

Chemical and Biological Profiling of Antimicrobial Agents from *Rhodognaphalon brevicuspe* (Malvaceae)



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Introduction

Antimicrobial resistance is a global health crisis driven by multidrug-resistant pathogens that have undermined the efficacy of available therapies that were once effective.

Estimates for 204 countries and territories confirm AMR as a global health threat, with the worst impacts in low- and middle-income countries (LMICs).

WHO reports ~1.27 million deaths in 2019 were directly attributable to AMR. The goal of WHO is to reduce AMR by 10% by 2030

This highlights the need to search for novel antimicrobial agents, antibiotics, or lead compounds with unconventional modes of action.

Rhodognaphalon brevicuspe is a flowering plant in Malvaceae family, a native to Ghana, Ivory Coast, Gabon, Nigeria and some part of Africa.

Locally valued for wood, dyes, fibers, and medicinal uses, the bark is used in Ghana to manage arthritis, venereal diseases, fractures, and diarrhea

Aims and Objectives

Main goal : To isolate, characterize, and evaluate the antimicrobial potential of bioactive compounds from the stem bark of *Rhodognaphalon brevicuspe*.

Specific objectives

- To extract and evaluate the antimicrobial activities of bioactive compounds from the stem bark of *Rhodognaphalon brevicuspe*.
- To isolate and characterize the isolated compounds from *Rhodognaphalon brevicuspe*.
- To evaluate the antimicrobial activities of the isolated compounds.

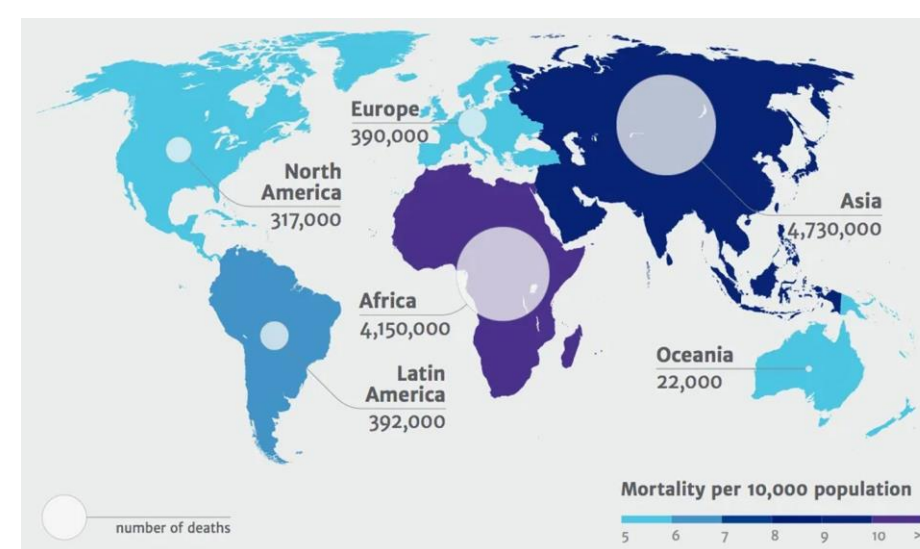


Figure 1: Global report on antimicrobial resistance among continents

GLOBAL A failure to address the problem of antibiotic resistance could result in:
10m deaths by 2050
Costing £66 trillion

