Production ofSemivolatile Components for Food Preservation from Different Myanmar Aromatic Plant Species

Myint Myint San, Tint Lwin, Khin Ohn Myint and Khin Thant Sin*
Department of Botany, University of Yangon

Abstract

Plant semivolatile oils and their components are known to exhibit antimicrobial activities, and many applications for controlling the growth of food borne pathogens. Extraction of semivolatile oils of *Apium graveolens* L. (Tayok-nannan), *Coriandrum sativum* L. (Nannan), *Anethum graveolens* L. (Sa meke), *Ocimum basilicum* L. (Pin sein), *Mentha longifolia* (L.) Hudson (Bu di nan) were done; antimicrobial activity of those semivolatile oils were evaluated in culture medium; and taste panel evaluation were also carried out with chicken roast. The detailed analysis of five Myanmar aromatic plants semivolatile oil was done by Gas Chromatography Mass Spectrometry technique. The antimicrobial results showed that all semivolatile oils could inhibit the growth of *Bacillus pumilus, Bacillus subtilis, Escherichia coli, Staphylococcus aureus* and *Candida albicans. Mentha longifolia* L. (Hudson) oil and *Ocimum basilicum* L. oil showed the strongest inhibition on *Staphylococcus aureus.* In the result of taste panel evaluation, *Ocimum basilicum* L. was the most suitable to use as preservative for chicken roast.

Keywords: semivolatile oils, antimicrobial activity, preservatives

1. Introduction

Semivolatile plant oils occur in edible and medicinal plants, and have been widely used as flavouring agents in foods since the earliest recorded history (Geethalakshmi and Sarada, 2012). It is well established that many essential oil, have antimicrobial activity against a wide range of spoilage and pathogenicbacteria (Alzoreky and Nakahara, 2002; Kim, Marshall, Wei, 1995; Packiyasothy and Kyle, 2002). In the present research, two family of five aromatic herbs are comprised namely Apiaceae and Limanaceae; their scientific names are *Apium graveolens* L., *Coriandrum sativum* L.,*Anethum graveolens* L., *Ocimum basilicum*L. and *Mentha longifolia*(L.) Hudson.

Apium graveolens L. (Tayok-nannan), a leafy herb of Apiaceae family, has been used as an ingredient of food for fragrance. The major components of the essential oil of *Apium graveolens* L. leaves are limonene and carvone (Sipailiene and Venskutonis, 2005). *Cariandrum sativum* L. (nannan), a leafy herb ofApiaceae family, has been used as a spice for favoringfoods. The major components of the volatile oil of *Cariandrum sativum* L. are α-pinene, ϒ-terpinene, geranylacetate and Geraniol (Diederichsen, 1996).*Anethum graveolens* L.(Sa meik) is also a leafy herb of the Apiaceae family. The main chemicalcomponents of *Anethum graveolens*L. are α-phellandrene, Dill ether and Tran's dihydrocarvone (Sharopov *et al.*, 2013).

*Ocimum basilicum*L.(pin seine), is a leafy herb of the Lamiaceae family, the major components of its essential oil are methyl chavicol geranial, neral and caryophyllene oxide (Sajjadi, 2006).*Mentha longifolia*(L.) Hudson(Bu din an), is a creeping herb which belongs to the family Lamiaceae. The main chemicalcomponents of*Mentha longifolia*(L.) Hudson is Piperitenone, 1, 8-Cineole and Piperitenone oxide (Mehran Moradalizadeh*et al.*, 2014).

In Myanmar,*Apium graveolens* L. (Tayok-nannan), *Coriandrum sativum* L. (nannan),*Eryngium foetidum* L. (Shan nannan), *Anethum graveolens* L. (Sa meke), *Ocimum basilicum*L. (pin sein) and *Mentha longifolia*(L.) Hudson (Bu di nan) are very popular spices and commonlyadded to traditional foods not only in cooking but also eat as fresh.

