

ABSTRAK

IDENTIFIKASI SENYAWA TERPENOID HASIL ISOLASI RIMPANG LEMPUYANG EMPRIT (*Zingiber amaricans*) DENGAN SPEKTROSKOPI NMR (*Nuclear Magnetic Resonance*) DAN UJI AKTIVITAS ANTIBAKTERI TERHADAP *Bacillus cereus*

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Latar Belakang: Rimpang *Z. amaricans* diketahui mengandung senyawa terpenoid. Beberapa senyawa terpenoid telah terbukti memiliki aktivitas antibakteri, terutama terhadap bakteri Gram positif. Hingga kini penelitian isolasi senyawa terpenoid dari rimpang *Z. amaricans* beserta aktivitas antibakterinya masih terbatas. Penelitian ini bertujuan untuk melakukan isolasi senyawa terpenoid dari rimpang *Z. amaricans* dan mengetahui potensi aktivitas antibakterinya terhadap *B. cereus*.

Metodologi: Penelitian ini merupakan penelitian eksperimental yang dilakukan dengan dua tahap. Pertama, isolasi senyawa terpenoid dari ekstrak metanol rimpang *Z. amaricans*, meliputi proses ekstraksi, fraksinasi, dan pemisahan menggunakan kromatografi kolom. Selanjutnya dilakukan identifikasi struktur senyawa isolat menggunakan spektroskopi NMR 1 Dimensi ($^1\text{H-NMR}$, $^{13}\text{C-NMR}$), NMR 2 Dimensi (HSQC, HMBC, COSY, ROESY), dan polarimetri. Kedua, uji aktivitas antibakteri ekstrak metanol, fraksi *n*-heksan, dan senyawa isolat terhadap bakteri *B. cereus* menggunakan metode mikrodilusi sehingga didapatkan nilai Konsentrasi Hambat Minimum (KHM).

Hasil Penelitian: Hasil penelitian ini didapatkan satu isolat murni. Pada spektra $^1\text{H-NMR}$ didapatkan 16 sinyal utama pada δ_{H} 4,12 (*d*, $J=5$ Hz, 1H); 5,35 (*dd*, $J=16,3$; 6 Hz, 1H); 5,17 (*d*, $J=16,3$ Hz, 1H); 1,98 (*dd*, $J=13,4$; 10 Hz, 1H); 1,81 (*overlap*, 1H); 5,04 (*dd*, $J=10$; 6 Hz, 1H); 2,09 (*dd*, $J=17,5$; 4,7 Hz, 1H), 1,86 (*overlap*, *dd*, $J=11$; 4,7 Hz, 1H); 1,2 (*overlap*, 1H); 1,62 (*m*, 1H); 1,44 (*m*, 2H); 1,24 (*overlap*, 1H); 1,49 (*s*, 3H); 0,99 (*d*, $J=6,9$ Hz, 3H); 1,10 (*s*, 3H); 1,08 (*s*, 3H). Pada spektra $^{13}\text{C-NMR}$ didapatkan 15 sinyal utama pada δ_{C} 76,6; 131,3; 137,3; 37,6; 40,9 (*overlap*, 2 C); 124,9; 134,3; 23,7; 26,5; 42,4; 16,2; 17,7; 25,1; 29,2. Sedangkan, hasil nilai putaran optik yaitu $[\alpha]_{\text{D}}^{23} +39,3$ (*c* 0,001; MeOH). Nilai KHM dari ekstrak metanol, fraksi *n*-heksan, dan isolat terhadap *B. cereus* secara berturut-turut sebesar 1000 ppm, 500 ppm, dan 500 ppm.

Kesimpulan: Senyawa terpenoid berhasil diisolasi dari rimpang *Z. amaricans* berupa senyawa 4,4,7,11-tetrametil-2,6-sikloundekadien-1-ol dengan rumus molekul $\text{C}_{15}\text{H}_{26}\text{O}$. Fraksi *n*-heksan memiliki aktivitas antibakteri lebih baik dibandingkan ekstrak metanol. Sedangkan, isolat tidak aktif sebagai antibakteri terhadap *B. cereus*.

Kata kunci: Isolasi, *Zingiber amaricans*, terpenoid, antibakteri, *Bacillus cereus*.

ABSTRACT

Identification of Isolated Terpenoid Compound from Lempuyang Emprit Rhizome (*Zingiber amaricans*) Using NMR (Nuclear Magnetic Resonance) Spectroscopy and Its Antibacterial Activity Against *Bacillus cereus*

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Background: *Z. amaricans* rhizome has been known to contain terpenoid compounds. Terpenoid compounds has been shown to have activity as antibacterial agent, specifically against Gram-positif bacteria. Until now, studies that related to isolation of terpenoid compounds from *Z. amaricans* rhizome and its activity as antibacterial agent are limited. This study aims to isolate terpenoid compounds from *Z. amaricans* rhizome and find out its antibacterial activity against *B. cereus*.

Methodology: This study was an experimental research that conducted in two steps. First, isolation of terpenoid compound from methanol extract of the *Z. amaricans* rhizome which included the extraction, fractination, and separation with column chromatography. Then, identification of terpenoid compound used 1-Dimensional NMR spectroscopy ($^1\text{H-NMR}$, $^{13}\text{C-NMR}$), 2-Dimensional NMR spectroscopy (HSQC, HMBC, COSY, ROESY), and polarimetry. Second, antibacterial activity were evaluated by microdilution method to determine Minimum Inhibitory Concentration (MIC) of methanol extract, n-hexane fraction, and isolated compound against *B. cereus*.

Result: The result of this study found one pure isolate. In the $^1\text{H-NMR}$ spectra, 16 main signals were obtained at δ_{H} 4,12 (*d*, $J=5$ Hz, 1H); 5,35 (*dd*, $J=16,3$; 6 Hz, 1H); 5,17 (*d*, $J=16,3$ Hz, 1H); 1,98 (*dd*, $J=13,4$; 10 Hz, 1H); 1,81 (*overlap*, 1H); 5,04 (*dd*, $J=10$; 6 Hz, 1H); 2,09 (*dd*, $J=17,5$; 4,7 Hz, 1H), 1,86 (*overlap*, *dd*, $J=11$; 4,7 Hz, 1H); 1,2 (*overlap*, 1H); 1,62 (*m*, 1H); 1,44 (*m*, 2H); 1,24 (*overlap*, 1H); 1,49 (*s*, 3H); 0,99 (*d*, $J=6,9$ Hz, 3H); 1,10 (*s*, 3H); 1,08 (*s*, 3H). In the $^{13}\text{C-NMR}$ spectra, 15 main signals were obtained at δ_{C} 76,6; 131,3; 137,3; 37,6; 40,9 (*overlap*, 2 C); 124,9; 134,3; 23,7; 26,5; 42,4; 16,2; 17,7; 25,1; 29,2. The angle of optical rotation was $[\alpha]_{\text{D}}^{23} +39,3$ (c 0,001; MeOH). MIC value of methanol extract, n-hexane fraction, and isolate against *B. cereus* were 1000 ppm, 500 ppm, dan 500 ppm, respectively.

Conclusion: Terpenoid compound was successfully isolated from *Z. amaricans* rhizome that identified as 4,4,7,11-tetramethyl-2,6-cycloundecadien-1-ol with the molecular formula $\text{C}_{15}\text{H}_{26}\text{O}$. Antibacterial activity of n-hexane fraction was better than methanol extract. Isolated compound showed no antibacterial activity against *B. cereus*.

Kata kunci: Isolation, *Zingiber amaricans*, terpenoid, antibacterial, *Bacillus cereus*.