

ANTI-CHOLINERGIC AND ANTIMICROBIAL PROPERTIES  
OF MANGROVE PLANT *Avicennia lanata*

NOR EMERA BINTI MOHAMED NAPIAH

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**ANTI-CHOLINERGIC AND ANTIMICROBIAL PROPERTIES OF  
MANGROVE PLANT *Avicennia lanata***

**By**

**Nor Emera Binti Mohamed Napiah**

**Research Report submitted in partial fulfillment of**

**the requirement for the degree of**

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SCHOOL OF MARINE SCIENCE AND ENVIRONMENT  
UNIVERSITI MALAYSIA TERENGGANU

DECLARATION AND VERIFICATION REPORT

FINAL YEAR RESEARCH PROJECT

It is hereby declared and verified that this research report entitled Anti-cholinergic and Antimicrobial Properties of Mangrove Plant *Avicennia lanata* by Nor Emera Binti Mohamed Napiah, Matric No. UK24873 have been examined and all errors identified have been corrected. This report is submitted to the School of Marine Science and Environment as partial fulfillment towards obtaining the Degree in Bachelor of Science (Marine Biology), School of Marine Science and Environment, Universiti Malaysia Terengganu.


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## LIST OF ABBREVIATIONS

°C	-	degree Celsius
ml	-	milliliter
g	-	Gram
g/ml	-	gram/milliliter
mg/ml or mg ml <sup>-1</sup>	-	milligram/milliliter
µg/ml or µg ml <sup>-1</sup>	-	microgram/milliliter
M	-	Molarity
mM	-	millimolar
µl	-	microliter
nm	-	nanometer
U	-	Unit
U/ml	-	Unit/milliliter

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## ABSTRACT

*Avicennia lanata* is commonly known as grey mangroves or white mangroves which classified in the family of Avicenniaceae. Several researches were conducted on its closely related species *Avicennia marina* but there is no or few being carried out on *A. lanata*. The leaf, bark and root part of this plant has been extracted sequentially using dichloromethane, ethyl acetate and methanol respectively. Each of the extracts is tested for its anti-cholinergic and antimicrobial properties. Two major active compounds (phenols/tannins and saponins) were observed in the root extracts which also contained glycosides and freeze dried leaf extract with alkaloid compounds. The highest anticholinesterase (AChE) enzyme activity is showed by freeze dried leaf extract with 86.22% of AChE enzyme inhibition then followed with 73.37% and 71.73% from methanol root extract and ethyl acetate root extract respectively at concentration of 2.5µg/ml. Antibacterial activities in disc-diffusion assay were expressed as the ratio of the inhibition zone produced by the sample extracts to the inhibition zone produced by the control, gentamicin. Bigger ratio gives better activities. Two Gram-positive bacteria (*Bacillus cereus* and *Staphylococcus aureus*), and three Gram-negative bacteria (*Escherichia coli*, *Salmonella typhi* and *Kleibsiella pneumoniae*) were tested. Ethyl acetate root extract are able to inhibit about 40% of the bacterial activities. Active compounds in root and leaf extracts increases with increasing polarity of solvents but active compounds in bark extracts increased with decreasing polarity of solvents. About 60% of the plant extracts showed MIC value <1.5mg/ml that gives highest antimicrobial activities in the MIC assay. Most of the extracts have low activities against Gram-negative bacteria compared to high

activities against Gram-positive bacteria but all of the extracts possessed antibacterial activities against both Gram-positive and Gram-negative bacterial strains. The freeze dried leaf extract showed the highest percentage of inhibition against acetylcholinesterase enzyme activities followed by root of methanol extract and ethyl acetate extract respectively. Root extracts has shown that the root of *A. lanata* is the most active parts to inhibit bacterial growth activities in disc-diffusion while the methanol extracts of *A. lanata* showed to have exhibited considerable antimicrobial activities against the tested bacterial stains.

# CIRI-CIRI ANTI-CHOLINERGIC DAN ANTIMIKROB TUMBUHAN

## BAKAU *Avicennia lanata*

### ABSTRAK

*Avicennia lanata*, atau lebih dikenali sebagai bakau kelabu atau bakau putih telah dikelaskan dalam keluarga Avicenniaceae. Terdapat banyak kajian yang telah dijalankan dengan spesis yang berkait rapat iaitu *Avicennia marina*, akan tetapi terdapat kekurangan atau tiada kajian mengenai *A. lanata*. Ekstrak bahagian daun, kulit kayu dan akar daripada tumbuhan ini telah dikeluarkan secara berurutan bermula dengan diklorometana, etil asetat dan berakhir dengan metanol. Setiap satu daripada ekstrak ini diuji untuk ciri-ciri anti-cholinergic dan antimikrob. Dua sebatian aktif utama (fenol/tannin dan saponin) telah dapat diperhatikan di dalam ekstrak akar yang juga terkandung glikosida dan ekstrak beku kering daun yang juga menunjukkan terdapatnya sebatian alkaloid. Ekstrak pembekuan daun kering telah menunjukkan aktiviti perencatan yang tertinggi terhadap enzim anticholinesterase (AChE) iaitu sebanyak 86.22% perencatan dan kemudian diikuti dengan 73.37% dan 71.73% perencatan daripada ekstrak akar metanol dan ekstrak akar etil asetat masing-masing pada kepekatan 2.5µg/ml. Aktiviti anti-bakteria di dalam cakera penyebaran telah dinyatakan sebagai nisbah zon perencatan yang dihasilkan oleh ekstrak sampel kepada zon perencatan yang dihasilkan oleh kawalan, gentamicin. Nisbah yang besar memberikan aktiviti yang lebih baik. Dua bakteria Gram-positif (*Bacillus cereus* dan *Staphylococcus aureus*) dan tiga bakteria Gram-negatif (*Escherichia coli*, *Salmonella typhi* dan *Klebsiella pneumoniae*) telah diuji. 80% anggaran daripada ekstrak akar

metanol telah dapat merencatkan aktiviti pertumbuhan bakteria dengan 0.533 nisbah tertinggi zon perencatan terhadap *S. typhi*. Ekstrak akar etil asetat dapat menghalang kira-kira 40% aktiviti pertumbuhan bakteria. Sebatian aktif di dalam ekstrak akar dan daun meningkat dengan peningkatan kutub pelarut tetapi sebatian aktif di dalam ekstrak kulit kayu meningkat dengan penurunan kekutuban pelarut. 60% anggaran daripada ekstrak tumbuhan menunjukkan nilai MIC <1.5mg/ml yang memberikan aktiviti antimikrob tertinggi dalam cerakin MIC. Kebanyakan ekstrak menunjukkan aktiviti yang rendah terhadap bakteria Gram-negatif berbanding aktiviti yang tinggi terhadap bakteria Gram-positif. Walau bagaimanapun, kesemua ekstrak telah menunjukkan beberapa aktiviti anti-bakteria terhadap kedua-dua jenis bakteria Gram-positif dan Gram-negatif. Ekstrak pembekuan daun kering menunjukkan peratusan perencatan yang tertinggi terhadap enzim acetylcholinesterase diikuti oleh ekstrak akar metanol dan ekstrak akar etil asetat. Kesemua ekstrak akar telah menunjukkan bahawa akar *A. lanata* adalah bahagian yang paling aktif untuk menghalang aktiviti pertumbuhan bakteria di dalam cerakin cakera penyebaran manakala ekstrak metanol *A. lanata* telah menunjukkan aktiviti yang antimikrob yang tinggi terhadap kesemua bakteria yang diuji dari kedua-dua cerakin cakera penyebaran dan MIC.