Original Article

Antimicrobial Activity and Chemical Composition of Coriander & Galangal Essential Oil

Sevil Özkinali[1*], Nesrin Şener[2], Mahmut Gür[3], Kerim Güney[4], Çağri Olgun[3]

[1]Department of Chemistry, Faculty of Science and Literature, Hitit University, *Çorum*, TURKEY
[2]Department of Chemistry, Faculty of Art and Science, Kastamonu University, Kastamonu, 37100, TURKEY
[3]Department of Forest Industrial Engineering, Faculty of Forestry, Kastamonu University, Kastamonu, TURKEY
[4]Department of Forest Engineering, Faculty of Forestry, Kastamonu University, Kastamonu, TURKEY

ABSTRACT

Essential oils were obtained from *Coriandrum sativum* and *Alpinia officinarum* through steam distillation method in this study. Antimicrobial activities of the obtained essential oils were investigated by using minimum inhibitory concentration (MIC) test by against 18 different species microorganisms. It was found that the *C. sativum* had strong antimicrobial activities against the 14 tested microorganism and *A. officinarum* oils showed strong antimicrobial activity against the 7 tested microorganisms. Furthermore, the contents of the essential oils were determined with GC-MS analyses. The most abundant compounds of essential oils of *A. officinarum* and *C. sativum* were determined as 28.4% eucalyptol and 69.4% linalool. As a result, it can be easily said that the essential oils of *C. sativum* and *A. officinarum* can be used as antimicrobial protector in related fields.

Keywords: *C. sativum*, *A. officinarum,* Essential oil, GC-MS, Antimicrobial activity.

INTRODUCTION

The different effects of plant based essential oils have been revealed by researches, recently. For example, *Coriander* (*Coriandrum sativum*) and *Galangal* (*Alpinia officinarum*) are very famous spices especially for Thai foods. These species give taste to foods, however their medical characteristics more important.[1] Although *Coriander's* motherland is south-west Asia and northern Africa, it also grows in European countries. This plant is used commonly as carminative, stomachic, and antispasmodic medicine by the people.[2,3] *Galangal* is also used as same purpose with *Coriander* as a carminative, besides stomachic, antispasmodic, antiphlogistic and anti-bacterial drugs.[4,5] The different effects of these essential oils have been revealed by researches which are increasing day by day. Consequently, it is seen that this species are frequently used in alternative medicine. Essential oils represent a small fraction of the constituents in plant extracts.[6] In this reason, determination of their components and qualities of plants is important to give more information about usability in cosmetics and pharmaceutical industry.

In this study, it was obtained essential oils of C. *sativum* and A. *officinarum* by using steam distillation method, determined chemical constituents of the obtained essential oils with GCMS and investigated their antibacterial activities against 18 microorganisms by the MIC test.

MATERIALS AND METHODS

Plant Samples and Essential Oil Extraction

C. sativum and A. *officinarum* seeds were obtained at 2016 from Özşen Lokman Hekim Company located in GIMAT - Ankara, TURKEY. The essential oil of seeds was obtained by steam distillation in

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Correspondence:
Sevil Özkinali,
Department of Chemistry, Faculty of Science and Literature, Hitit University, Çorum, TURKEY
Phone no: +90-364-2277000
E-mail: sevilozkinali@hitit.edu.tr

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a Clevenger apparatus for 3h then stored at 4 °C until other test.[7,8,9]

GC-MS Analysis

Samples was analysed by GCMS QP 2010 Ultra (Shimadzu) equipped with Rtx-5MS capillary column (30m·0.25 mm; coating thickness 0.25 μm). For the identification of chemical components, both fatty acid and essential oil Wiley Data library were used. Experimental conditions were applied according to Wiley Data library matching requirements

Test Organisms

The antimicrobial activity of essential oil samples were determinated with strains which were chosen through Gram negative and Gram positive strains. These strains were *Bacillus subtilis* DSMZ 1971, *Candida albicans* DSMZ 1386, *Enterococcus faecalis* ATCC 29212, *Enterobacter aerogenes* ATCC 13048, *Enterococcus durans, Enterococcus faecium*, *Escherichia coli* ATCC 25922, *Klebsiella pneumoniae*, *Listeria monocytogenes, Listeria innocua, Pseudomonas aeruginosa* DSMZ 50071, *Pseudomonas fluorescence* P1, *Salmonella enteritidis* ATCC 13075, *Salmonella infantis*, *Salmonella kentucky*, *Salmonella typhimurium* SL 1344, *Staphylococcus aureus* ATCC 25923 and *Staphylococcus epidermidis* DSMZ 20044. Strains, which have no standard ID (ATCC, DSMZ and SL) information were isolated from food samples and identified at the Department of Biology, Faculty of Science, and Ankara University.

