

Essential Oil of Oregano and Savory; Chemical Composition and Antimicrobial Activity

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ABSTRACT

The essential oils of oregano (*Origanum vulgare* ssp. *hirtum*) and savory (*Satureja thymbra*) plants were obtained through steam distillation method. The chemical compositions of their essential oils were analyzed via GC-MS technique. Furthermore, their antimicrobial activities were studied by using minimum inhibitory concentration (MIC) method. Their chemical composition was found as carvacrol (63.97%), p-cymene (12.63%) and linalool (3.67%) in oregano essential oil as major compounds and also, as carvacrol (42.7%), o-cymene (17.98%), linalool (9.65%), caryophyllene oxide (5.25%) and γ -terpinene (4.22%) in savory essential oil as major compounds. As a result, it can be said that that oregano and savory essential oil may be useful in the medicinal application and food industry as a preservative against harmful microorganisms.

Keywords: Oregano, Savory, Essential Oil, GC-MS, Antimicrobial Activity.

INTRODUCTION

The flora of Turkey has 23 species of *Origanum* (15 endemic) and 14 species of *Satureja* (4 endemic).¹ One of the these species, *Origanum vulgare* subsp. *hirtum* is a common East Mediterranean taxon, found mainly in the southern part of the Balkan region and in Turkey.² Savory are aromatic plants used for production of essential oils (EOs). The savory found in the mountain of the Mediterranean region in Turkey.³ The oregano, thyme and savory leaves have been added to meat, fish and food products.⁴ They are known and used as species with a thymol/carvacrol type odor in Turkey.¹ The carvacrol and thymol type plants are used as flavoring and herbal tea, are taken especially to cure various illness.^{3-5,6} *Origanum* EO is used as a food additive and also as a fragrance component in cosmetic products.^{7,8} Food poisoning is problem in the World, even in well developed countries. So far many bacteria species has been reported as the causal

agents of foodborne diseases.⁹ Essential oil of oregano and savory showed a good antioxidant capacity,^{9,10} antimicrobial activity against microorganisms^{1-3,9-10} and tyrosinase inhibition activity.⁵ In recent years, there have been important studies about the antimicrobial activity of essential oils of aromatic plants and their potential role in food preservation.¹¹ The aim of this study is the determination of the chemical composition and antimicrobial activity of the oregano (*Origanum vulgare* subsp. *hirtum*) and savory (*Satureja thymbra*) essential oils.

MATERIALS AND METHODS

Plant Material

The mature and healthy oregano (*Origanum vulgare* L. subsp. *hirtum*) and savory (*Satureja thymbra* L.) dried leaves obtained from Özşen Lokman Hekim Company located in GİMAT-Ankara, TURKEY.

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Extraction of Essential Oil

Essential oil was obtained by hydro distillation process using a Clevenger's type apparatus. After distillation process EO was separated and storage in refrigerator at 4 °C.

GC-MS Analyze

For identification of essential oil components GC-MS QP2010 Ultra (Shimadzu) equipped with Rtx-5MS capillary column (30m·0.25 mm; coating thickness 0.25 µm) was used. Identification of the constituents was based on comparison of the retention times and on computer matching against Wiley Data library. GC-MS chromatograms were scanned in essential oil data library.

Microorganism Strains

In antimicrobial activity test *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 13076, *Salmonella infantis*, *Salmonella kentucky*, *Salmonella typhimurium* SL 1344, *Staphylococcus aureus* ATCC 25923 and *Staphylococcus epidermidis* DSMZ 20044 was used. Most of the strains were ATCC, DSMZ and SL type standard strains. Other strains, which have no standard ID information were isolated from food samples and identified at the Department of Biology, Faculty of Science, and Ankara University.

Antimicrobial Activity (MIC)

A broth microdilution MIC test was applied with a slight modification.¹² Two-fold dilutions of the oils were prepared ranging from 100 µg/mL to 0.195 µg/mL by using 96-well micro titration plate. The micro titration

plates were incubated at 37 °C for 24 h for bacteria strains, where 27 °C for 48 h for *C. albicans*.

