



Phytochemical Screening and Biological Activities of *Swietenia macrophylla* (Tunjuk Langit)

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ABSTRACT

The aims of this research were to extract phytochemicals and to screen antioxidant and antibacterial activities of the leaves of *Swietenia macrophylla*. Extraction by cold maceration method was done for 72 hours using three different solvent, petroleum ether (PE), ethyl acetate (EA) and methanol (MeOH). The highest extraction yield was shown by the methanol extract with percentage of 11.11%. The phytochemical screening analysis was done on each extract and confirmed the presence of secondary metabolites including alkaloids, phenols, saponins, terpenoids, steroids and flavonoids in the leaves of *S. macrophylla*. Disc diffusion method was used to determine the antibacterial activities of crude extracts using four pathogenic bacteria, *Bacillus cereus*, *Staphylococcus aureus*, *Salmonella typhi* and *Escherichia coli*. It was found that ethyl acetate extract exhibited the strongest antibacterial activity with zone inhibition of 16.07 mm compared to the other extracts against tested bacteria. Meanwhile for antioxidant study, DPPH radical scavenging assay was used to determine antioxidant activity of the crude extracts. It was shown that methanol extract exhibited the highest antioxidant activity with IC₅₀ value of 85.32 µg/mL. The results of this study concluded that *Swietenia macrophylla* leaves extract contains medicinally important bioactive compounds with efficient biological activities and have a potential as antibacterial and antioxidant agents for pharmaceutical purpose.

KEYWORDS: *Swietenia macrophylla*, Phytochemical, Antibacterial, Antioxidant, Pharmaceutial

1 INTRODUCTION

The pharmacological activity in plant-derived natural product, especially secondary metabolites can act as an active components for modern medicines and play a critical role in the advancement of pharmacological industries aside from being a crucial element in maintaining human health [1]. Medicinal plants contain organic compounds which could produce definite physiological effect on the human body. These biological substances could

include tannins, alkaloids, terpenoids, steroids and flavonoids [2]. *Swietenia* is a genus in the Meliaceae family. This genus is natively grown in the Neotropics, from Southern Florida, Brazil, Mexico and Central America to Bolivia [3]. Three species of *Swietenia* genus which are *S. macrophylla*, *S. humilis* and *S. mahogani* were introduced into several Asian countries such as West India, Malaysia and Southern China [4]. The mahogany tree *S. macrophylla*, also called “sky fruit” due to the upward direction of its fruits towards the sky. *S. macrophylla* is a big-sized deciduous tree with height of 40–60 meters and trunk diameter up to 4 meters. It has been universally used as a traditional remedies to treat numerous illnesses such as diarrhea, fevers, hypertension and diabetes [5]. In this study, the phytochemical screening was done on *S. macrophylla* extracts in order to detect the presence of secondary metabolites such alkaloids, saponins, flavonoids, terpenoids, phenols and steroids. The screening of antibacterial and antioxidant activity of *S. macrophylla* extracts were also done.

2 OBJECTIVE

To investigate the potential of *S. macrophylla* as antibacterial and antioxidant agents for pharmaceutical purpose by conducting the preliminary analysis on the phytochemical screening and biological activities (antibacterial and antioxidant) of the *S. macrophylla* extracts.

3 SIGNIFICANCE (S)

The existence of the secondary metabolites in *S. macrophylla* extracts which were detected by phytochemical analysis may be useful as the preliminary step for further isolation of plant-derived natural product. Moreover, the result of *S. macrophylla* extracts on the antibacterial and antioxidant activity can provide initial information or data to find a natural antioxidant that can replace the usage of synthetic antioxidants. Finally, this study can give an extra knowledge to the pharmaceutical industries in medicinal development.

4 METHODOLOGY/TECHNIQUE

Plant Extraction

S. macrophylla leaves were collected from Puncak Alam, Selangor. Leaves were washed, shade dried, macerated and extracted with petroleum ether, ethyl acetate and methanol for 48 hours. The extracts were filtered through a filter paper and concentrated using rotary evaporator to obtain the crude extract.

Phytochemical Screening

Chemical tests for the screening and identification of bioactive chemical constituent such as alkaloid, flavonoid, phenols, saponins, terpenoids and steroid on *S. macrophylla* extracts were carried out by using standard procedure in [6].

Antibacterial Assay

The antibacterial activity of the crude extracts of *S. macrophylla* was determined using disc diffusion method with slightly modification [2]. The activity was tested against two Gram-positive bacteria, *B. cereus* and *S. aureus* as well as two Gram-negative bacteria, *E. coli* and *S. typhi*.

