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Valorisasi Hasil Samping Daun Serai (Cymbopogon citratus) Sebagai Sumber MInyak Atsiri dengan Praperlakuan Microwave
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INTISARI

Serai (*Cymbopogon citratus*) umumnya dimanfaatkan pada bagian batang atau *pseudostem*, sementara bagian daunnya dibuang sebagai hasil samping pertanian. Oleh karena itu, diperlukan penanganan lebih lanjut terhadap hasil samping daun serai agar dapat diolah menjadi produk bernilai tinggi, seperti minyak atsiri. Meskipun daun serai tidak memiliki aroma sekuat batangnya, bagian ini tetap mengeluarkan aroma yang serupa dengan batang tanaman serai yang sering digunakan.

Distilasi air umum digunakan untuk ekstraksi minyak atsiri karena prosesnya yang sederhana. Namun, metode ini memerlukan durasi yang lama dan tidak efisien. Salah satu pendekatan alternatif yang dapat digunakan, yaitu perlakuan pendahuluan terhadap bahan baku meliputi pengeringan bahan dan menggabungkan metode distilasi air yang dibantu dengan *microwave pretreatment*.

Tujuan penelitian ini untuk mengetahui rendemen, karakteristik fisikokimia, mengidentifikasi komponen senyawa, aktivitas antioksidan, dan aktivitas antibakteri minyak atsiri dari daun serai. Daun serai diberi perlakuan pengeringan yang berbeda, sehingga didapatkan daun segar, daun layu dan daun kering. Selain itu daun juga diberi perlakuan awal *microwave*. Perubahan mikrostruktur jaringan diamati dengan *Scanning Electron Microscope* (SEM). Ekstraksi minyak atsiri dilakukan dengan menggunakan metoda distilasi air selama 3 jam. Minyak atsiri hasil distilasi diuji sifat fisikokimia (berat jenis, indeks bias, dan kelarutan dalam alkohol), komposisi senyawa dilakukan dengan *Gas Chromatography – Mass Spectrometry* (GC – MS), aktivitas antioksidan ditentukan dengan DPPH (1,1-difenil-2- pikrilhidrazil), dan aktivitas antibakteri ditentukan dengan mikrodilusi 96 *well-plate*.

Hasil penelitian menunjukkan bahwa perlakuan awal *microwave* meningkatkan rendemen minyak atsiri daun serai. Daun serai kering dengan perlakuan awal *microwave* menghasilkan rendemen tertinggi sebesar 0,20%, dengan sifat fisikokimia meliputi aroma sitral yang kuat, warna kuning cerah, berat jenis 0,971 g/mL, indeks bias 1,486, dan kelarutan dalam alkohol dengan rasio 1:3. Komponen kimia utama minyak atsiri daun serai terdiri dari citral (neral 35,64 – 36,60% dan geranial 44,07 – 46,81%), geranyl acetate (2,03 – 5,66%), isogeranial (1,61 – 2,57%), isoneral (0,96 – 1,76), dan β-pinene (0,16 – 3,63%). Perlakuan pendahuluan pada daun serai meningkatkan aktivitas antioksidan minyak atsiri daun serai. Daun kering dengan perlakuan awal *microwave* memiliki aktivitas antioksidan terbaik, dengan nilai IC_{50} sebesar 61,65 µg/mL, karena kandungan total senyawa teroksigenasi tertinggi (96,44%). Perlakuan pendahuluan pada daun serai meningkatkan aktivitas antibakteri minyak atsiri daun serai. Daun segar dan kering menunjukkan aktivitas antibakteri terbaik terhadap bakteri *E. coli* dan *S. aureus,* dengan MIC berkisar 0,3 – 1% dan MBC berkisar 0,5 – 1,8%.

Kata kunci: daun *Cymbopogon citratus*; valorisasi hasil samping pertanian; minyak atsiri; *microwave*; GC-MS; antioksidan

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ABSTRACT

Lemongrass (*Cymbopogon citratus*) is typically utilised in the stem or pseudostem, with the leaves being discarded as agricultural by-product. Therefore, further processing of lemongrass leaf by-product is necessary to produce high-value products, such as essential oils. Although lemongrass leaves do not have as strong an aroma as the stems, they still emit a similar aroma to the stems of lemongrass plants that are often used.

Water distillation is commonly used for essential oil extraction due to its simple process. However, this method requires a long duration and is not efficient. An alternative approach is to pretreat the raw materials, which includes drying the materials and combining the water distillation method with microwave-assisted pretreatment.

The purpose of this study was to determine the yield, physicochemical characteristics, identify compound components, antioxidant activity, and antibacterial activity of essential oil from lemongrass leaves. Lemongrass leaves were given various drying treatments, resulting in fresh leaves, withered leaves and dried leaves. In addition, the leaves were also pretreated with microwave. Tissue microstructure changes were observed by Scanning Electron Microscope (SEM). Essential oil extraction was carried out using the water distillation method for 3 hours. Essential oils were tested for physicochemical properties (specific gravity, refractive index, and solubility in alcohol), compound composition was identified by Gas Chromatoghrphy – Mass Spectrometry (GC – MS), antioxidant activity was determined by DPPH (1,1-diphenyl-2-picrylhydrazyl), and antibacterial activity was determined by 96 well-plate micro-dilution.

The results showed that microwave pretreatment increased the yield of lemongrass leaf essential oil. The highest yield of 0.20% was produced by microwave-pretreated dried lemongrass leaves, exhibiting a strong citral aroma, bright yellow colour, specific gravity of 0.971 g/mL, refractive index of 1.486, and solubility in alcohol with a ratio of 1:3. The chemical components of lemongrass leaf essential oil were primarily citral (35.64 – 36.60% and geranial 44.07 – 46.81%), geranyl acetate (2.03 – 5.66%), isogeranial (1.61 – 2.57%), isoneral (0.96 – 1.76), and β-pinene (0.16 – 3.63%). The pretreatment of lemongrass leaves resulted in an enhancement of the antioxidant activity of lemongrass leaf essential oil. The use of microwave pretreatment, the dried leaves resulted in the highest antioxidant activity, as indicated by an IC_{50} value of 61.65 µg/mL, attributable to the presence of a significantly higher percentage of total oxygenated compounds (96.44%). Furthermore, the pretreatment of lemongrass leaves enhanced the antibacterial activity of lemongrass leaf essential oil. The antibacterial activity of lemongrass leaf essential oil was found to be most significant against *E. coli* and *S. aureus* bacteria, with MIC values ranging from 0.3 – 1% and MBC values ranging from 0.5 – 1.8%.

Keyword: *Cymbopogon citratus* leaves; agricultural by-product valorisation; essential oil; microwave; GC-MS; antioxidant