Chapter 1

Introduction

1.1 Background

Every year, foodborne bacterial contamination causes millions of diseases and substantial financial losses, making it a major global public health concern (Almaary, 2023). The growth of biofilms, which are organized microbial colonies covered in an extracellular matrix that attach to surfaces including stainless steel, glass, and plastic, is one of the main elements that permits bacterial persistence in food processing environments (Carrascosa et al., 2021). These biofilms reduce the efficacy of conventional sanitation practices by shielding microorganisms, such as *Staphylococcus aureus* and Escherichia coli, from environmental stressors, disinfectants, and antibiotics. As a result, despite stringent cleanliness procedures, foodborne outbreaks connected to biofilm-associated contamination still happen (Ban-Cucerzan et al., 2025).

Chemical disinfectants and synthetic antimicrobials play a major role in current biofilm control efforts. However, long-term and excessive use of these agents has resulted in antimicrobial resistance (AMR) and sparked worries about environmental safety and hazardous residues in food products (Ifedinezi et al., 2024). Previous studies have shown that a number of substances originating from plants, including flavonoids, tannins, and phenolics, have antibacterial and antibiofilm properties (Er-rahmani et al., 2024). However, few studies have evaluated these compounds' cytotoxicity and safety for usage in food applications, and the majority of current research concentrates on their antibacterial rather than antibiofilm properties (Tripathi & Goshisht, 2022).

This gap emphasizes the necessity of investigating natural and safe antibiofilm compounds that can stop bacterial adhesion and biofilm formation on surfaces that come into contact with food. Strong antibiofilm efficacy, low cytotoxicity, and suitability for food applications are ideal characteristics of such agents. The current work suggests evaluating the medicinal plant, Binahong plant extracts, as possible antibiofilm agents against *Salmonella typhimurium* and *Staphylococcus*

aureus in order to address this problem. The extracts will be subjected to antibiofilm tests utilizing the crystal violet microtiter plate method after phytochemical screening to identify important bioactive components. To make sure they are suitable for food-related situations, their safety will be evaluated using food-simulant compatibility tests and MTT cytotoxicity assays on human cell lines.

1.2 Objective

This study aims to examine the cytotoxicity, antibacterial and antibiofilm capabilities of Binahong (*Anredera cordifolia*) extracts against foodborne bacteria, *Salmonella typhimurium* and *Staphylococcus aureus*, for potential food-contact application. The goal of the project is to aid in the creation of safe, sustainable, and natural methods for managing bacterial biofilms in settings connected to food.

1.3 Hypothesis

Binahong (*Anredera cordifolia*) water extract is expected to exhibit no cytotoxicity toward HaCaT cells while demonstrating antibacterial and antibiofilm activities against *Staphylococcus aureus* and *Salmonella typhimurium*. These properties would support its potential as a safe, natural antibiofilm agent for food-contact applications and contribute to improving food safety.