 450 deaths (Mackins, 2018). Within the recall, it has been reported at least 22 illness report due to the contamination. Another foodborne outbreak occurs last year in West Australia (WA) and the Department of Health of WA traced the source of 18 food poisoning cases that happen in the first semester of 2017. An example of the case shown that a couple of people living in private property was struck down by diarrhea after consuming homemade mousse cake. Authorized personnel analyzes the egg use by the cook, and it turns out to be positive for Salmonella.

To counterpart this problem, several food companies use this opportunity to process the egg into various food products. Mayonnaise is one of the examples of food product that mainly use egg as the primary ingredient and has been consumed by many people around the world. It is primarily used as sauce or food condiment when consumed along with other food. Additionally, this food product is mostly used as salad dressing to give the flavor for the salad especially vegetarian people who consumed salad as part of their daily food intake. Salad has a good source of fiber that provided by the vegetables. However, it cannot fulfill the needs of fat as well as protein and other several vitamins such as Vitamin B complex, Vitamin D, and Vitamin E. To compensate for the needs of fat and protein, people mostly incorporate mayonnaise as a salad dressing. The reason why mayonnaise is used as the salad dressing because mayonnaise can provide a high-fat content and moderate protein amount from the egg as their main composition. Despite this, consumer demand food company to produce mayonnaise which the fat content is reduced to minimal amount because the consumers want to have healthy living and eating while reducing the amount of fat consumed to their daily need (Rapp et al., 2009).

Although the effort to produce low-fat mayonnaise is not difficult to begin with, the outbreak still occurs for this food product. Egg product is difficult to sterilize because it is susceptible to heat and this may impact to the chemical and physiochemical properties in the egg that can also lead to the changes in the physical properties (Immerseel, Nys & Bain, 2014). Currently, there is new technology that does not use high temperature, and it is well known for its microbial inactivation. This developing technology is called cold plasma technology. The principle for this technology is to use free radical generated from the interaction of high energy transfer to a gas molecule (Misra, Schlüter & Cullen, 2016). As free radical is highly reactive, fat content in mayonnaise will tend to be affected by the free radical and cause lipid oxidation. However, there is no current research regarding mayonnaise and lipid oxidation of this product which is why it is still unknown whether the impact of plasma toward mayonnaise will be significant. Therefore, the effect of cold plasma in regards to

whether or not cause substantial changes to the mayonnaise properties will be observed in this research.

## **1.2 Research Objectives**

The effect of cold plasma technology can be evaluated in many different areas. The research aims to assess the effect of cold plasma technology toward the quality of low-fat mayonnaise in regards to the physical and chemical properties of the mayonnaise product. Although cold plasma is well known for its microbial inactivation, this part of the research will not be studied and will be set aside for future study. The study will be focused on the change of color, pH, water activity as well as the amount of oxidation product produced by the plasma technology. This research was conducted to see whether the application of cold plasma would affect the quality of the mayonnaise despite for its function to inactivate microorganism. The study compared between product treated and untreated with the plasma process. Hypothetically, plasma technology would not give significant changes toward the physical and chemical properties of mayonnaise product. If the research shows a positive result, this demonstrated that plasma application could be used as a potential technology for sterilization of mayonnaise product without affecting to the quality of the product.