*Khin Thant Sin, Department of Botany, University of Yangon

Plant semivolatile oils and their components are known to exhibit antimicrobial activities, and many applications for controlling the growth of foodborne pathogens and food spoilage microorganisms have been developed using these semivolatile oils as natural food preservatives. In general, higher concentrations of essential oils are required in foods than in laboratory media; accordingly, the practical application of semivolatile oils is restricted, since the addition of high concentrations of the oils causes undesirable flavorchanges in the food product. Essential oils have been usedin combination with other antibacterial agent and the use of natural food preservatives in order to maintain minimal processing and also to ensure protection from both spoilage and pathogenic microorganisms (Chouliara and Kontominas, 2006).

Currently, there is a strong debate about the safetyaspects of chemical preservatives since they are consideredresponsible for many carcinogenic and teratogenic attributesas well as residual toxicity. For these reasons, consumerstend to be suspicious of chemical additives and thusthe demand for natural and socially more acceptable preservativeshas been intensified (Skandamis *et al.*, 2001). The exploration of naturallyoccurring antimicrobials for food preservation receivesincreasing attention due to consumer awareness of naturalfood products and a growing concern of microbial resistancetowards conventional preservatives (Schuenzel and Harrison, 2002).

A renewed interest in natural preservation appears to bestimulated by present food safety concerns, growing problemswith microbial resistance, and a rise in production ofminimally processed food, together with green image policiesof food industries. Many studies have documentedthe antifungal (Aligiannis *et al.*, 2001) and antibacterial (Canillac and Mourey, 2001; Lachowicz *et al.*, 1998) effects of plant essential oils.

The aims of this research are to investigate the semivolatile composition from Myanmar habitant five aromatic plants by GC-MS technique,to screen biologically activities on microorganism by those five different semivolatile components,to evaluate taste panel of the chicken roast and to substitute the food preservative chemicals with Myanmar habitant aroma plants product semivolatile components.

2. Material and Methods

Plant material

Apium graveolens L. (Tayok-nannan), *Coriandrum sativum* L. (nannan),*Anethum graveolens* L. (Sa meke), *Ocimum basilicum*L. (pin sein) and *Mentha longifolia*(L.) Hudson (Bu di Nan) were collected in Hmaw-be township, Yangon region, Republic of Union of Myanmar in February 2014 and identified with Flora of British India (1875), Flora of Ceylon (1995) and Flora of Hong Kong (2007). The collected plant samples (leaves and stems) were dried at room temperature with good ventilation. The dried samples were pulverized with grinding machine until to get fine powder and stored them with the containers in the cool and dry place.

Preparation of semivolatile components

Isolation of semivolatile components from the dried leaves and stems of aromatic plants was madeby solvent extraction method (Thantsin *et al.*, 2008). 1kg of powdered sample was soaked with 2 Liter of petroleum etherfor thirty minutes in ultrasonic bath and

that was repeated three times. Total filtrate was allowed to concentrate by using pressure with rotary evaporator for removing the solvent.To remove the chlorophyll content, those multicomplex mixtures were purified with silica gelGF_{254} eluted with petroleum ether by the column chromatography method. Isolated semivolatile components were stored in dark glass bottles and kept at 4°C until composition analysis or their use.

Analytical methods for essential oil

Gas chromatography mass spectrometry technique was carried out on a Shimadzu GCMS-QP5000 mass spectrometer operating at 70 eVionization energy at the Department of Medical Research (Lower Myanmar). The GC column used was a DB-5 capillary column (30mx0.25mm; 0.25μm film thickness); programmed from 35°C to 280°C at 3°C min-1 with helium as the carrier gas. Split ratio was 1:20. Most compounds were identified by gas chromatography by matching their mass spectral fragmentation patterns with those stored in the spectrometer database (Wiley NBS library) or with the comparison of their retention indices (*I*) with references value. Retention indices were determined in relation to a homologous series of *n*-alkanes (C_8-C_{20}) under the same operation condition.

Chemical and microorganism

The semi-volatile oils from five different aromatic plant species were tested with five different type of bacteria and one fungal species such as *Bacillus pumilus, Bacillus subtilis, Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus* and *Candida albicans* by using agar well diffusion method (Cruickshank *et al.*, 1975). 95% Ethanol was used as solvent and control. The semi-volatile oils from five different aromatic plant species were prepared 1:15 ratio with 95% ethanol. The tests were conducted at the Development Centre for Pharmaceutical and Food Technology (DCPFT).

