Identification of the Chemical Compound of Essential Oil from Ketumbar (Coriandrum sativum L.) Leaves with Gc-Ms

Kasta Gurning¹*, Iksen¹, Helen Anjelina Simanjuntak¹, Hermawan Purba¹₂

Kasta Gurning¹*, Iksen¹, Helen Anjelina Simanjuntak¹, Hermawan Purba¹²

¹Department of Pharmacy, Sekolah Tinggi Ilmu Kesehatan Senior Medan, Medan-20141, INDONESIA. ²Department of Chemistry, Faculty of Mathematics and Natural Science, Universitas Sumatera Utara, Medan-20155 INDONESIA.

Correspondence
Kasta Gurning
Department of Pharmacy, Sekolah Tinggi Ilmu Kesehatan Senior Medan, Medan-20141, INDONESIA.
Phone no: +6285296522212
E-mail: kastagurning@gmail.com

ABSTRACT

Introduction: Coriandrum sativum L. leaves are plants used as a cooking spice that has a distinctive aroma. Various components of bioactive compounds are known from various parts of this plant, but the components of the bioactive compounds of essential oils from the leaves have never been reported. Objective: This research was designed to analyze the components of bioactive compounds contained in the essential oil of C. sativum leaves using a modified simple distillation tool. Method: C. sativum leaves essential oil component analysis with GC-MS (Shimadzu QP-2010 Plus). Results: Analysis GC-MS of the content of the bioactive compounds of essential oils contained various bioactive compounds. The dominant bioactive compounds are 2-Decen-1-ol (17.01%), 9-Octadecenal (9.59%), 1-Decanol (8.20%), Dotriacontane (4.40%), and Tetrapentacosan (3.68%). Conclusion: The results of the research showed that there were various bioactive compound contents from the essential oil of C. sativum leaves and it was important to test the activity of each component of the bioactive compound as an important recommendation for pharmaceutical natural ingredients.

Key words: Bioactive compounds, Coriandrum sativum, Distillation, Essential oil and GC-MS.

INTRODUCTION

Ketumbar (Coriandrum sativum L.) is a plant that is widely used as a spice, especially in cooking spices. This plant has a distinctive aroma. The distinctive aroma that is owned because this plant contains essential oils.¹ Phytochemical screening results of coriander seeds have diverse secondary metabolites, including steroids, flavonoids, saponins, tannins, coumarin,² volatile compounds³ and coriander leaves are contain phenolic acid, poliyphenols, glycosides, saponins, flavonoids and tannins.⁴,⁵ These coriander plants have diverse biology activities including antioxidant,⁶ antimicrobial, hypoglycemic, hypolipidemic, anxiolytic, analgesic, anti-inflammatory, anti-convulsant⁷ and anti-cancer activities and gastrointestinal, anti-inflammatory, antiseptic, tranquilizing nervous system, lipolytic and miorelaksan, rerigeran, tonic, dieteric, rheumatic, neuralgia, and flatulence⁸ and antimicrobials.⁹ This study aims to characterize, isolate essential oils and analyze the content of bioactive compounds of C. sativum leaves using Gas Chromatography-Mass Spectroscopy (GC-MS).

MATERIALS AND METHODS

Preparation sample

Fresh of ketumbar (C. sativum) leaves were obtained from the Berastagi area, Karo district, North Sumatera, Indonesia. The C. sativum leaves is carried out for 1-2 days per 500 g simplicia of C. sativum leaves. Isolation of essential oils of simplicia of C. sativum leaves was carried out by means of modified distillation (Figure 1). Simpisia C. sativum leaves are put into a round pumpkin, plus boiling stones and distilled water to taste. The distillation process is carried out for 1-2 days per 500 g simpicia of C. sativum leaves.
Coriandrum sativum leaves. The isolated essential oil was separated from the water mixture and stored in a vial bottle. The residue of water was removed by adding anhydrous Na₂SO₄ to obtain water-free essential oil. The essential oil obtained was determined by the yield.

