CHAPTER 1

INTRODUCTION

1.1 Background

In the current era of fast-pacing lifestyle, food products offering convenience are winning over consumers' interest (De Barcellos *et al*., 2011). Convenient food offers preparation simplicity such as short preparation time and less cooking equipment. One example of convenient food includes processed meat products such as marinated meat, frozen nugget, ready-to-eat sausages, meatballs, etc. In Indonesia, the sales growth of processed meat products is derived from the increasing number of busy consumers accompanied by the rapid expansion of modern grocery retailers. Among all processed meat products, the sales of frozen processed meat products outperformed other product types from 2011-2016 with up to 37% sales forecast increment by 2020 (Euromonitor International, 2016). The leading frozen processed meat product was derived from poultry (chicken) due to its affordable price (Petracci *et al*., 2013). Based on their type, chicken sausage was in the second highest position of the retail sales value by 2015 after chicken nugget. Its increasing high demand is currently led by low- and middle-income demographics, which encourage chicken sausage manufacturers to expand their business (Euromonitor International, 2016).

In meeting the market demand towards chicken sausages, the utilization of food additives in their manufacturing process is inevitable. Food additives are used in the formulation in order to obtain the desired product characteristics yet inexpensive production cost. One of the prevalent additives used in chicken sausage industry is phosphate, which is popular for its outstanding water retaining and texture modulating functions. In comparison with numerous types of which, sodium tripolyphosphate (STPP) possesses eminent properties such as high alkalinity and high solubility index mainly to promote good myofibrillar protein solubilization and water holding capacity (WHC) of meat (Long et al., 2011; Keeton, 2001). These properties will profoundly impact the physical characteristics of the finished product *per se*, such as high cooking yield and texture. Its effectivity, application simplicity, and low price make STPP to become the most common phosphate additive used in the industries (Alvarado and McKee, 2007).

Despite its exceptional functions, vast growing health concerns towards the usage of STPP in processed meat industry are increasing. Hyperphosphatemia due to excessive consumption of phosphate additives (higher than 700 mg/day) becomes the risk factor of vascular damages such as endothelial dysfunction and vascular calcification especially in late-stage chronic kidney disease (CKD) patients (Ritz *et al.*, 2012). Avoidance towards food containing phosphate additives is also promoted by some of European Union countries which will drive consumer perspective and future demand of phosphate-free products (Petracci *et al.*, 2013). These issues prompt processed meat manufacturers to substitute STPP with other functional ingredients during processing. In doing so, STPP substitute could be discovered through product reformulation in comparison with its control sample (product containing STPP) to result in similar physical characteristics.

The targeted ingredients for STPP substitute are aimed to have comparable mechanisms with STPP such as pH alteration and actomyosin complex dissociation (Petracci and Bianchi, 2012). pH alteration mechanism could be substituted using pH regulating ingredient. The latter mechanism, however, is found to be uniquely irreplaceable. Dissociated actomyosin complex would result in an effective water holding capacity and a typical texture of the final product. This mechanism could be deceived by directly incorporating ingredients with high water holding and texture modulating mechanisms.

Prior to this research, author's previous findings (unpublished data) showed that 0.2% of STPP in chicken sausage (control) could be replaced by a combination of 0.2% of calcium carbonate and 1.5% of sodium lactate (as pH regulating ingredients) with 0.5% of carrageenan (as water holding ingredient) which resulted in a comparable texture profile. However, the substitution using sodium lactate caused a noticeable saltier taste compared to control, which raises another problem to solve. Therefore, the reformulation of STPP substitute should be conducted using other potential pH altering ingredient.

In this research, potassium carbonate (K_2CO_3) which is a pH altering ingredient was used due to its prospective function in alkalinizing meat which effectively swells myofibrillar proteins (Balestra and Petracci, 2019). Reformulation was be done initially with different concentrations of K_2CO_3. The combination with 0.5% carrageenan (based on previous research) further supported its function. Subsequently, further analyses such as pH measurement, cooking loss, color (brightness) measurement, and freeze-thaw stability were conducted to determine the quality of treatment sample (without STPP) compared to control sample (with STPP).

1.2 Objectives

The objective of this project is to determine the effect of K_2CO_3 concentrations combined with carrageenan as STPP replacer on chicken sausage.

1.3 Research Significance

This research could offer a groundwork STPP-free formula for chicken sausage manufacturers to overcome the current/upcoming STPP-related health issue of their products. Moreover, the potential STPP substitute ingredients could be used for preliminary reference in formulating other STPP-free processed meat applications.

1.4 Outline of Subsequent Chapters

The outline of subsequent chapters is the following: Literature Review (Chapter 2), Methodologies (Chapter 3), Results (Chapter 4), Discussion (Chapter 5), and Conclusion and Recommendation (Chapter 6). In Literature Review, fundamental concepts and previous related findings were introduced as the following subchapters:

- Rigor mortis and pH decrement of chicken meat after slaughtering
- Effect of WHC towards processed chicken meat quality
- Phosphate additives mechanisms, functions, and concerns in processed meat application
- Chicken sausage manufacturing process and ingredients overview

- Potential ingredients for STPP replacer
- Methodologies to determine chicken sausage quality and statistical analysis overview

In Methodologies, the experimental design, experimental flow, chicken sausage formula and manufacturing process, and detailed analysis methodologies were covered. In Result, the analyses' results along with each of their description were shown. In Discussion, further result explanations, troubleshooting, and comparison to previous studies were elaborated. In Conclusion and Recommendation, all key findings of the study were summarized. Furthermore, suggestions for improvement in future related study were given. In the end, a list of references is provided along with appendices attaching supplemental research information and raw data of results' statistical analyses.