Original Article

Determination of Antimicrobial Activity and Chemical Composition of Pimento & Ginger Essential Oil

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ABSTRACT

The essential oil was obtained from pimento (*Pimenta racemosa* Mill.) and ginger (*Zingiber officinale* Rosc.) through hydrodistillation method. The chemical composition of pimento and ginger essential oils were analyzed by GC-MS. It was found that the most abundant components were methyleugenol (52.33%) and zingiberene (16.32%) in essential oils of pimento and ginger, respectively. The antimicrobial activities of essential oils were investigated against 18 microorganisms with minimum inhibitory concentration (MIC) method. While pimento essential oil behaved strong antimicrobial against all bacteria apart from *S. epidermidis*, ginger essential oil exhibited poor activity against all bacteria. As a result of this study; it can be suggested that pimento essential oil is a preservative in the medicinal application and food industry.

Keywords: Pimento, Ginger, Essential oil, Antimicrobial Activity, Hydrodistillation method, Chemical composition.

INTRODUCTION

Pimenta racemosa (Miller) J. Moore is a Caribbean tree which grows to a height of about 15 m. It is known to exist in five varieties. *Pimenta racemosa* is the most widespread among this varieties.[1] Pimento is commonly used for aromatizing foods. It is used in process of the manufacturing of creams, lotions, detergents, or in the shampoos. It is also used in cosmetics industry.[2,3] Ginger oil is usually produced from dried ginger by steam distillation method.[4] The ginger has been used in traditional medicine for treating several sicknesses such as coughs, sinusitis, sore throats, fever and flu.[5] Ginger extracts, gingerols, and gingerdiol were found to exhibit antiviral, antibacterial and antifungal activities.[6-9] Also, their synergistic antimicrobial effects[4] and antihyperlipidemic effects[10] have been recently reported. The main purpose of the current study is to determine the chemical composition and antimicrobial activities of pimento and ginger essential oils.

MATERIALS AND METHODS

Plant Material and Extraction of Essential Oil

The plant materials obtained from Ankara and identified by the Dr. Kerim Güney. Essential oil was obtained by hydro distillation process using a Clevenger's type apparatus.

GC-MS Analyze

GC-MS QP 2010 Ultra (Shimadzu) equipped with Rtx-5MS capillary column was used.

Microorganism Strains

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

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Antimicrobial Activity

A broth microdilution MIC test was applied according to the literature.[11] 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. Each well is inoculated with an inoculum prepared as mentioned before. 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

GC-MS analyses revealed that methyleugenol (52.33%), chavibetol (19.47%), caryophyllene (4.96%), myrcene (3.72%), eucalyptol (2.46%) and α-terpineol (2.38%) identified as the components of essential oils; ginger contains zingiberene (16.32%), curcumene (12.42%), sesquiphellandrene (11.40%), farnesene (6.51%), β-phellandrene (6.01%), β-bisabolene (4.23%), 10-β(H)-cadina-1(6),4-diene (3.21%), acoradiene (3.00%), camphene (2.92%) and eucalyptol (2.48%) as shown in **Table 1.**

According to the **Table 2**, pimento essential oil showed an antimicrobial activity against all microorganisms with a MIC value ranging from <0.195 to 100 µg/mL. However, ginger essential oil presented antimicrobial activity against some microorganisms with a MIC value ranging between 3.125 and 100 µg/mL. The pimento essential oil showed very strong antimicrobial activity against *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 and S. aureus* with a MIC value of <0.195 µg/mL for all microorganisms. Also, the pimento essential oil showed strong antimicrobial activity against *B. subtilis* and *S. enteritidis* with a MIC value of 0.781 and 3.125 µg/mL, respectively.

The pimento essential oil showed very strong antimicrobial activity against 15 different test microorganisms.

