

RINGKASAN

Makroalga hijau (Chlorophyta) merupakan sumber potensial keragaman metabolit sekunder yang berpotensi sebagai senyawa antibakteri. Penelitian ini bertujuan untuk mengidentifikasi spesies chlorophyta secara terintegrasi melalui pendekatan morfologi, anatomi, dan *DNA barcoding* menggunakan penanda gen *rbcL*, *tufA*, dan ITS guna mengatasi keterbatasan identifikasi berbasis morfologi akibat plastisitas fenotipik. Selanjutnya, eksplorasi senyawa bioaktif dilakukan melalui profil metabolomik non-targeted berbasis LC-HRMS yang dikombinasikan dengan variasi metode ekstraksi, yaitu maserasi bertingkat, *Microwave Extraction* (ME), dan *Heat Assisted Extraction* (HAE), serta penggunaan pelarut dengan tingkat kepolaran berbeda. Hasil penelitian menunjukkan bahwa spesies chlorophyta yang teridentifikasi dari Pantai Sepanjang meliputi *Ulva laetevirens*, *Ulva meridionalis*, dan *Cladophora* sp. Analisis metabolomik mengungkap keberagaman metabolit sekunder yang mencakup lipid dan turunannya, pigmen klorofil, serta senyawa oksigenasi asam lemak. Variasi metode ekstraksi dan jenis pelarut terbukti memengaruhi profil metabolit yang dihasilkan, dengan metode ekstraksi berbantuan panas dan pelarut polar hingga non-polar menghasilkan jumlah dan keragaman metabolit yang lebih tinggi. Pendekatan *molecular networking* memungkinkan dereplikasi sejumlah senyawa yang dilaporkan memiliki potensi sebagai antibakteri. Secara keseluruhan, integrasi *DNA barcoding* dan profil metabolomik efektif dalam identifikasi spesies serta eksplorasi potensi biokimia chlorophyta. Penelitian ini memberikan dasar ilmiah yang kuat bagi pengembangan penelitian lanjutan, terkait uji bioaktivitas dan isolasi senyawa aktif, serta mendukung pemanfaatan makroalga hijau sebagai sumber kandidat antibakteri alami dari ekosistem pesisir Indonesia.

SUMMARY

Green macroalgae (Chlorophyta) are a potential source of secondary metabolite diversity with potential as antibacterial compounds. This study aims to identify chlorophyta species in an integrated manner through morphological, anatomical, and DNA barcoding approaches using the *rbcL*, *tufA*, and ITS gene markers to overcome the limitations of morphology-based identification due to phenotypic plasticity. Furthermore, the exploration of bioactive compounds was conducted through non-targeted metabolomic profiling based on LC-HRMS combined with various extraction methods, namely stepwise maceration, Microwave Extraction (ME), and Heat Assisted Extraction (HAE), as well as the use of solvents with different polarities. The results showed that the chlorophyta species identified from Sepanjang Beach included *Ulva laetevirens*, *Ulva meridionalis*, and *Cladophora* sp. Metabolomic analysis revealed a diversity of secondary metabolites, including lipids and their derivatives, chlorophyll pigments, and fatty acid oxygenation compounds. Variations in extraction methods and solvent types were found to influence the resulting metabolite profiles, with heat-assisted extraction methods and polar to non-polar solvents yielding higher amounts and diversity of metabolites. The molecular networking approach enabled the dereplication of a number of compounds reported to have antibacterial potential. Overall, the integration of DNA barcoding and metabolomic profiling is effective in species identification and the exploration of the biochemical potential of chlorophyta. This study provides a strong scientific basis for further research related to bioactivity testing and the isolation of active compounds, and supports the use of green macroalgae as a source of natural antibacterial candidates from Indonesia's coastal ecosystems.