

Abstrak

PENDEKATAN NON-TARGETED METABOLOMIC DAN KEMOMETRIK DALAM PROFILING MINYAK ATSIRI *Zingiber officinale* DAN *Zingiber cassumunar* SERTA AKTIVITAS ANTIBAKTERINYA TERHADAP *Pseudomonas aeruginosa* DAN MRSA

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Latar Belakang : Resistensi antibiotik sedang menjadi masalah global yang sulit diatasi. Diperlukan eksplorasi senyawa antibakteri baru yang mampu menjadi alternatif bagi bakteri resisten. Salah satu target potensialnya adalah minyak atsiri tanaman karena banyak mengandung senyawa bioaktif. Tanaman yang telah digunakan secara empiris sebagai obat seperti *Zingiber cassumunar* dan *Zingiber officinale* dapat dijadikan target eksplorasi. Penelitian ini bertujuan untuk memperoleh dan membandingkan profil metabolit dari kedua sampel, serta membandingkan aktivitas antibakterinya terhadap bakteri dengan tingkat resistensi tinggi, seperti *Pseudomonas aeruginosa* dan MRSA.

Metodologi : Penelitian eksperimental dilakukan menggunakan sampel berupa minyak atsiri *Z. cassumunar* dan *Z. officinale*. Analisis dilakukan menggunakan pendekatan non-targeted metabolomic menggunakan GC-MS yang dikombinasi kemometrik dan dilakukan uji antibakteri terhadap bakteri *P. aeruginosa* dan MRSA menggunakan metode *broth microdilution* (BMD).

Hasil Penelitian : Analisis *non-targeted metabolomic* menghasilkan 169 metabolit terdeteksi, 85 diantaranya merupakan metabolit teranotasi. Uji antibakteri menunjukkan bahwa sampel minyak atsiri *Z. cassumunar* dan *Z. officinale* memiliki aktivitas antibakteri sedang. Kedua sampel menghasilkan nilai KHM yang sama pada uji antibakteri terhadap MRSA. Sedangkan pada pengujian terhadap *P. aeruginosa*, nilai KHM minyak atsiri *Z. cassumunar* lebih baik.

Kesimpulan : Pendekatan *non-targeted metabolomic* dengan GC-MS dapat mendeteksi senyawa metabolit dalam sampel secara lebih komprehensif. Hasil uji antibakteri menunjukkan bahwa kedua sampel minyak atsiri memiliki aktivitas antibakteri sedang terhadap *P. aeruginosa* dan MRSA.

Kata Kunci : Metabolomik, Zingiber, GC-MS, Kemometrik, MRSA

Abstract

NON-TARGETED METABOLOMICS AND CHEMOMETRIC APPROACHES IN PROFILING ESSENTIAL OILS OF *Zingiber officinale* AND *Zingiber cassumunar* AND THEIR ANTIBACTERIAL ACTIVITIES AGAINST *Pseudomonas aeruginosa* AND MRSA

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Background : Antibiotic resistance has become a global issue that is increasingly difficult to resolve. There is a pressing need to explore new antibacterial compounds that can serve as alternatives for combating resistant bacteria. One potential target is essential oils from plants, as they are rich in bioactive compounds. Plants that have been traditionally used as medicines, such as *Zingiber cassumunar* and *Zingiber officinale*, offer promising targets for exploration. This study aims to obtain and compare the metabolite profiles of these two samples and evaluate their antibacterial activities against highly resistant bacteria, including *Pseudomonas aeruginosa* and MRSA.

Methods : The experimental study was conducted using essential oil samples of *Zingiber cassumunar* and *Zingiber officinale*. Analysis was performed using a non-targeted metabolomics approach with GC-MS combined with chemometric analysis. Antibacterial testing was carried out against *Pseudomonas aeruginosa* and MRSA using broth microdilution (BMD) method.

Results : The non-targeted metabolomics analysis detected 169 metabolites, of which 85 were annotated. Antibacterial testing revealed that the essential oils of *Z. cassumunar* and *Z. officinale* exhibited moderate antibacterial activity. Both samples showed identical minimum inhibitory concentration (MIC) values against MRSA. However, for *P. aeruginosa*, the essential oil of *Z. cassumunar* demonstrated a superior MIC value.

Conclusion : The non-targeted metabolomics approach using GC-MS provides a comprehensive detection of metabolites in the samples. Antibacterial testing demonstrated that both essential oil samples exhibit moderate antibacterial activity against *Pseudomonas aeruginosa* and MRSA.

Keywords : Metabolomics, *Zingiber*, GC-MS, Chemometrics, MRSA.