Figure 2 : Global treat of failure to address AMR



Figure 3 : Stem bark and whole plant of *R. brevicuspe*

Methodology

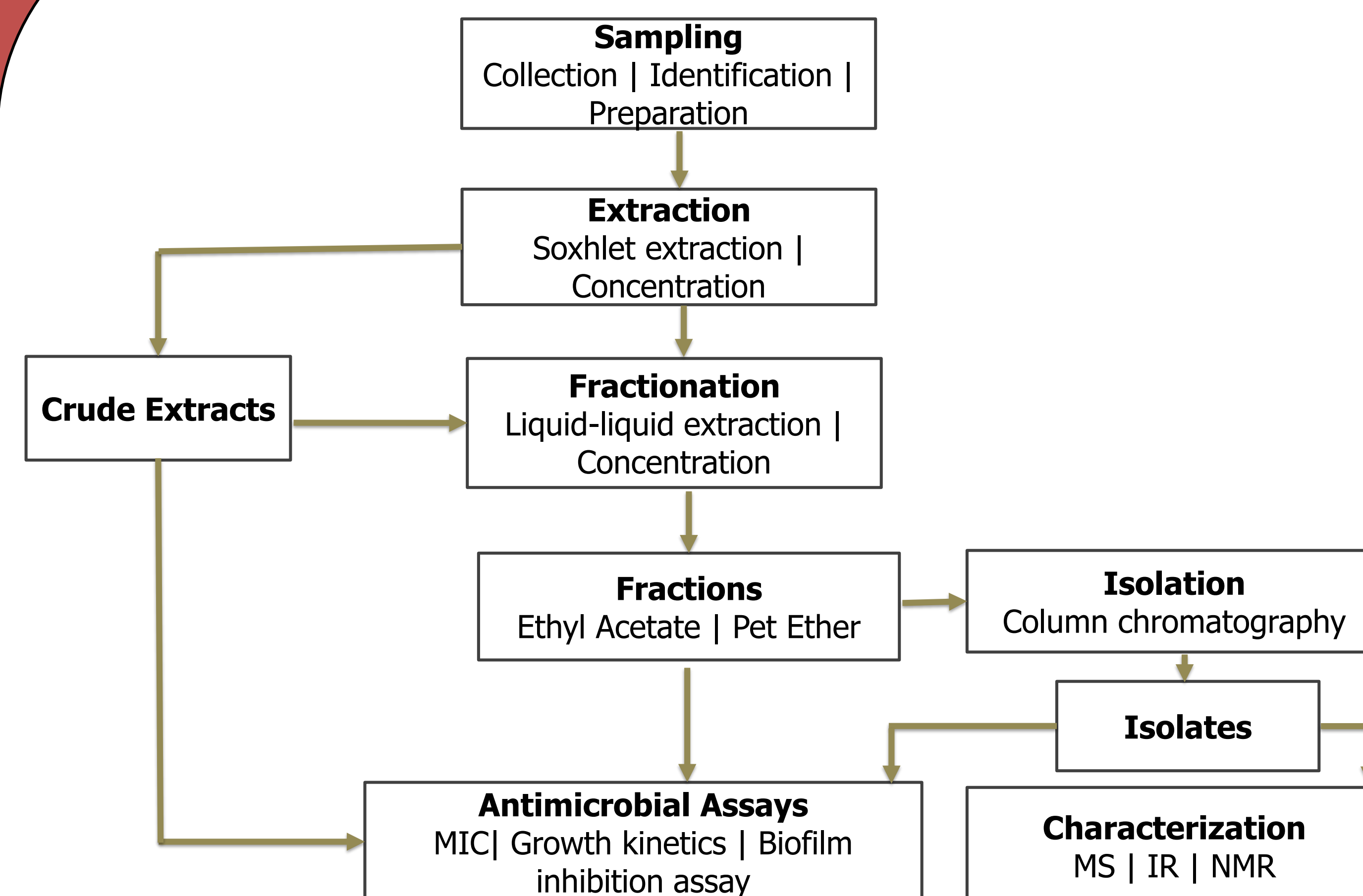


Figure 4 : Scheme for methodology employed in this study

Isolation Scheme

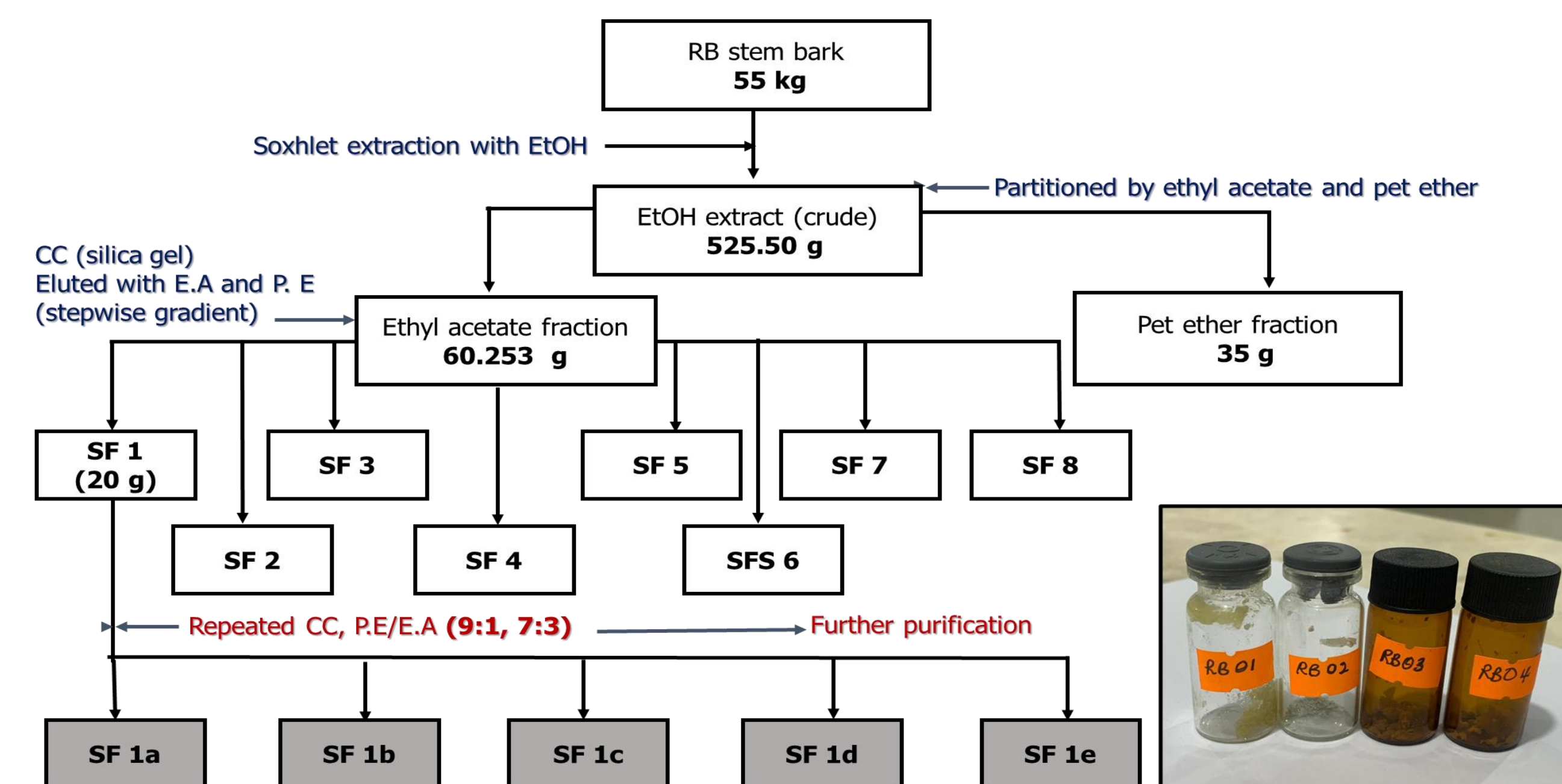


Figure 5 : Isolation scheme used in this study

Results

1 Research Data for *R. brevicuspe*

Table 1 : Research Data for *Rhodognaphalon Brevicuspe*

Category	Details
Scientific Name	<i>Rhodognaphalon Brevicuspe</i>
Family	Malvaceae
Common Names	Onyina-koben, Kuntunkuni
Habitat & Distribution	African countries, including Ghana, Congo, Ivory Coast, Nigeria, and Sierra Leone
GPS coordinates	Longitude, Latitude; 6.677, -0.6612
Plant Part(s) Used	Bark
Traditional Uses	It is used in Ghana to manage arthritis, venereal diseases, fractures, and diarrhea
Voucher specimen ID	KNUST/HMI/2023/SB020
Pharmacological Activities	Antibacterial, antifungal, antioxidant, anti-inflammatory
Extraction Method	Soxhlet, liquid-liquid
Solvent Used	Ethanol, ethyl acetate, petroleum ether
Analytical Techniques Used	Column chromatography, IR, NMR

2 Phytochemical Screening

Table 2 : Results obtained from phytochemical screening on plant sample used in this study.