Preparation of antimicrobial activities test

Nutrient agar was prepared according to the method by Cruickshank *et al.*, 1975. Nutrient agar was boiled and 20 - 25 ml of the cultural medium was poured into conical flask and plugged with cotton wool and sterilized at 121°C for 15 minutes in autoclave. After this conical flask were cooled down to 30-35°C and poured into sterilized petridishes and 0.2 ml of test organisms were added into the dishes. The agar was allowed to set for 2-3 hours, and then 10 mm agar-well was made by the help of sterilized agar-well cutter. After that, about 0.2 ml of samples (1 ethanol: 15 semi-volatile oil) were introduced into agar-well and incubated at 37°C for 24 hours. The inhibition (clear) zones appear around the agar-well, indicating that the presence of antimicrobial activity. The extent of antimicrobial activity was measured from the diameter of inhibition zones were recorded in millimeter.

Taste panel evaluation

Taste panel evaluation test was done by the method of Hashmi (2007). For the discriminative test, all panelists will be assessed for the following two types of discriminative test; different taste and sensitive taste. Different taste is the taste to find a difference between the control and the other product. Sensitive taste is to taste the ability of panelists to direct sensory characteristic. The descriptive taste to be carried out among the panelists is to measure the ability to evaluate qualitative and quantitative characteristic of the product. Totally 5 panelist was tasted the control and treated chicken roast. CP chicken roast is used as

the control. The extract of *Ocimumbasilicum* L. and *Mentha longifolia* (L.) Hudson were applied on chicken separatelyand roasted in microwave oven at 375°F for 2 hrs.

3. Results

Morphological identification

Scientific Name - *Apium graveolens* L.

English Name - Celery

Myanmar Name - Tayok Nan Nan

Family - Apiaceae

Aromatic biannual herbs, erect, grow in 1 meter tall, roots woody, stems cylindrical, erect, divergently branched from the base, and striated, nodes solid, internodes fistular, glabrous. Leaves uni to tripinnately compound, the leaflets variable in shape, the lower ones ovate, pinnatifid, dentate along the margin, coarsely toothed at the tip, the middle ones ovate-cuneate, pinnatisect, dentate along the margin, the upper ones dissected, the lobes linear, glabrous on both surfaces; petioles cylindrical. Inflorescences terminal compound umbels, peduncle cylindrical, unequal, the umblets 8-20 flowered, axillary compound umbels smaller and shorter than the terminal ones, flowers are creamy to grey white, complete, bisexual, zygomorphic, epigynous. Sepals' teeth minute, obsolete, valvate, green, persistent. Petals 5, free, obcordate with inflexed tips, white or yellowish in colour, stamens 5, free, alternate with the petals, filaments slender, distinct, white or yellowish white, inflaxed in bud, exserted an open flower; the anther lobes globose or ovoid, yellowish white, glabrous; ovaries ellipsoid or ovoid, yellowish-green, glabrous; styles 2, stigma branched. Fruits yellowish green, seeds yellowish brown, endospermic.

Figure 1. Habit of *Apium graveolens* L.

Scientific Name - *Coriandrum sativum* L.

English Name - Coriander

Myanmar Name - Nan Nan

Family - Apiaceae

Annual aromatic herbs erect; stem herbaceous, cylindrical, fistular, striated, glabrous. Leaves are alternate, simple or uni to tripinnately compound, the leaflets variable in shape, the lower ones ovate, pinnatifid, dentate along the margin, obtuse at the tips, wide, the middle

