ANTIOXIDANT AND ANTIMICROBIAL ACTIVITIES OF *SONNERATIA ALBA IN VITRO* AND *IN VIVO*: COMPARATIVE STUDY WITH *RHIZOPHORA MUCROANTA* AND *BRUGUIERA GYMNORRHIZA*.

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Abstract

The present study evaluated the antioxidant and antimicrobial potential of three mangrove species namely, *Sonneratial alba*, *Rhizophora mucronat* and *Bruguiera gymnorrhiza*. The bioactivities of methanol, ethanol and chloroform extracts of in vivo and in vitro explants of *S. alba* and in vivo explants of *R. mucronata* and *B. gymnorrhiza* were evaluated. The effects of growth regulators on seed germination of *S. alba*, to obtain the in vitro explants, were also studied. In the first part of bioactivity study, total phenolic contents were detected by using the Folin-ciocalteu assay. Ethanol extract of leaves of *R. mucronata* had the highest result for total phenolic content as 358.6 ± 0.53 mg of GAE/g of dry sample. Both enzymatic and non-enzymatic antioxidant assays were used to examine the potential of antioxidant activities of all tested samples. Ethanol and methanol extracts of barks showed better antioxidant activities compared to the leaves. Chloroform extracts in both leaf and bark samples exhibited poor antioxidant activities for all selected mangrove plants.

Disc diffusion method was used to detect the antimicrobial activity of the extracts of all three plants. Two gram positive (*Bacillus cereus* and *Staphylococcus aureus*) and two gram negative (*Escherichia coli* and *Pseudomonas aeruginosa*) bacterial pathogens were used to evaluate antimicrobial activity. Methanol and ethanol extracts of leaves and barks showed promising antimicrobial activities when tested for all four abovementioned bacterial pathogens. Nevertheless, chloroform extracts exhibited poor or no antimicrobial activities against all tested microbial.

Ethanol extract of barks of *S. alba* was fractionated into water and ethyl acetate fraction, and their antioxidant and antimicrobial activities were assessed. Water fraction exhibited better bioactive potential compared with ethyl acetate fraction. Liquid chromatography

tandem mass spectrometry (LCMS/MS) analysis was also carried out with water fraction to obtain the nominal mass of the major active components in the water fraction.

Abstrak

Dalam kajian ini, potensi antioksida dan antimikrob telah dinilai daripada tiga species bakau iaitu *Sonneratia alba*, *Rhizophora mucronata* dan *Gymnorrhiza bruguiera*. Yang bioactivities metanol, etanol dan ekstrak kloroform in vivo dan dalam eksplant vitro *S. alba* dan dalam eksplant vivo tannin *R. mucronata* dan *B. gymnorrhiza* telah dinilai. Kesan pengawal selia pertumbuhan dikaji dari segi percambahan benih *S. alba* untuk mendapatkan eksplant dalam vitro. Dalam menggunkan asai Folin-Ciocalteu. Ekstrak etanol daun tanin *R. mucronata* mympunyai hasil tertinggi bagi kandungan jumlah fenol sebagai 358.6 ± 0.53mg GAE/g sampel kering. Kedua-dua ujian antioksidan enzim dan bukan-enzim digunakan untuk memeriksa potensi aktiviti antioksidan semua sampel yang diuji. Etanol dan metanol ekstrak kulit menunjukkan aktiviti antioksidan yang lebih baik berbanding dengan duan. Ekstrak kloroform dalam kedua-dua duan dan kulit kayu sampel menunjukkan aktiviti antioksidan yang miskin untuk semua tumbuh-tumbuhan kakau.

Resapan cakera kaedah telah digunakan untuk mengesan aktiviti antimikrob ekstrak ketiga-tiga loji. Dua gram positif (*B. cerues* & *S. aureus*) dan dua gram negative (*E. coli* & *P. aeruginosa*) pathogen bacteria telah digunakan untuk menilai aktiviti. Metanol dan etanol ekstrak daun dan kulit kayu menunjukkan aktiviti antimikrob menjanjikan terhadap semua pathogen bacteria 4. Ekstrak kloroform mempamerkan miskin atau tiada aktiviti antimikrob terhadap mikrob semua diuji.

Ekstrak etanol kulit kayu *S. alba* adalah berperingkat ke dalam air dan pecahan etil asetat dan dinilai juga antioksidan dan aktiviti antimicrobial. Pecahan air mempamerkan potensi bioaktif yan lebih baik berbanding dengan pecahan etil asetat. Kromatogrfi cecair sejajar spektrometri jisim (LCMS/MS) analisis telah dijalankan dengan pecahan air untuk mangetahui jisim nominal komponen aktif yang utama dalam pecahan air.

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Md. Imdadul Haq

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ABTS	2, 2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid)
AST	Aspartate Aminotransferase
BAP	6-Benzylaminopurine
BHA	Butylated hydroxyanisole
CB	Chloroform extract of Barks
CL	Chloroform extract of Leave
CV	Chloroform extract of In vitro explants
DMSO	Dimethyl Sulphoxide
DNA	Deoxyribonucleic Acid
DPPH	1, 1-diphenyl-2-picrylhydrazyl
EB	Ethanol extract of Barks
EL	Ethanol extract of Leave
EV	Ethanol extract of In vitro explants
FRAP	Fluorescence Recovery after Photobleaching
GA	Gibberellic Acid
GAE	Gallic Acid Equivalents
HIV	Human Immunodeficiency Virus
IC_{50}	The half maximal Inhibitory Concentration
LC-MS	Liquid Chromatography-mass Spectrometry
LCMS/MS	Liquid Chromatography Tandem Mass Spectrometry
MB	Methanol extract of Barks
MIC	Minimal Inhibitory Concentration
ML	Methanol extract of Leave
MS	Murashige and Skoog

MSMS	Tandem mass spectrometry
MV	Methanol extract of In vitro explants
OD	Observer-Dispatch
ROS	Reactive Oxygen Species
SD	Standard Deviation
SOD	Superoxide Dismutase
TBHQ	Tert-butylhydroquinone
TCA	Trichloroacetic Acid
WHO	World Health Organization
WPM	Woody Plant Medium
WST	Water-soluble tetrazolium salt