GC-MS (Gas Chromatography-Mass Spectrometry) analysis

Investigation of essential oil chemical compounds was carried out using Gas Chromatography-Mass Spectrometry equipment (Shimadzu QP-2010 Plus) with the condition of the tool specifications as follows: Rtx-5MS capillary column type, column length of 30 meters, column diameter of 0.25 mm, column thickness of 0.25 μm, injector temperature of 300°C, pressure of 53 kPa, carrier gas He with flow rate of 0.99 ml/min, methyl silicon the stationary phase, temperature of the programmed column (temperature programming) with an initial temperature of 50°C, then slowly increased with a rate of increase of 10°C until reaching the final temperature of 300°C and maintained. The volume of essential oils injected 5 µl, the results were compared using the Wiley spectral library database program.

RESULTS AND DISCUSSION

Isolation of essential oil C. sativum leaves and GC-MS analysis

The results of isolation of C. sativum essential oil with a yield of 0.2% with a reddish yellow color, produce a distinctive aroma (Figure 2). Essential oils from GC-MS analysis obtained 35 peaks with different retention times, eighteen compounds identified with six compounds identified repeatedly (Figure 3 and Table 1).

Components of bioactive compounds found essential oils in C. sativum leaves have been reported to have diverse potential activities. Potential activities of essential oils include antibacterial, antifungal, Antioxidant, Anti Inflammatory, irritant to mouth, throat and stomach, antimicrobial, antifibrinolytic, hemolytic, lubricant, nematicide, antialopecic, and hypocholesterolemic. The results of analysis of essential oils of C. sativum leaves with the 5 biggest components are 2-Decen-1-ol (tₘ 14.298 min; C₁₀H₂₀O and peak area 17.01%), 9-Octadecenal (tₘ 16.860 min; C₁₈H₃₄O and peak area 15.08%), 2-Nonenal (tₘ 20.779 min; C₁₀H₁₆O and peak area 17.02%), 3-Hexanol (tₘ 11.092 min; C₆H₁₂O and peak area 16.03%), and 1-Octen-3-ol (tₘ 13.565 min; C₉H₁₆O and peak area 15.00%).

Figure 2: Essential oils from C. sativum leaves.

Figure 3: GC-MS chromatogram spectrum essential oils of C. sativum leaves.
Table 1: Identification essential oil of C. sativum leaves compound using GC-MS.

