Chapter 1

Introduction

1.1 Background

Banana (Musa spp.) is a widely consumed climacteric fruit that originated in the Southwestern Pacific region. Known for its rich nutritional content and appealing taste, bananas are among the most popular fruits across all age groups and rank as the fourth most important food crop globally, following wheat, rice, and corn (Yang et al., 2022). As a key agricultural product, bananas serve as a major export commodity for many developing countries. Asia leads global banana production, contributing 54.4% of global production, where it ranks as the second most produced fruit after citrus (Wongwaiwech et al., 2022). Due to its high demand, bananas are extensively cultivated in many tropical and subtropical regions, particularly in Thailand, where over a thousand varieties are currently available (Al-Dairi et al., 2023). Thai Banana, commonly known as Kluai Namwa or *Pisang Awak,* is one of Thailand's most popular native banana cultivars that are widely cultivated across the country for commercial purposes. It is the result of the hybridization of two banana species, which are *Musa acuminata and Musa balbisiana,* classified under the ABB genome cultivar group (Salaemae et al., 2022). Kluai Namwa is highly favored in Thailand, accounting for approximately 70% of the domestic banana market. In addition to its rich nutritional profile, Kluai Namwa is also packed with lots of nutraceuticals, including flavonoids, phenolic compounds, prebiotics, antioxidants, etc (Sidhu & Zafar, 2018).

As climacteric fruit, bananas are highly perishable and have a short shelf life due to their continuous ripening process after harvesting, which results in significant postharvest losses. During the ripening process, the climacteric phase is characterized by physicochemical, biochemical, and organoleptic transformations, affecting the fruit's quality (Arista & Ardiningtyas, 2024). As a key indicator of ripeness, the color changes from green to yellow to brown are connected with the sugars, acids, or other flavor compounds on the banana. The softening process impacted by moisture loss during the ripening stages will also alter the firmness of the banana, causing it to gradually compromise its marketability and consumer acceptance (Sinanoglou et al., 2023). Therefore, to maintain quality and extend the shelf life of bananas, implementing effective preservation strategies is very important.

Edible coating is one of the most widely used solutions for preserving fruits due to its safety and environmental friendliness, proven in several crops, including apples, bananas, strawberries, and many more. Applying a thin layer to the surface of fruit can act as a substitute for its natural waxy coating, helping to extend shelf life by regulating moisture loss, gas exchange, and oxidation prevention (Esyanti et al., 2019). In recent years, chitosan has gained a lot of attention as a promising biomaterial for biocompatible coatings. Chitosan as a coating material is biodegradable, non-toxic, and biocompatible, offering excellent antibacterial and antifungal properties along with selective permeability to O_2 and CO_2 (Barik et al., 2024; Harugade et al., 2023). On the other hand, sericin is a biowaste protein secreted from silkworms during silk production that has antioxidant, bioavailable, biodegradable, pH and temperature-responsive properties, which allow the integration with polymer or other material (Mathew et al., 2024). The combination of sericin, chitosan, and aloe vera has been proven effective in reducing moisture loss, slowing respiration rate, and preventing infection (Kavi et al., 2024). Additionally, a chitosan and sericin (CS-SE) composite developed by Niyaz & Gok (2024) exhibited strong antibacterial properties and high biocompatibility, making it a promising alternative for polymer-based antibacterial materials in functional packaging to enhance product shelf life.

Furthermore, various nanosystems, including nanocomposites, nanoparticles, and nano-emulsions, have been employed to integrate nanotechnology with advancements in coating technology. When materials are reduced to the nanosize, they exhibit distinctive and enhanced properties, allowing for the incorporation of hydrophilic or lipophilic compounds with antioxidant or antibacterial functions (Zambrano-Zaragoza et al., 2018). As a result, combining edible coatings with nanotechnology can effectively reduce surface permeability to water vapor and gases, thereby extending the shelf life of fruits while preserving the desired properties of chitosan-based coatings. This is also supported by Esyanti et al. (2019), which demonstrated that a chitosan nanoparticle coating could delay the ripening process of bananas by 2–3 days.

Therefore, in this research, a chitosan and sericin (CS-SE) nanoparticles mixture was developed and applied as a fruit coating in the Thai Banana (Kluai Namwa) to prolong their shelf life and maintain its quality. A comparative study also evaluated the effects on the physicochemical properties of the Thai bananas (Kluai Namwa) after 7 days of storage.

1.2 Objective

The objectives of this research were:

1. To investigate the chitosan and sericin (CS-SE) nanoparticle-based coating as a post-harvest technique.
2. To evaluate the effect of chitosan and sericin (CS-SE) nanoparticle-based coating on the physicochemical properties of Thai bananas throughout 7 days of storage.

1.3 Hypothesis

The hypotheses of this research were:

1. The chitosan and sericin nanoparticle-based coating will have a uniform and higher porosity as well as improved colloidal stability.
2. H0: The chitosan and sericin (CS-SE) nanoparticle-based coating will not significantly affect the physicochemical properties of Thai banana after 7 days of storage.

   H1: The chitosan and sericin (CS-SE) nanoparticle-based coating will significantly affect the physicochemical properties of Thai banana after 7 days of storage.