Determination antibacterial activity

Minimum inhibitory concentration (MIC) test were used for determination the antibacterial activities of essential oils sample. A broth microdilution MIC test was applied as mentioned by modificated Balouiri *et al.* (2016) method. [10] 0.45 µm filters (Millipore) were used for essential oils sterilization by filtration. Two-fold dilutions of the oils were prepared ranging from 100 µg/mL to 0.195 µg/mL by using micro titration plate, were incubated at 37 ℃ for 24 h for bacteria strains and where 27 ℃ for 48 h for *C. albicans*. The MIC value is defined as the lowest concentration of essential oil that completely inhibits growth of the organism.

RESULTS AND DISCUSION

Chemical composition of *C. sativum* and A. *officinarum* essential oils were analysed by using GC-MS and essential oil constituents were identified by comparing Wiley Data Library. The components, which observed more than 3 percent, are accepted as the main components of the oils and are shown in Table 1. GC-MS analyses revealed that the main essential oil components

Table 1: Main components in essential oil scanning

A. officinarum	%	*C. sativum*	%
Eucalyptol	28.42	Linalool	69.49
α-terpineol	11.4	cis-ocimene	6.05
Farnesene <(E,E)-, α->	4.75	Neryl Acetate	5.71
γ-cadinene	5.57	γ-terpinene	4.34

Table 2: MIC values for A. *officinarum* and *C. sativum* (µg/mL)

	A. officinarum	*C. sativum*
B. subtilis	1.562	<0.195
C. albicans *E. faecalis*	50 25	<0.195 1.562
E. aerogenes *E. durans*	- 1.562	3.125 100
E. faecium	1.562	<0.195
E. coli	1.562	50
K. pneumonia *L. monocytogenes* *L. innocua*	6.25 25 3.125	0.390 6.25 0.390
P. aeruginosa	1.562	0.390
P. fluorescens	50	3.125
S. enteritidis	1.562	<0.195
S. infantis	-	<0.195
S. kentucky	0.781	<0.195
S. typhimurium	6.25	<0.195
S. aureus	100	12.5
S. epidermidis	12.5	3.125

"-": No activity observed

of oils obtained from A. *officinarum* contains Eucalyptol (28.42%), α-terpineol (11.4%), Farnesene <(E,E)-, α-> (4.75%), γ-cadinene (5.57%) and *C. sativum* contains cis-ocimene (6.05%), γ-terpinene (4.34%), linalool (69.49%), neryl acetate (5.71%) like previous studies [6,11]. The most abundant compound in essential oils was found as 1,8-Cineole (28.42%) for A. *officinarum,* and Linalool (69.49%) for *C. sativum*.

The results for MIC test of A. *officinarum* and *C. sativum* oils are given in Table 2. According to the table, *C. sativum* essential oil showed strong antimicrobial activity against the 14 tested microorganisms and *A. officinarum* oils showed strong antimicrobial activity against the 7 tested microorganisms. *A. officinarum* showed strong antimicrobial activity against *B. subtilis*, *E. durans, E. faecium*, *E. coli, P. aeruginosa*, *S. enteritidis*, and *S. kentucky*, with a MIC value of between 0.781 to 1.562 µg/mL, and showed moderate antimicrobial activity against *E. faecalis, K. pneumonia, L. monocytogenes*, *L. innocua*, *S. typhimurium* and *S. epidermidis* with a MIC value of between 25 µg/mL

and 3.125 µg/mL, where no activity was observed against, *E. aerogenes*, *S. infantis*. It was reported that *Alpina galangal*, which was another species of *Galangal*, has anti-microbial effect on *Staphylococcus aureus*.[4]

C. sativum showed strong antimicrobial activity against *B. subtilis*, *C. albicans, E. faecalis, E. faecium*, *K. pneumonia, L. innocua*, *P. aeruginosa*, *S. enteritidis, S. infantis*, *S. kentucky*, and *S. typhimurium* with a MIC value of between <0.195 to 1.562 µg/mL, and showed moderate antimicrobial activity against, *E. aerogenes*, *L. monocytogenes*, *P. fluorescens S aureus*, and *S. epidermidis* with a MIC value of between 25 µg/mL to 3.125 µg/mL for tested microorganisms. This situation as same as previous studies.[12]

CONCLUSION

Consequently, it can be said that *A. officinarum* essential oil has potential as a raw material for eucalyptol, and *C. sativum* essential oil has potential as a raw material for linalool. Antimicrobial studies revealed that both *A. officinarum* and *C. sativum* has strong antibacterial activities. Therefore, it can be recommended that these essential oils can be used as antimicrobial protector agent in cosmetic and medicine industry.

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CONFLICT OF INTEREST

None

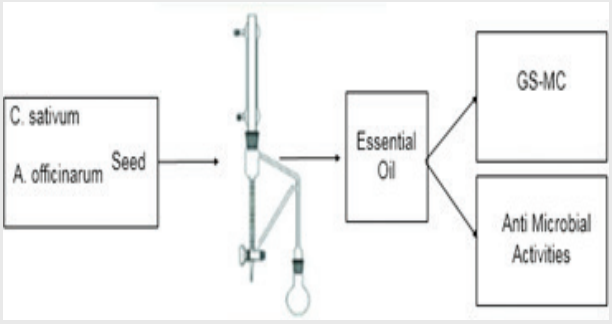
ABBREVIATION USED

GC-MS: Gas Chromatography Mass Spectometry.