Antioxidant Assay

DPPH radical scavenging assay was utilized to determine the antioxidant activity of *S. macrophylla* with some modifications [7]. Each sample (1.0 mg) was dissolved in methanol (1 mL) to obtain a stock solution with concentration of 1000 µg/mL. A series of diluted solutions were prepared from the stock solution with methanol starting from 1000, 500, 250, 125, 62.5, 31.3, 15.63 and 7.81 µg/mL. The sample solutions with various concentrations (0.2 mL) were mixed with 3.8 mL of methanolic DPPH solution (50 µM). The mixture was incubated for 30 minutes at room temperature in the dark. After 30 minutes, the absorbance of the reaction mixture was recorded at 517 nm.

5 RESULT

Phytochemical screening of *S. macrophylla* extracts

S. macrophylla contains many active compounds such as alkaloids, flavonoids, steroids, phenols, saponins and terpenoids. In this study, phytochemical screening was carried out to detect the presence of secondary metabolites in three leaf extracts which were petroleum ether, ethyl acetate and methanol. Table 1 shows the result of the phytochemical analysis of those extracts.

Table 1: Phytochemical analysis of leaves extract of *S. macrophylla*

Group of phytochemicals	Petroleum ether extract	Ethyl acetate extract	Methanol extract
Alkaloids	+	+	+
Flavonoids	+	+	+
Phenols	-	-	+
Saponins	-	+	+
Terpenoids	-	+	+
Steroids	+	+	+

+: present ; -: absent

According to the result, alkaloids and flavonoids can be found in all of the three extracts. Moreover, the appearance of saponins and terpenoids can be found in methanol and ethyl acetate extracts. However, these groups of compounds were absent in petroleum ether extract.

Antibacterial Activity

The diameter of the inhibition zone for each extract was measured. Table 2 showed that ethyl acetate extract gave the greatest inhibition zones against *S. aureus* with a diameter of 16.07 mm compared to other extracts. In contrast, there was no inhibition zone observed for petroleum ether extract against *S. typhi*.

Table 2: Inhibition zone (mm) of each extract against tested bacteria

Type of bacteria	PE extract (mm)	EA extract (mm)	MeOH extract (mm)	Streptomycin ^a (mm)
<i>B. cereus</i>	7.20 ± 0.05	12.13 ± 0.07	7.13 ± 0.17	17.20 ± 0.20
<i>S. aureus</i>	7.33 ± 0.08	16.07 ± 0.13	14.01 ± 0.11	18.07 ± 0.13
<i>S. typhi</i>	-	14.24 ± 0.12	10.05 ± 0.13	13.02 ± 0.24
<i>E. coli</i>	7.23 ± 0.03	10.13 ± 0.09	10.03 ± 0.10	16.05 ± 0.15

Data represent mean ± standard deviation of three replicate experiments; Inhibition zone diameter (mm) including diameter of disc 6 mm; ^aPositive control

Antioxidant Activity

Based on Table 3, the methanol extract showed the highest antioxidant activity with IC₅₀

value of 85.32 $\mu\text{g/mL}$ followed by the ethyl acetate extract with IC_{50} value of 387.18 $\mu\text{g/mL}$.

Table 3 Percentage inhibition and IC_{50} value of *S. macrophylla*

Extract	% inhibition at 1000 ($\mu\text{g/mL}$)	IC_{50} ($\mu\text{g/mL}$)
Petroleum ether	11.16 \pm 0.09	ND
Ethyl acetate	59.40 \pm 0.34	387.18 \pm 0.96
Methanol	92.56 \pm 0.42	85.32 \pm 0.94
Ascorbic acid	97.50 \pm 0.16	49.42 \pm 0.08

Notes; ND: Non determined

6 CONCLUSION

Phytochemical screening analysis revealed the presence of alkaloids, flavonoids, phenols, saponins, terpenoids and steroids in the leaves of *S. macrophylla*. Methanol extract demonstrated the highest DPPH radical scavenging activity compared to the other extracts with IC_{50} value of 85.32 $\mu\text{g/mL}$ meanwhile ethyl acetate extract gave the highest antibacterial activity against *S.aureus* with diameter of inhibition 16.07 mm. The results showed that the leaves extract of *S. macrophylla* have a potential as antibacterial and antioxidant agents for pharmaceutical purpose.

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