RESULTS AND DISCUSSION

The main components of the essential oil obtained from oregano and savory samples are given in Table 1. GC-MS analyses revealed that the main components of oregano EO was carvacrol (63.97%), p-cymene (12.63%) and linalool (3.67%), α-terpineol (2.54%) and (-)-terpinen-4-ol (2.24%); the main components of savory EO was carvacrol (42.7%), o-cymene (17.98%), linalool (9.65%), caryophyllene oxide (5.25%), γ-terpinene (4.22%), caryophyllene (2.73%) and (-)-borneol (2.24%).

According to the MIC test results, oregano and savory essential oil showed a perfect antimicrobial activity against all test microorganisms with a MIC value of <0.195 µg/mL. The oregano and savory essential oil showed very strong antimicrobial activity against *B. subtilis*, *C. albicans*, *E. faecalis*, *E. aerogenes*, *E. durans*, *E. faecium*, *E. coli*, *K. pneumoniae*, *L. monocytogenes*, *L. innocua*, *P. aeruginosa*, *P. fluorescence*, *S. infantis*, *S. kentucky*, *S. typhimurium*, *S. aureus* and *S. epidermidis* with a MIC value of <0.195 µg/mL for all microorganisms.

As the current literature is concerned there are several studies for the antimicrobial activity of oregano and savory against several microorganisms. The oregano and savory essential oil showed very strong antimicrobial activity against 19 different test microorganisms. Previous studies shows that the essential oils obtained from plants of *Origanum* and *Satureja* species have been found to have significant antimicrobial activities.¹⁻³ These properties depend greatly on their chemical compositions such as carvacrol,¹³ linalool,¹⁴ α-terpineol¹⁴ and γ-terpinene.¹⁵

CONCLUSION

Essential Oil	Components	Relative Area %	Essential Oil	Components	Relative Area %
Oregano	carvacrol	63.97	Savory	carvacrol	42.7
	p-cymene	12.63		o-cymene	17.98
	linalool	3.67		linalool	9.65
	α-terpineol	2.54		caryophyllene oxide	5.25
	(-)-terpinen-4-ol	2.24		γ-terpinene	4.22
				caryophyllene	2.73
			(-)-borneol	2.24	

Finally, it can be suggested that the essential oils of oregano and savory have perfect antimicrobial activities against different microorganisms. In view of their activity, these essential oils may find industrial applications as natural conservative and agents in the pharmaceutical and food industries.

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CONFLICT OF INTEREST

None

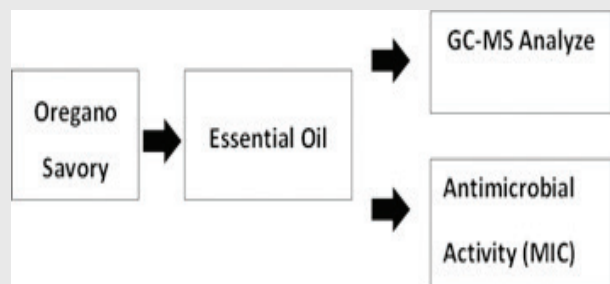
ABBREVIATION USED

GC-MS: Gas chromatography-mass spectrometry; EO: Essential Oil; GIMAT: Association of Food and Consumer Goods Ankara; DSMZ: German Collection of Microorganisms and Cell Cultures; ATCC: American Type Culture Collection; ID: Identity; MIC: Minimum Inhibitory Concentration.

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PICTORIAL ABSTRACT



SUMMARY

- Antimicrobial activities of the Oregano and Savory essential oils were investigated by using MIC test by against 18 different species microorganisms.
- Furthermore, the contents of the essential oils were determined with GC-MS.
- As a result, it can be said that the essential oils of Oregano and Savory can be used as antimicrobial agent.

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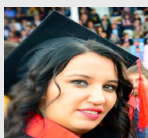
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