

## CHAPTER 1: INTRODUCTION

### 1.1. Research Background

Diabetes mellitus is a metabolic endocrine abnormality indicated by hyperglycemia which is attributable to a deficiency in production of the hormone Insulin. Chronic hyperglycemia of diabetes is connected with a range of damage and failure of the heart, nerves, kidneys and blood vessels. Cases of diabetes mellitus are divided into two distinct categories; type 1 diabetes as a result of deficiency in insulin production while type 2 diabetes is prompted by the resistance of insulin action (Mellitus., 2005). One of the debilitating complications of diabetes mellitus is diabetic ulcers which increases the overall morbidity and in extreme conditions may lead to amputation. Regardless of treatment, diabetic foot ulcers readily become chronic wounds. This is deemed threatening as diabetic individuals have a lower healing process due to poor immune system activation hence open wounds can act as paths for pathogens such as *Staphylococcus aureus* (*S.aureus*) to enter the body and bring about infections (Packer., 2021).

Fortunately, the development of diabetes from prediabetes occurs over many years. Studies have strong evidence to support intervention to delay the progression of prediabetes. Randomized trials have established the successful delay of diabetes through lifestyle intervention and modes of pharmacotherapy but management still remains controversial (Aroda et al., 2008).

According to studies, oil extract has been used as a traditional medicine for a variety of human ailments for thousands of years. Natural plant products have been shown to offer a rich source of active chemicals, many of which can be exploited to produce new pharmacological treatments. The fundamental reason for the emphasis on extracting and developing treatments with plant-derived oils is the encouraging results. *Calophyllum inophyllum* or commonly known as Tamanu is found in tropical countries and its oil is utilized as a treatment topically to cure a variety of dermal infections such as diabetic sores, ulcers, eczema, acne, etc. The extraction of tamanu oil from the

fruit kernel of *Calophyllum inophyllum* has a diversity of benefits including antimicrobial, anti-bacterial, anti-fungal, and namely its wound healing properties. Furthermore, constituents in tamanu oil were found to exhibit a high antibacterial activity against pathogens commonly involved in skin infections (Raharivelomanana et al., 2018).

To increase the delivery of these wound healing properties, a wound dressing should be utilized. Recently, biocellulose has been instigated for many applications including wound dressing to develop a favorable environment for quick tissue regeneration, pain reduction and impede infection during the healing process. Due to the advantages it possesses including high biocompatibility, high water uptake capacity and permeability. This makes it an exemplary material for the healing of high exudate wounds. In addition, biocellulose has a high crystallinity content which provides huge mechanical strength (Napavichayanun et al., 2015). Hence the combination of Biocellulose and Tamanu oil has the best potential to induce wound healing in diabetic patients due to the moisture retention of the Biocellulose and the beneficial properties of Tamanu oil.

This study entails the potential wound healing assessment of tamanu oil from *Calophyllum inophyllum* and evaluating its wound healing and antimicrobial activities. The extraction of Biocellulose by growing *Komagataeibacter intermedius* in MRS media and the synthesis of the biocellulose hydrogel is also executed. Diabetic induced mice through intraperitoneal injection (IP) with full thickness dermal wounds are tested and utilized.

## **1.2. Research Objective / Aims**

In this research, we will be discussing the potential wound healing evaluation of Biocellulose Dark Tamanu oil hydrogels through wound measurement and histological skin sample analysis in diabetic induced mice using in vivo studies.

### **1.3. Research Hypothesis**

The hypothesis of this research is that the synthesis of biocellulose-tamanu oil hydrogel as a topical treatment is able to increase the wound healing activities in diabetic wounds.