ones ovate-cuneate, pinnatisect, dentate along the margin, the upper ones dissected, the lobes linear-setaceous, glabrous on both surfaces; petioles cylindrical, canaliculated, sheathing, striated, glabrous; exstipulate. Inflorescence terminal and axillaty, compound umbels; peduncles slender; flowers complete, bisexual, zygomorphic, pentamerous, cyclic, epigynous; pedicels slender, glabrous; sepals 3+2 ,aposepalous, unequal, valvate, persistent; petals 2+3, apopetalous, unequal, white or pinkish purple, valvate, glabrous; stamens 5, free, the filaments white or pinkish purple, inflexed in bud, exserted, the anther dithecous, dorsifixed, introrse, longitudinally dehiscent; ovary and hypanthium turbinate, ribbed, bicarpellary, syncarpous, bilocular, the axile placentation, one ovule in each locule; style dilated at the base forming stylopods, stigma bifid. Fruits yellowish green, seeds orbicular, compressed, solitary, endospermic.

Figure 2. Habit of *Coriandrum sativum* L.

Scientific Name - *Anethum graveolens* L.

English Name - Dill

Myanmar Name - Sameik

Family - Apiaceae

Annual aromatic herbs, stem cylindrical, erect, profusely branched above, striated or vertically ridged, nodes solid, internodes fistular, the tip acute to pointed , the margins entire, the bases attenuate; glabrous. Leaves bi to tripinnately compound, dissected, the leaflets linear or filiform, the tip acute to pointed, and the margins entire, the bases attenuate; petiolate. Inflorescences compound umbel, terminal compound umbel larger than the axillary ones, peduncles cylindrical, flowers yellow; ebracteate, ebracteolate, complete, bisexual, irregular, zygomorphic, epigynous; calyx teeth obsolete, yellow, corolla yellow, obovate; stamens 5, alternate with the petal, filament slender, ovaries elliptic-ovoid, the style slender, stigma capitate. Fruits yellowish green seeds yellowish white, endosperm oily.

Figure 3. Habit of *Anethum graveolens* L.

Scientific Name - *Ocimum basilicum* L.

English Name - Basils

Myanmar Name - pin sein

Family - Lamiaceae

An erect annual herbs, 20–60 cm long, with ovate, toothed or entire, leaves which are up to 8 cm in length, with opposite, light green, silky leaves 1.5–5 cm long and 1–3 cm broad, ovate toothed or entire. The inflorescences are simple terminal raceme. The flowers are quite big, white in colour and arranged in a terminal spike. The flowers are bracteates, fruiting calyx very shortly pedicelled,Calyx is deflexed, upper tooth very large and decurrent. Corolla of two lower tooths are ovate-lanceolate longer than the rounded upper, lateral smaller than the lower, white or purple-tinged, around 1 cm long.The four stamens and the pistil are not pushed under the upper lip of the corolla, stigma bifid but lay over the inferior.

Figure4. Habit of *Ocimum basilicum*L.

Scientific Name - *Mentha longifolia* (L.) Hudson

English Name - Horse Mints

Myanmar Name - Bu di Nan

Family - Lamiaceae

Plant height: 20-80 cm tall.Growth habit: perennial from creeping rhizomes.Stems: ascending or erect, 4-sided, hairy with few to numerous, short and backward, to longer and more spreading hairs, often hairless between the angles. Leaves: opposite, short-stalked, slightly

reduced upwards. The blade is 2-8 cm long and 6-40 mm wide, rather narrowly ovate or elliptic-ovate to more often somewhat rhombic elliptic, hairless or hairy, sharp-toothed, pointed, with several pairs of lateral veins. Flowers: funnel shaped with 4 spreading lobes, white to light purple or pink, 4-7 mm long, numerous in compact, separate whorls, borne in the axils of the middle and upper leaves. Calyx is hairy, 2.5-3 mm long, with short, triangular, pointed lobes. Flowering time: July-September. Fruits: 4 small, egg-shaped nutlets.

