CHAPTER 1

INTRODUCTION

1.1 Introduction

Nasi lemak is a complete meal, consisting of rice, onion-chili paste (*sambal bawang*), hard-boiled egg, fried anchovies, fried peanuts and slices of cucumbers. It is widely sold all over Malaysia and can be easily found from street stalls, high-end restaurants or hotels and even on aircraft.

Figure 1.1: Chill Nasi Lemak for inflight meal & Frozen Ready-to-eat Nasi Lemak for retail

Due to the rapid deterioration of quality results of microbial growth, usually the shelf life of Nasi Lemak stored at chill temperature of 0 to 4 degrees Celsius, is limited to five to seven days only; hence food industries are nowadays exploring alternatives to increase the stability. Most of the time, microbiological spoilage is coherent with food sensory acceptance that determines the quality of food by the

consumers. Based on the Malaysia Ministry of Health (MOH) Annual Report 2021, under the Food and Waterborne Diseases, it is recorded that there have been no significant changes in food poisoning incident numbers and rates since the year 2011 until 2019. However, a drastic rate reduction is observed from the year 2019 to 2021. This is the consequence of the Movement Control Order (MCO) during the pandemic that caused limitation of movement to all Malaysians. Besides that, on October 6th, 2019 it was reported in The Star newspaper, the nasi lemak served by the organizer of the Malay Dignity Congress held in Shah Alam on that day was found to be the cause of the food poisoning that affected 197 participants having symptoms of diarrhea and vomiting. The cause of the poisoning is confirmed based on the analysis of five Nasi Lemak samples taken from the location. Nonetheless, based on an unpublished record, there were several cases of passengers onboard complaining about the unpleasant smell and taste of the nasi lemak which after investigation, has passed the shelf life of the day. The need to extend the shelf life of the chill Nasi Lemak is crucial as this will ease the meal forecasting which will help to minimize the waste generated from each meal uplifted onboard. Besides that, the long shelf life of chill Nasi Lemak can replace the frozen Nasi Lemak hence eliminating the issue of broken rice due to the freezing storage process. Based on the record captured from the demand planners, the total of food waste generated in 2022 alone is 96216.5kg compared to the year before the COVID-19 pandemic 304,332kg. The repetitive complaints from customers concerning the broken rice in the Nasi Lemak since the meal started selling in retail.

Due to its rich nutrition and high water activity, nasi lemak is a suitable medium for bacteria growth of the metabolic activity of bacteria, yeast, and molds negatively affects the sensorial characteristics and safety of this dish. Fundamentally, a product becomes unacceptable during storage due to poor quality appearance, low

sensory score, and/or nutritional quality of the product. Second, it is mostly associated with safety issues potentially leading to a risk for the public's health. Unacceptability due to food consumption under unsafe conditions is extremely critical and can be the result of the occurrence of pathogen microbes, packaging cross-contamination and formation of toxicity during storage (Kaur et al., 2019).

Many modern technologies are employed to combat those safety, quality and sensory issues in food products. For instance, Modified Atmosphere Packaging (MAP) gives the benefit of reducing the oxygen level in the food package and replacing it with other gasses, so it will reduce or slow the oxidation reactions and microbiological spoilage (Kaur et al., 2019). However, MAP is focusing on manufacturing products and is costly. Radiofrequency (RF) and microwave (MW) heating are cost-effective, simple, quick to operate, high energy efficiency, nontoxicity, and suitable for heat-sensitive fluids but they possess some major drawbacks (Bermudez-Aguirre, 2018; Chatterjee & Abraham, 2018). Khan et al., 2017 stated that one of the observed disadvantages of dielectric heating is its use is restricted to high-moisture, high-salt, and high-fat content food products only. The non-stable heating eventually gives hot and cold spots inside the food product, thereby impacting the microbial safety of the treated product (Tavman et al., 2019). Meanwhile, ozone food treatment requires high precaution when using high ozone concentrations to reduce the microbial counts due to its tendency to give adverse effects during the preservation of food quality because of potential toxicity signs. Most impacted foods include color changes, loss of firmness, water, reduction of weight, vitamins, polyphenols and volatile compound contents (Brodowska, Nowak & Śmigielski, 2017).

Extending the shelf life of food while preserving its nutritional value and organoleptic properties is a primary focus in the food industry. Many food manufacturers and entrepreneurs create various types of fancy and tasty foods, but few possess the techniques to balance shelf life extension with nutritional preservation to ensure high quality throughout the product's lifecycle. Short shelf lives, unappealing or untasty food, and poor FIFO (First-In-First-Out) handling can lead to spoilage, expiration, and waste. Improper planning, resulting in high food wastage or loss, impacts stakeholders and consumers both economically and environmentally. Therefore, extending the shelf life of food can be considered a sustainable solution to reduce food loss, alongside using alternative packaging materials (Soro et al., 2021).

1.2 Problem Statement

Consumers and the food industry produce enormous amounts of food waste and loss in the food supply chains of developing and developed economies (Gustavsson et al., 2011). A better secure global food system will result in a reduction of all food losses (Martindale & Schiebel, 2017). There have been some effective attempts at addressing these issues which include modern technology of food preservation methods. However, these interventions have yet to have any significant effect on turnout. One of the existing food preservation to lengthen the meal's shelf life at a room-temperature stable meal product is by thermal food processing, and retort. However, the concept of high-temperature treatment for achieving an extended shelf life may lead to varying consumer perceptions, such as concerns about the food being unhealthy, nutrient loss, excessive preservatives, or bland taste. Additionally, the downside with retorting is the requirement of capable packaging to withstand the

high temperatures and the pressure differential swing that may happen, hence, retorts are the production bottleneck to most manufacturers. Plus, this technique incurs extra costs with the packaging and the complex machinery (Da-Wen Sun, 2006). Retort or pasteurization techniques also require a long period of testing, trial as well as research and development to get the desired taste and quality. All these flaws have been shown to pose challenges to small and medium enterprises (SMEs) to overcome the issue. Consumers reported complaints on the poor quality and food safety with regards to the meal which eventually resulted due to the shelf life abuse. This study is critically important as it will prove that the food preservation method proposed in this study will extend the shelf life of chill Nasi Lemak and gradually reduce food waste over annual periods. Consumer acceptability, preference, and selection of food products are the most vital measures for industries to make decisions about a product (G.W. Meijer et al, 2021). It aims to guide domestic, local, and multinational industries on the novel's ways to ensure proper food safety and quality management along with the Hazard Analysis Critical Control Point (HACCP) application. The result of the study is relevant to researchers, students, food/feed handlers, and policymakers who are working in related areas. The main advantage of this additive is that it does not act as a food preservative and neither complicated nor sophisticated machinery or equipment is required. Hence, it is cost-effective and consumer-friend.

1.3 Objectives

Therefore, the objectives of this study is to investigate the effect of different Acidity Regulators (Soluex B and Soluex C) at different concentrations of 0.5% and 1% on the extended shelf life of Nasi Lemak by assessing the parameters of:

a) Pathogenic microbial load of *Escherichia coli, Staphylococcus aureus* and *Salmonella* during 24 days in chilled storage.

b) Quality and the sensory acceptability during 24 days in chilled storage.