

UNIVERSITI TEKNOLOGI MARA

**ANTIBIOFILM AND
ANTIBACTERIAL ACTIVITIES OF
Swietenia macrophylla METHANOLIC
EXTRACT (SMME) AGAINST
GRAM-POSITIVE BACTERIA**

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ABSTRACT

Gram-positive bacteria are responsible for 62% - 76% of all bloodstream infections in human. They can cause infections such as skin infections, pneumonia, sinusitis and anthrax. Some of these bacteria are able to form biofilm, causing serious impact in health as biofilm is known to be difficult to eradicate as they are more resistant to kill when treated with antibiotics. *Swietenia macrophylla* is a medicinal plant that had been used by folks to treat some diseases like fever and diarrhoea could be an excellent source drug to fight off this problem. The objectives of this research were to investigate phytochemical profile, antibacterial activity and antibiofilm activity of *Swietenia macrophylla* methanol extract (SMME). The phytochemical profile was analysed by Gas Chromatography Mass Spectrometry (GC-MS). The antibacterial and antibiofilm activities of SMME were assessed against four Gram-positive bacteria namely *Staphylococcus aureus* ATCC 33862, *Streptococcus pneumoniae* ATCC 19615, *Bacillus cereus* ATCC 11778 and *Clostridium sporogenes* ATCC 13124 by minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) and biofilm assay respectively. Time kill assay was performed to further investigate the antibiofilm activity of selected test concentration against the microorganisms. Phytochemical screening revealed the presence of six compounds in the SMME. The major compound was β -amyrin (22.8%). SMME showed the lowest minimum inhibitory concentration (MIC) values against *B. cereus* (31.25 $\mu\text{g/ml}$) and *C. sporogenes* (31.25 $\mu\text{g/ml}$) and the lowest minimum bactericidal concentration (MBC) value against *S. aureus* (1000 $\mu\text{g/ml}$). Meanwhile, the SMME significantly ($p < 0.05$) inhibited all the biofilms. It promoted the biofilm inhibition formation during early hours and started to inhibit after twelve hours. Biofilm inhibitory concentration (BIC_{50}) revealed *B. cereus* exhibited the highest activity. The present study confirmed the efficacy of SMME as antibacterial agent and suggested the possibility of employing SMME in drug for the treatment of infectious diseases caused by the tested bacteria. In conclusion, the bioactive compounds which are present in SMME may play an important roles in antibacterial and antibiofilm activity against Gram-positive bacteria.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Medicinal plant refers to any plant that contain beneficial substances in one or more of its organs that can be used for therapeutic purposes or forerunner for the synthesis of useful drug (Sofowora *et al.*, 2013). There are approximately 50,000 of plants species with medical uses and World Health Organization (WHO) estimated that 80% of the population of developing countries used traditional medicine as their main source of medicine (Tejada *et al.*, 2021). One of the most popular medicinal plant used is *Swietenia macrophylla*. *S. macrophylla* or also known as “pokok tunjuk langit” is a flowering plant that consists of trees and shrubs. It is distributed from Mexico to Bolivia and central Brazil (Krisnawati, 2011). Grogan and Barreto (2005) reported *S. macrophylla* had been listed by The Convention on International Trade in Endangered Species of Wild Fauna and Flora as a species that faces extinction. In recent studies showed that *S. macrophylla* had significant value and benefits in phytochemical due to its variety of biological activities its presents (Moghamtousi, 2013). According to Ayyappadhas *et al.* (2012), the phytochemical of *S. macrophylla* consist of alkaloids, terpenoids, antraquinones, cardiac glycosides, saponins, phenols, flavonoids, volatile oils, phospholipid and long chain unsaturated acid. Karande *et al.* (2016) stated that bioactive compounds that present in plants are useful for healing and treatment human diseases. Therefore, due to the rich phytochemical compounds in *S. macrophylla* many people use this plant to cure some diseases. Maiti *et al.* (2007) reported that the seed of *S. macrophylla* has significant antimicrobial activity. It is also proven by Ayyadhas *et al.* (2012) that *S. macrophylla* ethanolic and petroleum ether leaves extract possess good antibacterial activity against *Esherichia coli*, *Pseudomonas aeruginosa* and *Bacillus subtilis* due to the presence of phytochemical flavonoids, alkaloid terpenoids and tannins. Hence, it is showed that *S. macrophylla* are proven to be a very useful medicinal plant with potential antibacterial properties particularly the leaves part.

One of the main health problems occur worldwide is due to diseases transmitted by microbes such as bacteria and fungi. *Staphylococcus aureus*, *Streptococcus pneumonia*,