

**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, *Sonneratia alba*, *Rhizophora mucronata* 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 antioksidan 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 menggunakan asai Folin-Ciocalteu. Ekstrak etanol daun tanin *R. mucronata* mempunyai hasil tertinggi bagi kandungan jumlah fenol sebagai 358.6 ± 0.53 mg 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 yang lebih baik berbanding dengan pecahan etil asetat. Kromatografi cecair sejajar spektrometri jisim (LCMS/MS) analisis telah dijalankan dengan pecahan air untuk mengetahui jisim nominal komponen aktif yang utama dalam pecahan air.

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Table of content:

Abstract	i
Acknowledgement	iv
List of Tables	x
List of Figures	xi
Chapter 1: Introduction	1
1.1. Mangroves: An overview	1
1.2. Mangrove in Malaysia:	2
1.3. Environmental and economic importance of the mangroves:	3
1.4. Objectives of research:	4
Chapter 2: Literature review:	6
2.1. Medicinal plants:	6
2.1.1. Medicinal properties in plants:	7
2.1.2. Plants selection for medicinal properties discovery:	8
2.2. Phenolic components in plants:	10
2.3. Mangroves:	12
2.3.1. Mangroves as unconcerned genera:	12
2.3.2. Potentials of mangroves:	13
2.3.3. Medicinal potentials of mangroves:	14
2.4. Taxonomy of mangroves:	15
2.5. <i>Sonneratia alba</i> :	16
2.5.1. Morphology of <i>S. alba</i> :	16
2.5.2. Traditional uses of <i>S. alba</i> :	17
2.6. <i>Rhizophora mucronata</i> :	18
2.6.1. Morphology of <i>R. mucronata</i> :	18
2.6.2. Traditional uses of <i>R. mucronata</i> :	19
2.7. <i>Bruguiera gymnorrhiza</i> :	20
2.7.1. Morphology of <i>B. gymnorrhiza</i> :	20
2.7.2. Traditional uses of <i>B. gymnorrhiza</i> :	21
2.8. Tissue culture and plant growth regulators:	22

2.8.1. Tissue culture in plant development:-----	22
2.8.2. Growth regulators in plant development:-----	23
2.8.3. Tissue culture in mangrove plants: -----	24
2.9. Oxidative and oxidative stress: -----	25
2.10. Antioxidants: -----	26
2.10.1. Definition: -----	26
2.10.2. Mechanism of antioxidants:-----	26
2.10.3. Plant derived antioxidants: -----	29
2.10.4. Antioxidant derived from mangrove plants:-----	32
2.10.5. Methods for determination of antioxidant activity:-----	33
2.11. Antimicrobial:-----	34
2.11.1. Antimicrobial agent: -----	34
2.11.2. Plants as a natural source of antimicrobial components: -----	36
2.11.3. Mangrove as a source of antimicrobial activity: -----	37
2.12. Antimicrobial susceptibility test:-----	38
2.13. Bio-assay guided fractionation: -----	40
2.14. LCMS/MS analysis:-----	40
Chapter-3: Materials and methods -----	42
3.1. Plant material: -----	42
3.1.1. Plant sample collection: -----	42
3.2. Plant sample preparation: -----	42
3.2.1. In vivo plant sample preparation:-----	42
3.2.2. In vitro plant sample preparation: -----	42
3.2.2.1. Maturation of fruits: -----	42
3.2.2.2. Sterilization of seeds:-----	42
3.2.2.3. Culture of seeds: -----	43
3.2.2.4. Sample preparation for bioactivity: -----	43
3.3. Extraction: -----	44
3.3.1. In vivo sample extraction: -----	44
3.3.2. In vitro sample extraction:-----	44
3.4. Determination of Total Phenolic Contents: -----	44

3.4.1. Preparation of reagent: -----	44
3.4.1.1. Galic Acid stock Solution:-----	44
3.4.1.2. Sodium Carbonate Solution: -----	44
3.4.2. Protocol:-----	45
3.5. Antioxidant activities: -----	45
3.5.1. Superoxide Dismutase (SOD) Assay:-----	45
3.5.1.1. Equipment required:-----	45
3.5.1.2. Preparation of working solutions: -----	45
3.5.1.3. General protocol:-----	46
3.5.2. Scavenging activity on 1, 1-diphenyl-2-picrylhydrazyl (DPPH) radicals: -----	47
3.5.2.1. Preparation of DPPH solution:-----	47
3.5.3. Determination of IC50 Value in DPPH assay:-----	49
3.5.3.1. Sample preparation: -----	49
3.5.4. Reducing Power Assay:-----	50
3.5.4.1. Chemical preparation:-----	50
3.5.4.2. Protocol:-----	50
3.6. Antimicrobial Activity: -----	51
3.6.1. Bacterial pathogen: -----	51
3.6.2. Sensitivity test: -----	51
3.6.2.1. Media preparation:-----	51
3.6.2.2. Extracts Preparation: -----	51
3.6.2.3. Bacterial suspension preparation: -----	52
3.6.2.4. Discs extract preparation:-----	52
3.6.2.5. Sensitivity test protocol: -----	52
3.7. LCMS/MS analysis of water fraction: -----	53
Chapter-4: Results -----	61
4.1. Effect of different hormones and medium on seed germination of <i>Sonneratia alba</i> : 61	
4.2. Total phenolic contents and the antioxidant activity of <i>Sonneratia alba</i> : -----	65
4.3. Antimicrobial activity of <i>Sonneratia alba</i> :-----	69
4.4. Total phenolic contents and antioxidant activity of <i>Rhizophora mucronata</i> : -----	70
4.5. Antimicrobial activity of <i>R. mucronata</i> :-----	73