Figure 5. Habit of *Mentha longifolia* (L.) Hudson

Chemical compositions of semivolatile components

Table 1. List the names of components of *Apium graveolens* L. (Tayok-nannan)

S. N	Name of Compounds	Retention time	Retention Index	Molecular formula
1.	α pinene	13.420	928	$C_{10}H_{16}$
2.	Sabinene	14.215	959	$C_{10}H_{16}$
3.	β pinene	15.243	973	$C_{10}H_{16}$
4.	Limonene	15.600	1027	$C_{10}H_{16}$
5.	β-caryophyllene	16.023	1419	$C_{10}H_{16}$
6.	α-humulene	16.813	1450	$C_{15}H_{24}$

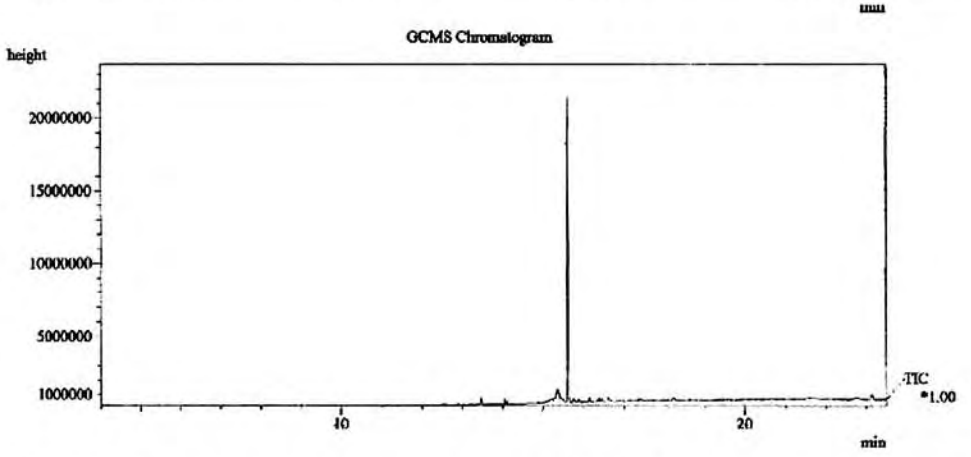

Figure 6. GC-MS Chromatogram of semivolatile oil of *Apium graveolens* L.

Table 2. List the names of components of *Coriandrum sativum* L. (nannan)

S.N	Name of Compounds	Retention time	Retention Index	Molecular formula
1.	α pinene	12.347	928	$C_{10}H_{16}$
2.	Camphene	12.766	930	$C_{10}H_{16}$
3.	β- pinene	13.215	970	$C_{10}H_{16}$
4.	Myrcene	13.420	1009	$C_{10}H_{16}$
5.	α-limonene	14.086	1023	$C_{10}H_{16}$
6.	β –Phellandrene	15.208	1035	$C_{10}H_{16}$
7.	Y-Terpinene	15.562	1085	$C_{10}H_{16}$
8.	3,7-dimethyl-6-octenal	16.595	1108	$C_{10}H_{18}O$
9.	1-p-menthen-4-ol	17.359	1114	$C_{10}H_{18}O$
10.	Decanal	18.14	1205	$C_{10}H_{20}O$
11.	Geraniol	19.632	1238	$C_{10}H_{18}O$
12.	2-decenal	20.873	1263	$C_{10}H_{18}O$
13.	Geranyl acetate	23.200	1361	$C_{12}H_{20}O_2$

