

# CHAPTER I

## INTRODUCTION

### I.1 Research Background

Wounds are a common medical condition experienced by individuals across various settings. They represent a leading cause of global morbidity, with approximately 14 million people suffering from wounds annually, and 80% of these cases occurring in developing countries. Studies further indicate that for every one million individuals who suffer from wounds, at least 10,000 deaths result from microbial infections (Gang et al., 2024). One of the most widely used therapeutic approaches is wound dressing, which serves not only to protect the wound area but also to accelerate tissue regeneration.

An effective wound dressing must be capable of absorbing exudate, exhibit antibacterial properties, and provide an environment conducive to healing (Rousselle et al., 2019). Matrix materials such as hydrogels play a critical role due to their ability to retain large volumes of fluid. The success of such systems is determined not only by the hydrogel matrix but also by the presence of bioactive compounds incorporated within them such as antibacterial, anti-inflammatory, or antioxidant agents—that actively support the wound healing process (Wang et al., 2021).

Hydrogels are three-dimensional hydrophilic polymer networks capable of absorbing large amounts of water without dissolving, making them highly suitable for biomedical applications, including wound dressings. One of the primary natural hydrogel forming materials is cellulose, known for its high absorbency and

structural stability. Cellulose can be derived from various lignocellulosic wastes, including corncobs. Indonesia, as one of the largest corn producers with an annual production capacity of 14.77 million tons, generates substantial quantities of corncob waste approximately 30% of total corn production which remains largely underutilized (Haris et al., 2024; Suwasono et al., 2022). Corncobs contain approximately 34.11% cellulose and other lignocellulosic components, which are potentially valuable as raw materials for hydrogel production (Harini et al., 2020).

The incorporation of bioactive compounds into hydrogels is a crucial step in developing functional wound dressings. One key bioactivity sought is antibacterial activity to prevent infection. In this context, liquid smoke, a byproduct of lignocellulosic biomass pyrolysis, has emerged as a promising candidate. Liquid smoke contains various active compounds, including phenols, carbonyls, and organic acids, known for their antibacterial properties and already applied in various antibacterial systems (Maulina et al., 2020). Therefore, the use of liquid smoke as a bioactive agent in hydrogels represents an innovative approach worthy of further exploration.

Despite the increasing interest in hydrogel-based wound dressings, there remains a limited number of studies focusing on the utilization of agricultural waste-derived cellulose, particularly from corncob biomass, for biomedical applications. Moreover, although the antibacterial potential of liquid smoke has been demonstrated in food preservation and disinfection, its application in wound healing systems, particularly as an active component in hydrogel matrices, is still poorly investigated. Current synthetic hydrogel formulations often involve

expensive, non-renewable materials, which may pose biocompatibility and sustainability concerns. These limitations underscore the need for developing eco-friendly, biocompatible, and cost-effective wound dressings that integrate both absorbent natural polymers and naturally sourced antibacterial agents.

A cellulose-based hydrogel wound dressing derived from corncob and loaded with liquid smoke as a bioactive compound is expected to exhibit high absorbency, biocompatibility, and the ability to absorb wound exudate while inhibiting bacterial growth. This innovation not only addresses medical challenges but also adds value to agricultural waste through the principles of green chemistry and circular economy. The present study is expected to contribute to the development of sustainable health materials and support the Sustainable Development Goals (SDGs), particularly in the areas of health, responsible consumption and production, and industrial innovation.

## **I.2 Research Objectives**

1. To extract and characterize cellulose obtained from corncob.
2. To synthesize and characterize cellulose-based hydrogel derived from corncob.
3. To produce and characterize hydrogel loaded with liquid smoke as a bioactive compound.
4. To analyze the effectiveness of liquid smoke-loaded hydrogel in absorbing wound exudate and inhibiting bacterial growth in vitro.