4.6. Total phenolic contents and antioxidant activity of <i>Bruguiera gymnorrhiza</i> : -----	74
4.7. Antimicrobial activity of <i>Bruguiera gymnorrhiza</i> :-----	77
4.8. Bioactivity of fractionated ethanol extract of <i>Sonneratia alba</i> : -----	78
4.9. The liquid chromatography tandem mass spectrometry (LCMS/MS) analysis of Water fraction:-----	81
Chapter-5: Discussion -----	91
5.1. Effects of hormones on seed germination of <i>Sonneratia alba</i> :-----	91
5.2. Total phenolic contents:-----	92
5.3. Bioactivity of mangrove plants: -----	93
5.4. Total phenolic content of <i>Sonneratia alba</i> : -----	94
5.5. Bioactivity of <i>Sonneratia alba</i> : -----	95
5.5.1. IC50 value of <i>Sonneratia alba</i> in DPPH assay: -----	95
5.5.2. SOD assay of <i>Sonneratia alba</i> : -----	96
5.5.3. Reducing Power assay of <i>Sonneratia alba</i> : -----	96
5.5.4. Antimicrobial activity of <i>Sonneratia alba</i> :-----	97
5.6. Total phenolic content of <i>Rhizophora mucronata</i> :-----	97
5.7. Bioactivity of <i>Rhizophora mucronata</i> :-----	98
5.7.1. SOD assay of <i>R. mucronata</i> : -----	99
5.7.2. DPPH assay of <i>R. mucronata</i> : -----	99
5.7.3. Reducing power assay of <i>R. mucronata</i> : -----	100
5.7.4. Antimicrobial activity of <i>R. mucronata</i> :-----	100
5.8. Total phenolic content of <i>Bruguiera gymnorrhiza</i> : -----	100
5.9. Bioactivity of <i>Bruguiera gymnorrhiza</i> :-----	101
5.9.1. SOD assay of <i>B. gymnorrhiza</i> :-----	102
5.9.2. DPPH assay of <i>B. gymnorrhiza</i> : -----	102
5.9.3. Reducing power assay of <i>B. gymnorrhiza</i> : -----	102
5.9.4. Antimicrobial activity of <i>B. gymnorrhiza</i> : -----	103
5.10. Bioactivities of fractionated ethanol extract of <i>Sonneratia alba</i> :-----	103
5.10.1. SOD activity of the fractionated ethanol extract of <i>Sonneratia alba</i> : -----	104
5.10.2. Reducing Power Assay of the Fractionated Ethanol Extract of <i>Sonneratia alba</i> : -----	104

5.10.3. IC ₅₀ Value in DPPH Assay of the Fractionated Ethanol Extract of <i>Sonneratia alba</i> : -----	104
5.10.4. Antimicrobial activity of the fractionated ethanol extract of <i>Sonneratia alba</i> : -----	104
5.11. LCMS/MS analysis of active fraction of the fractionated ethanol extract of <i>Sonneratia alba</i> : -----	104
Chapter 6: Conclusion and recommendation of research -----	106
6.1. Conclusion: -----	106
6.2. Recommendation of the research: -----	108
References: -----	109
Appendix A -----	124
Appendix B -----	125
Appendix C -----	126

List of Tables

Table 1.1: Taxonomy of mangrove	16
Table 3.1: Amount of each solution for sample, blank 1, 2, 3	47
Table-3.2: Reaction mixture of ascorbic acid, DPPH and DMSO for DPPH assay.	48
Table 3.3: Reaction mixtures for positive extracts, DPPH and DMSO	49
Table 4.1: Total phenolic contents of in vivo and in vitro explants of ethanol, methanol and chloroform extracts of <i>Sonneratia alba</i>	66
Table 4.2: IC50 value of in DPPH assay of methanol ethanol and chloroform extracts of in vivo and in vitro explants of <i>Sonneratia alba</i>	68
Table 4.3: antimicrobial activity of methanol, ethanol and chloroform extracts of in vivo and in vitro explants of <i>Sonneratia alba</i>	69
Table 4.4: Total phenolic contents of methanol, ethanol and chloroform extracts of leaves and barks of <i>Rhizophora mucronata</i>	71
Table 4.5: The antimicrobial activity of methanol, ethanol and chloroform crude extracts of leaves of barks of <i>Rhizophora mucronata</i>	74
Table 4.6: Total phenolic contents of methanol, ethanol and chloroform extracts of leaves and barks of <i>Burguiera gymnorhiza</i>	75
Table 4.7: Antimicrobial activity of methanol, ethanol and chloroform crude extracts of leaves and barks of <i>Bruguiera gymnorhiza</i>	78
Table 4.8: IC50 value of in DPPH assay of water and ethyl acetate fraction of fractionated ethanol extract of <i>Sonneratia alba</i>	80
Table 4.9: antimicrobial activity of water and ethyl acetate fraction of fractionated ethanol fextract of <i>Sonneratia alba</i>	81