REFERENCES

1. Chaisawadi S, Thongbute D, Methawiriyasilp W, Pitakworarat N, Chaisawadi A, Jaturonrasamee K, *et al*. Preliminary study of antimicrobial activities on medicinal herbs of Thai food ingredients. In Proceedings of the III WOCMAP Congress on Medicinal and Aromatic Plants: Bioprospecting and Ethnopharmacology, Chiang Mai, Thailand. 2005;111-4
2. Khan IA, Abourashed EA. Leung's encyclopedia of common natural ingredients: used in food, Drugs and cosmetics. John Wiley & Sons, 2011.
3. Latha K, Rammohan B, Sunanda B, Uma Maheswari MS, Mohan SK. Evaluation of anxiolytic activity of aqueous extract of Coriandrum sativum Linn. in mice: A preliminary experimental study. Phcog Res. 2015;7(Suppl 1):4750.
4. Mayachiew P, Devahastin S. Antimicrobial and antioxidant activities of Indian gooseberry and galangal extracts. LWT-Food Science and Technology. 2008;41(7):1153-9.
5. Basri AM, Taha H, Ahmad N. A review on the pharmacological activities and phytochemicals of Alpinia officinarum (Galangal) extracts derived from bioassayguided fractionation and isolation.Phcog. Rev 2017;11(21):4356
6. Anitescu G, Doneanu C, Radulescu V. Isolation of coriander oil: comparison between steam distillation and supercritical CO_2 extraction. Flavour and fragrance journal. 1997;12(3):173-6.
7. de Morais SR, Oliveira TL, de Oliveira LP, Tresvenzol LM, da Conceição EC, Rezende MH, *et al*. Essential oil composition, antimicrobial and pharmacological activities of Lippia sidoides cham. (verbenaceae) from São Gonçalo do Abaeté, Minas Gerais, Brazil. Phcog Mag. 2016;12:262-70.
8. Sela F, Karapandzova M, Stefkov G, Cvetkovikj I, Kulevanova S. Chemical composition and antimicrobial activity of essential oils of Juniperus excelsa Bieb. (Cupressaceae) grown in R. Macedonia. Phcog Res. 2015;7(1):74-80.
9. Sharma PK, Singh V, Ali M. Chemical Composition and Antimicrobial Activity of Fresh Rhizome Essential Oil of Zingiber Officinale Roscoe. Pharmacognosy Journal. 2016;8(3):185-90.
10. Balouiri M, Sadiki M, Ibnsouda SK. Methods for in vitro evaluating antimicrobial activity: A review. Journal of Pharmaceutical Analysis. 2016;6(2):71-9.
11. Zhang J, Dou J, Zhang S, Liang Q, Meng Q. Chemical composition and antioxidant properties of the essential oil and methanol extracts of rhizoma Alpinia officinarum from China in vitro. African Journal of Biotechnology. 2010;9(28):4414-21.
12. Baratta MT, Dorman HD, Deans SG, Biondi DM, Ruberto G. Chemical composition, antimicrobial and antioxidative activity of laurel, sage, rosemary, oregano and coriander essential oils. Journal of Essential Oil Research. 1998;10(6):618-27.

PICTORIAL ABSTRACT



SUMMARY

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- Furthermore, the contents of the essential oils were determined with GC-MS analyses.
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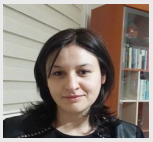
ABOUT AUTHORS

Dr. Sevil Özkınalı is Assistant Professor, Department of Chemistry, Faculty of Science and Literature, Hitit University, Çorum, TURKEY. Her areas of research interest include 'Calixarene Chemistry and Spectroscopic Characterization', 'Synthetic Organic Chemistry-and their Antimicrobial-Antioxidant Properties'' and 'Azo dyes, Schiff bases'.



Dr. Nesrin Şener is working as Assistant Professor in Kastamonu University at Chemistry department, Kastamonu. She keeps her interests in the development of synthetic molecules as dyes. She has published a number of publications in different Journals in National and International Repute

Mahmut GÜR has been working as Assistant Professor in Kastamonu University at Forest Industrial Engineering department, Kastamonu. He is interesting in the development of synthetic molecules. He has published a number of publications in different Journals in National and International Repute.

Kerim GÜNEY has been working as Assistant Professor at Botanic department, Forest Engineering Faculty in Kastamonu University. Kerim Güney has many publications on flora, vegetation, biodiversity and medical and aromatic plants.

Çağrı OLGUN Is working as a research assistant in Forest Industry Engineering Department , Faculty of Forestry in Kastamonu University, TURKEY. His interests include fiberboard, wood chemistry and non-wood forest product industry.

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