

INTISARI

Anggur laut (*Caulerpa* spp.) mengandung senyawa fenolik yang perolehannya dipengaruhi oleh kondisi ekstraksi. Penelitian ini bertujuan mengoptimasi ekstraksi senyawa fenolik menggunakan *Ultrasound-Assisted Extraction* (UAE), memvalidasi metode, serta mengaplikasikannya pada sampel *Caulerpa* spp. dari berbagai lokasi budidaya di Indonesia. Screening menggunakan *One Factor at a Time* (OFAT) dilakukan terhadap jenis dan konsentrasi pelarut, suhu, waktu, amplitudo, serta rasio pelarut terhadap sampel. Hasil menunjukkan bahwa seluruh faktor memberikan perbedaan signifikan terhadap *total phenolic content* (TPC), kecuali waktu ekstraksi. Konsentrasi etanol, suhu, dan rasio pelarut terhadap sampel selanjutnya dioptimasi menggunakan *Box–Behnken Design* dan *Response Surface Methodology*. Kondisi optimal diperoleh pada etanol 68%, suhu 50 °C, dan rasio 20:1 (mL/g), menghasilkan TPC eksperimental $1,567 \pm 0,02$ mg GAE/g sampel, mendekati prediksi 1,582 mg GAE/g sampel. Metode menunjukkan presisi yang baik dan efektivitas ekstraksi siklus pertama sebesar 80,6%. Aplikasi pada *C. lentillifera* dan *C. racemosa* menunjukkan variasi TPC dan senyawa fenolik antar sampel. Analisis HPLC-PDA mengidentifikasi asam 4-hidroksibenzoat, kaempferol, 4-hidroksibenzaldehida, dan *syringic acid*. Hasil penelitian menunjukkan bahwa UAE yang dioptimasi dapat digunakan untuk ekstraksi dan karakterisasi senyawa fenolik pada sampel *Caulerpa* spp.

Kata kunci: *Caulerpa* spp.; *Ultrasound-Assisted Extraction*; senyawa fenolik; *total phenolic content*; *Response Surface Methodology*; HPLC-PDA.

ABSTRACT

Sea grapes (*Caulerpa* spp.) contain phenolic compounds whose extraction is influenced by extraction conditions. This study aimed to optimize phenolic compound extraction using Ultrasound-Assisted Extraction (UAE), validated the method performance, and apply the method to *Caulerpa* spp. samples from different cultivation locations in Indonesia. Screening using the One-Factor-at-a-Time (OFAT) approach was performed for solvent type and concentration, extraction temperature and time, amplitude, and solvent-to-sample ratio. All factors significantly affected total phenolic content (TPC), except extraction time. Ethanol concentration, temperature, and solvent-to-sample ratio were subsequently optimized using Box–Behnken Design and Response Surface Methodology. The optimal conditions were 68% ethanol, 50 °C, and a solvent-to-sample ratio of 20:1 (mL/g), yielding an experimental TPC of 1.567 ± 0.02 mg GAE/g sample, which was close to the predicted value of 1.582 mg GAE/g sample. The method demonstrated good precision and an extraction efficiency of 80.6% in the first extraction cycle. Application to *C. lentillifera* and *C. racemosa* showed variations in TPC and phenolic compounds among samples. HPLC-PDA analysis identified 4-hydroxybenzoic acid, kaempferol, 4-hydroxybenzaldehyde, and syringic acid. Overall, the optimized UAE method can be applied for the extraction and characterization of phenolic compounds in *Caulerpa* spp.

Keywords: *Caulerpa* spp.; Ultrasound-Assisted Extraction; phenolic compounds; total phenolic content; Response Surface Methodology; HPLC-PDA.