Phytochemicals	Crude extract	Plant sample
Saponins	+	+
Tannins	+	+
Flavonoids	-	-
Terpenoids and steroids	+	+
Alkaloids	+	+
Glycosides	+	+
Coumarins	-	-

(+) = Detected; (-) = Not detected

3 Isolated Compound

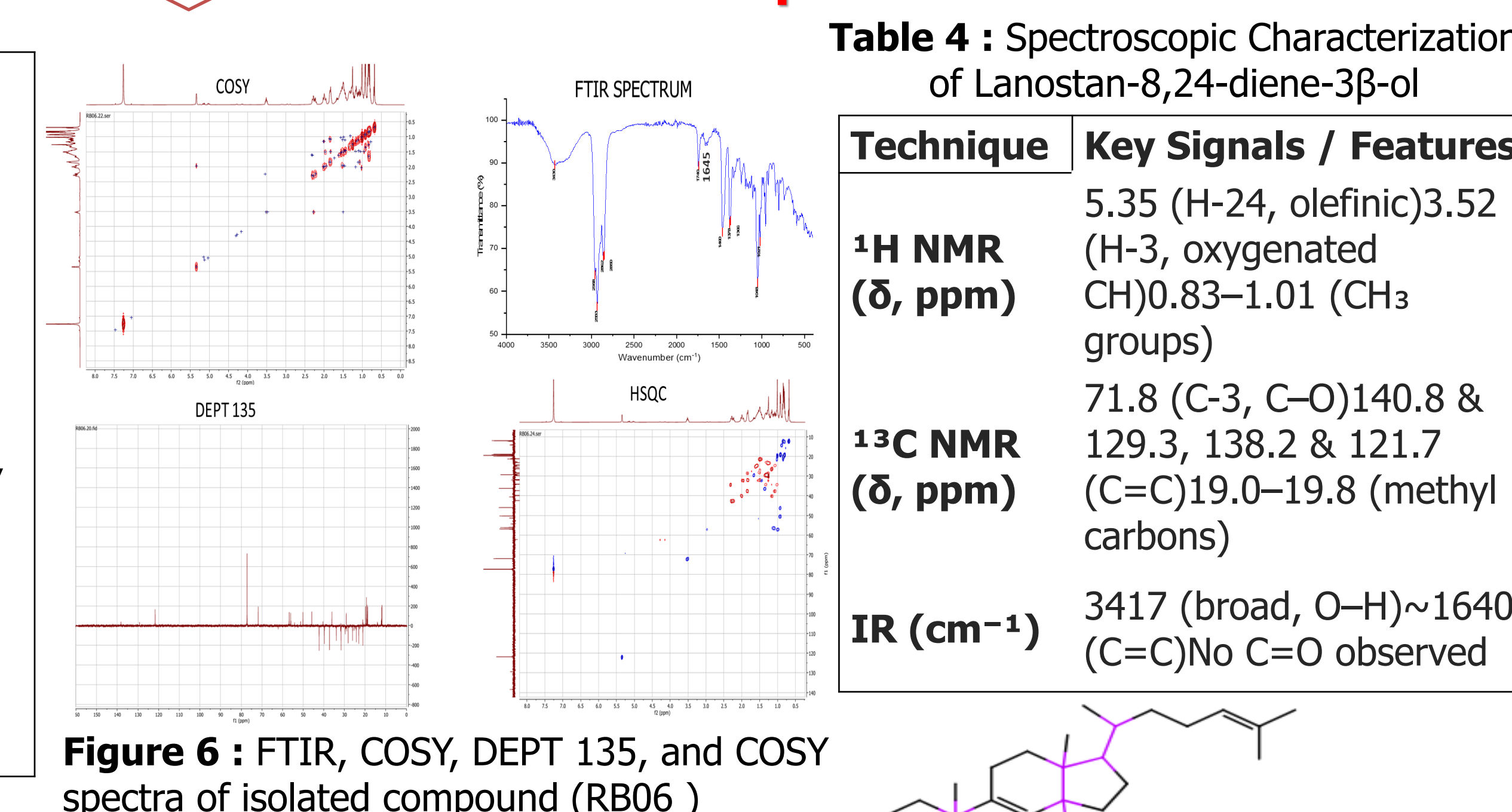
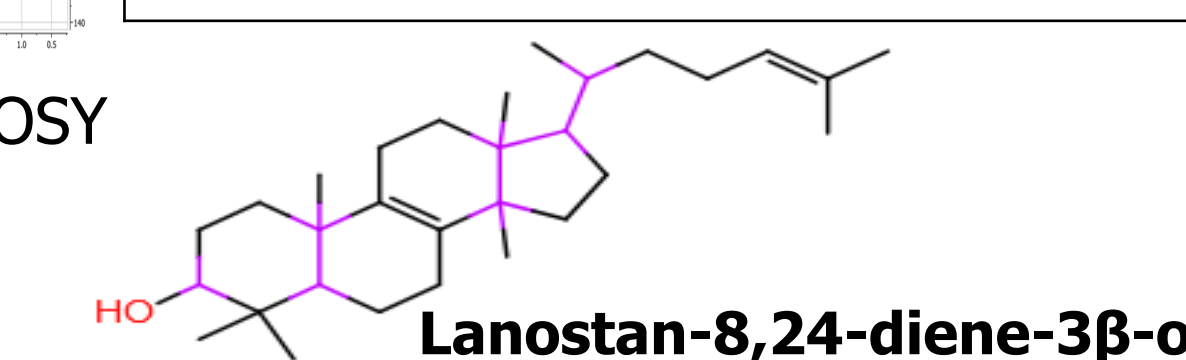