| No. Peak | Component name              | Retention time/t_R (min) | Molecular formula | Molecular weight (g/mol) | Peak Area (%) |
|---------|-----------------------------|--------------------------|-------------------|--------------------------|---------------|
| 1       | Nonane                      | 5.214                    | C_{9}H_{20}O       | 128                      | 0.42          |
| 2       | Decanal                     | 10.458                   | C_{10}H_{20}O      | 156                      | 2.14          |
| 3       | 1-Decanol                   | 11.459                   | C_{10}H_{20}O      | 158                      | 8.20          |
| 4       | Undecanal                   | 12.008                   | C_{11}H_{22}O      | 170                      | 0.43          |
| 5       | Tetradecanal                | 13.462                   | C_{12}H_{24}O      | 212                      | 3.38          |
| 6       | 2-Decen-1-ol                | 14.298                   | C_{12}H_{24}O      | 170                      | 17.01         |
| 7       | Tridecanal                  | 14.833                   | C_{13}H_{26}O      | 198                      | 0.45          |
| 8       | Octadecanal                 | 15.608                   | C_{14}H_{28}O      | 268                      | 0.84          |
| 9       | 9-Octadecanal               | 15.984                   | C_{14}H_{28}O      | 266                      | 0.79          |
| 10      | Tetradecanal                | 16.126                   | C_{14}H_{28}O      | 212                      | 1.35          |
| 11      | 9-Octadecanal               | 16.860                   | C_{14}H_{28}O      | 266                      | 9.59          |
| 12      | 9-Octadecanal               | 18.055                   | C_{15}H_{30}O      | 266                      | 1.10          |
| 13      | Neophytadiene               | 18.756                   | C_{20}H_{38}       | 278                      | 0.70          |
| 14      | 9-Octadecanal               | 19.196                   | C_{16}H_{32}O      | 266                      | 0.51          |
| 15      | Hexadecanoic acid           | 19.674                   | C_{16}H_{32}O      | 292                      | 0.59          |
| 16      | 9,12,15-Octadecatrienoi acid| 21.489                   | C_{18}H_{34}O      | 292                      | 0.52          |
| 17      | 9,12,15-Octadecatrienoi acid| 21.489                   | C_{18}H_{34}O      | 292                      | 0.49          |
| 18      | Neophytadiene               | 21.498                   | C_{19}H_{36}O      | 278                      | 0.60          |
| 19      | Pentadecane                 | 22.380                   | C_{20}H_{40}       | 296                      | 0.99          |
| 20      | Dotriacontane               | 22.979                   | C_{22}H_{44}       | 450                      | 2.77          |
| 21      | Hexacosane                  | 23.291                   | C_{22}H_{44}       | 366                      | 2.48          |
| 22      | Tetracontane                | 24.165                   | C_{24}H_{50}       | 562                      | 2.94          |
| 23      | Dotriacontane               | 25.004                   | C_{25}H_{52}       | 450                      | 3.61          |
| 24      | Dotriacontane               | 25.122                   | C_{25}H_{52}       | 450                      | 2.95          |
| 25      | Dotriacontane               | 25.813                   | C_{26}H_{54}       | 450                      | 3.76          |
| 26      | Dotriacontane               | 26.592                   | C_{26}H_{54}       | 450                      | 3.92          |
| 27      | Dotriacontane               | 26.683                   | C_{26}H_{54}       | 450                      | 3.13          |
| 28      | Dotriacontane               | 27.353                   | C_{26}H_{54}       | 450                      | 3.81          |
| 29      | Tetrapentacosan             | 28.098                   | C_{28}H_{56}       | 758                      | 2.22          |
| 30      | Dotriacontane               | 28.169                   | C_{28}H_{56}       | 450                      | 4.40          |
| 31      | Dotriacontane               | 29.079                   | C_{28}H_{56}       | 450                      | 3.89          |
| 32      | Tetrapentacosan             | 29.679                   | C_{28}H_{56}       | 758                      | 1.98          |
| 33      | Tetrapentacosan             | 30.112                   | C_{28}H_{56}       | 758                      | 3.68          |
| 34      | Tetrapentacosan             | 31.313                   | C_{28}H_{56}       | 758                      | 3.06          |
| 35      | Tetrapentacosan             | 31.511                   | C_{28}H_{56}       | 758                      | 1.32          |

9.59%), 1-Decanol (t_R 11.459 min; C_{10}H_{20}O and peak area 8.20%), Dotriacontane (t_R 28.353 min; C_{32}H_{66} and peak area 4.40%), and Tetrapentacosan (t_R 30.112 min; C_{54}H_{110}O and peak area 3.68%).

CONCLUSION

The components of the bioactive compounds contained essential oils in C. sativum leaves after being analyzed by GC-MS were very diverse. This strongly supports the use of C. sativum leaves for various treatments and traditional cooking spices. An ongoing evaluation needs to be carried out to determine for certain the potential activities of each component as important information on phytopharmacy.

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GRAPHICAL ABSTRACT
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ABOUT AUTHORS

**Kasta Gurning** is a lecturer in the field of research and focus on study about organic chemistry, natural chemical chemistry, natural medicinal compounds and their combination.

**Iksen** is a lecturer in the field of research and focus on study about pharmacy, pharmacology and toxicology. He is currently honored to continue his doctoral program in pharmacology at Chulalongkorn University.

**Helen Anjelina Simanjuntak** is a lecturer in the field of research and focus on study about biology, microbiology, pharmaceutical botanist and its combination for the discovery of drug compounds.

**Hermawan Purba** is a lecturer in the field of research and focus on study about analytical chemistry, natural product, and analytical instrumentation. He is currently honored to continue his doctoral program in Mathematics and Natural Sains Universitas Sumatera Utara.

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