List of Figures

Figure 2.1: Benefit of antioxidants in our body system -----	27
Figure 3.1: Picture showing- Leaves of <i>Sonneratia alba</i> (1), Leaf of <i>Rhizophora mucronata</i> (2), Leaves of <i>Bruguiera gymnorrhiza</i> (3) and Bark of <i>Sonneratia alba</i> (4). -----	56
Figure 3.2: Picture showing-Stem of <i>Rhizophora mucronata</i> (1), Fruits of <i>Sonneratia alba</i> (2), Stem of <i>Bruguiera gymnorrhiza</i> (3),.....	57
Figure 3.3: The flow chart of in vitro seed germination methods of <i>Sonneratia alba</i> . ----	58
Figure 3.4: The flow chart of the methods of antioxidant and antimicrobial activities of crude extracts of <i>Sonneratia alba</i> , <i>Rhizophora mucronata</i> and <i>Bruguiera gymnorrhiza</i> .--	59
Figure 3.5: The flow chart of the methods of fractionation of the active crude extract into polar, semi-polar and non-polar fractions.-----	60
Figure 4.1: Seed germination of <i>Sonneratia alba</i> in different medium with BAP in concentration of 100ppm, 500ppm and 1000ppm. -----	62
Figure 4.2: Seed germination of <i>Sonneratia alba</i> in different medium with GA ₃ in concentration of 100ppm, 500ppm and 1000ppm. -----	62
Figure 4.3: Seed germination of <i>Sonneratia alba</i> in different medium with Kinetin at the concentration of 100ppm, 500ppm and 1000ppm. -----	63
Figure 4.4: Seed germination of <i>Sonneratia alba</i> in different medium with different hormone at the concentration of 100ppm, 500ppm and 1000ppm. -----	63
Figure 4.5: Different stage of Seed germination of <i>S. alba</i> with different hormones..-----	64
Figure 4.6: Antioxidant activity of ethanol, methanol and chloroform extracts of in vivo and in vitro explants of <i>Sonneratia alba</i> using SOD activity assay presented as inhibition rate. BHA was used as the positive control. Samples presented with different alphabetic letters are significantly different (p<0.05). -----	67
Figure 4.7: Antioxidant activity of ethanol, methanol and chloroform extracts of in vivo and in vitro explants of <i>Sonneratia alba</i> using reducing power assay presented. -----	67
Figure 4.8: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Rhizophora mucronata</i> using SOD activity assay presented as inhibition rate. BHA was used as the positive control. Samples presented with different alphabetic letters are significantly different (p<0.05).-----	72
Figure 4.9: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Rhizophora mucronata</i> using Reducing Power assay-----	72
Figure 4.10: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Rhizophora mucronata</i> using DPPH activity assay presented as inhibition rate. BHA was used as the positive control. Samples presented with different alphabetic letters are significantly different (p<0.05). -----	73

Figure 4.11: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Bruguiera gymnorrhiza</i> using SOD activity assay presented as inhibition rate. BHA was used as the positive control. Samples presented with different alphabetic letters are significantly different ($p < 0.05$). -----	76
Figure 4.12: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Bruguiera gymnorrhiza</i> using Reducing Power assay -----	76
Figure 4.13: Antioxidant activity of methanol, ethanol and chloroform extracts of leaves and barks of <i>Bruguiera gymnorrhiza</i> using DPPH activity assay presented as inhibition rate. Ascorbic acid was used as the positive control. Samples presented with different alphabetic letters are significantly different ($p < 0.05$). -----	77
Figure 4.14: Antioxidant activity of water and ethyl acetate fraction of fractionated ethanol extract of <i>Sonneratia alba</i> using SOD activity assay presented as inhibition rate. BHA was used as the positive control. Samples presented with different alphabetic letters are significantly different ($p < 0.05$). -----	79
Figure 4.15: Antioxidant activity of water and ethyl acetate fraction of fractionated ethanol extract of <i>Sonneratia alba</i> using reducing power assay. -----	80
Figure 4.16: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 456.....	82
Figure 4.17: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 452.....	83
Figure 4.18: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 331	84
Figure 4.19: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 480.....	85
Figure 4.20: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 345	86
Figure 4.21: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 494	87
Figure 4.22: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 473.....	88
Figure 4.23: Fragmentation pattern from MS/MS spectrum of the major peak with m/z value 464.....	89
Figure 4.24: Pictures shows- no inhibition zone (1) and inhibition zone against bacterial pathogen.....	90

List of abbreviation

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 Equivalent
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