Figure 6 : FTIR, COSY, DEPT 135, and COSY spectra of isolated compound (RB06)

Table 4 : Spectroscopic Characterization of Lanostan-8,24-diene-3β-ol

Technique	Key Signals / Features
¹ H NMR (δ, ppm)	5.35 (H-24, olefinic) 3.52 (H-3, oxygenated CH) 0.83–1.01 (CH ₃ groups)
¹³ C NMR (δ, ppm)	71.8 (C-3, C-O) 140.8 & 129.3, 138.2 & 121.7 (C=C) 19.0–19.8 (methyl carbons)
IR (cm ⁻¹)	3417 (broad, O-H) ~1640 (C=C) No C=O observed



4 Antimicrobial Activity

Table 3 : Minimum inhibition concentration of crude, fractions and standard drug against microorganisms.

Microorganism (Gram status)	Minimum Inhibitory Concentration (mg/mL)			
	Crude	Pet Ether fraction	Ethyl Acetate fraction	*Ciprofloxacin(μg/ml)
<i>P. aeruginosa</i> (-)	0.781	3.125	1.560	0.156
<i>E. coli</i> (-)	6.250	6.250	3.125	3.125
<i>S. aureus</i> (+)	> 6.250	> 6.250	1.560	0.625
<i>E. faecalis</i> (+)	6.250	6.250	3.125	3.125
* <i>C. albicans</i>	3.125	3.125	0.750	0.156***

*MICs of ciprofloxacin are in μg/ml; +, Gram-positive bacteria; -, Gram-negative bacteria; # *C. albicans* is a fungus, ***fluconazole

Conclusion

Lanostan-8,24-diene-3β-ol was successfully isolated from *Rhodognaphalon brevicuspe* and structurally confirmed by NMR, IR, and MS. The fractions showed potent antimicrobial activity against *P. aeruginosa*, *S. aureus*, and *C. albicans*, indicating strong potential as a lead for new drug development.

Expands the pipeline of affordable, plant-based antimicrobials and strengthens resilience against antimicrobial resistance (AMR). Promotes integration of traditional medicine with modern healthcare.

References

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