Table 1: Main components of essential oil scanning in GC-MS

Essential Oil	Components	Area %	Essential Oil	Components	Area %
Pimento	methyleugenol	52.33	Ginger	zingiberene	16.32
	chavibetol	19.47		curcumene	12.42
	caryophyllene	4.96		sesquiphellandrene	11.40
	myrcene	3.72		farnesene	6.51
	eucalyptol	2.46		β-phellandrene	6.01
	α-terpineol	2.38		β-bisabolene	4.23
				10-β(H)-cadina-1(6),4-diene	3.21
				acoradiene	3.00
				camphene	2.92
				eucalyptol	2.48

Table 2: MIC values for pimento and ginger (µg/mL)

Microorganisms	Pimento	Ginger	Microorganisms	Pimento	Ginger
Bacillus subtilis DSMZ 1971	0.781	-	*Listeria innocua*	<0.195	-
Candida albicans DSMZ 1386	<0.195	100	*Pseudomonas aeruginosa* DSMZ 50071	<0.195	100
Enterococcus faecalis ATCC 29212	<0.195	100	*Pseudomonas fluorescence P1*	<0.195	3.125
Enterobacter aerogenes ATCC 13048	<0.195	-	*Salmonella enteritidis* ATCC 13075	3.125	-
Enterococcus durans	<0.195	-	*Salmonella infantis*	<0.195	-
Enterococcus faecium	<0.195	-	*Salmonella kentucky*	<0.195	-
Escherichia coli ATCC 25922	<0.195	-	*Salmonella typhimurium* SL 1344	<0.195	-
Klebsiella pneumoniae	<0.195	-	*Staphylococcus aureus* ATCC 25923	<0.195	100
Listeria monocytogenes	<0.195	25	*Staphylococcus epidermidis* DSMZ 20044	100	6.25

Also, pimento showed strong antimicrobial activity against two microorganisms, but pimento did not show any antimicrobial activity against *S. epidermidis*. Interestingly, ginger had strong antibacterial activities against *P. fluorescence* and *S. epidermidis*. Previous studies revealed that the essential oils of pimento have been found to possess significant antimicrobial and antioxidative activities.[12-14] Contrary to pimento, the ginger essential oil did not show very strong antimicrobial activity against other test microorganisms. As a result, although the ginger essential oil had a strong antimicrobial activity against two microorganisms, it had moderate and weak antimicrobial activity against one microorganism (*L. monocytogenes*) and four microorganisms (*Candida albicans, E. faecalis, P. aeruginosa, Staphylococcus aureus*), respectively.

CONCLUSION

Finally, it can be suggested that the essential oils of pimento have strong antibacterial activities against different microorganisms of importance to food spoilage and poisoning. The pimento essential oils may find industrial applications as natural preservatives and antimicrobial agents in cosmetics and food industries.

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CONFLICT OF INTEREST

None

ABBREVIATION USED

GC-MS: Gas Chromatography Mass Spectometry.

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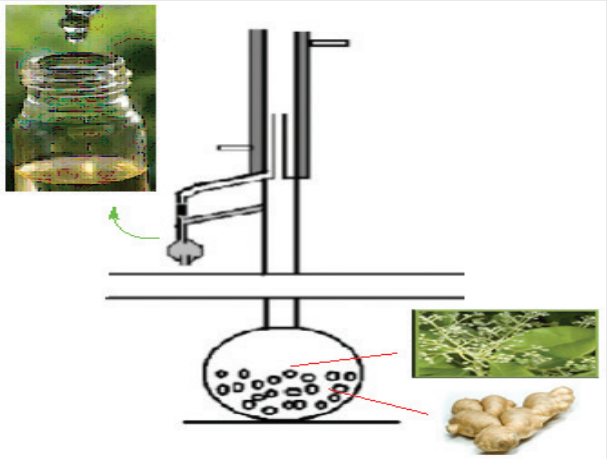
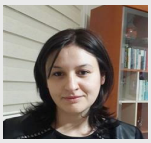
PICTORIAL ABSTRACT



SUMMARY

- The essential oil was obtained from pimento and ginger through hydrodistillation method.
- The chemical composition of pimento and ginger essential oils were analyzed by GC-MS.
- The antimicrobial activities of essential oils were
- Investigated against 18 microorganisms with minimum inhibitory concentration (MIC) method.

ABOUT AUTHORS



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