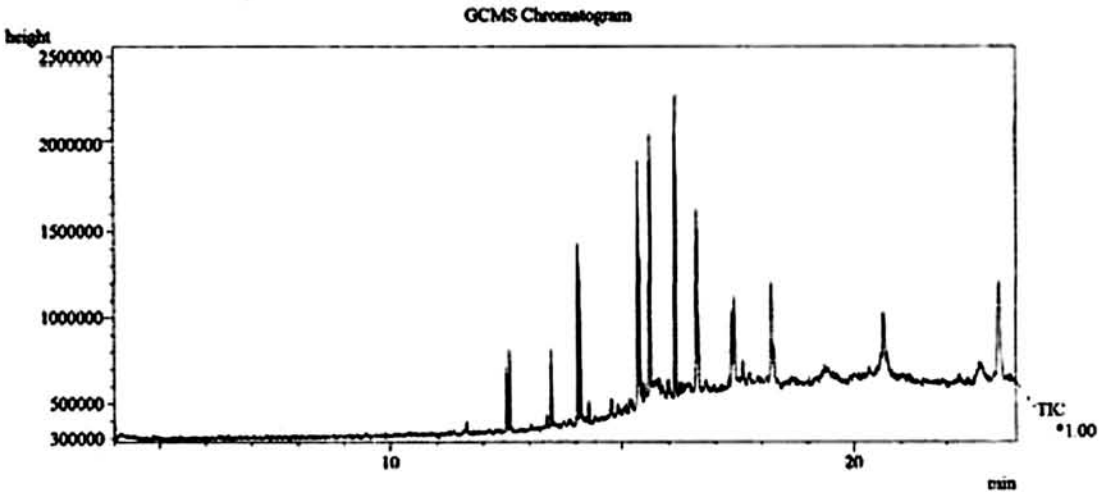

Figure 7. GC-MS Chromatogram of semivolatile oil of *Coriandrum sativum* L.

Table3. List the names of components of *Anethum graveolens* L. (Sa-make)

S.N	Name of Compounds	Retention time	Retention Index	Molecular formula
1.	α-phellandrene	11.862	1007	$C_{10}H_{16}$
2.	Dill ether	16.017	1188	$C_{10}H_{16}O$
3.	Trans dihydrocarvone	16.601	1209	$C_{10}H_{16}O$
4.	Carvone	18.187	1254	$C_{10}H_{14}O$

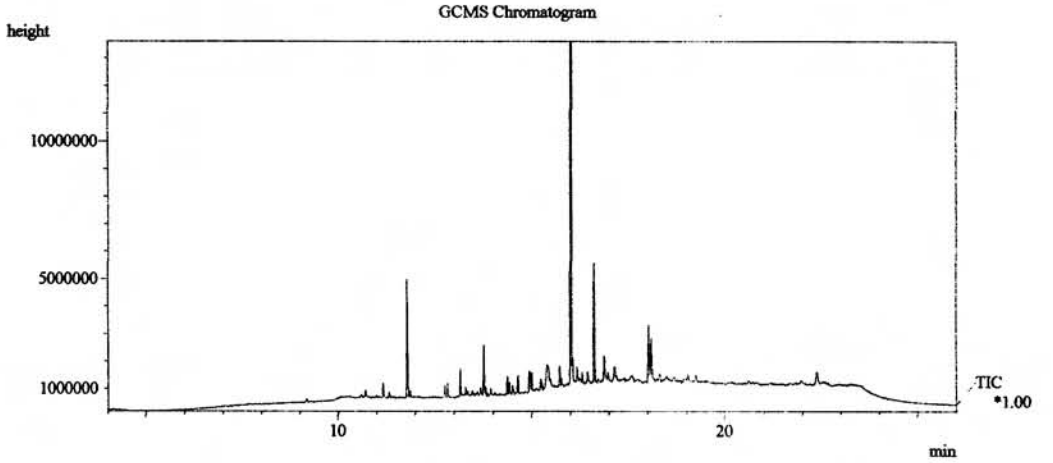

Figure 8. GC-MS Chromatogram of semivolatile oil of *Anethum graveolens* L.

Table4. List the names of components of *Mentha longifolia*(L.) Hudson (Bu di nan)

S. N	Name of Compounds	Retention time	Retention Index	Molecular formula
1.	Sabinene	11.527	959	$C_{10}H_{16}$
2.	Limonene	13.534	1027	$C_{10}H_{16}$
3.	1,8 cineole	13.637	1035	$C_{10}H_{18}O$
4.	Cis hydrate de sabine	14.870	1073	$C_{10}H_{18}O$
5.	Borneol	15.8	1169	$C_{10}H_{18}O$
6.	α –Terpineol	16.2	1189	$C_{10}H_{16}$
7.	Piperitone	17.4	1253	$C_{10}H_{16}$
8.	Piperitenone	20.485	11343	$C_{10}H_{16}O$
9.	Piperitenone oxide	22.286	1369	$C_{10}H_{14}O_2$
10.	trans-Caryophyllene	23.190	11419	$C_{15}H_{24}$

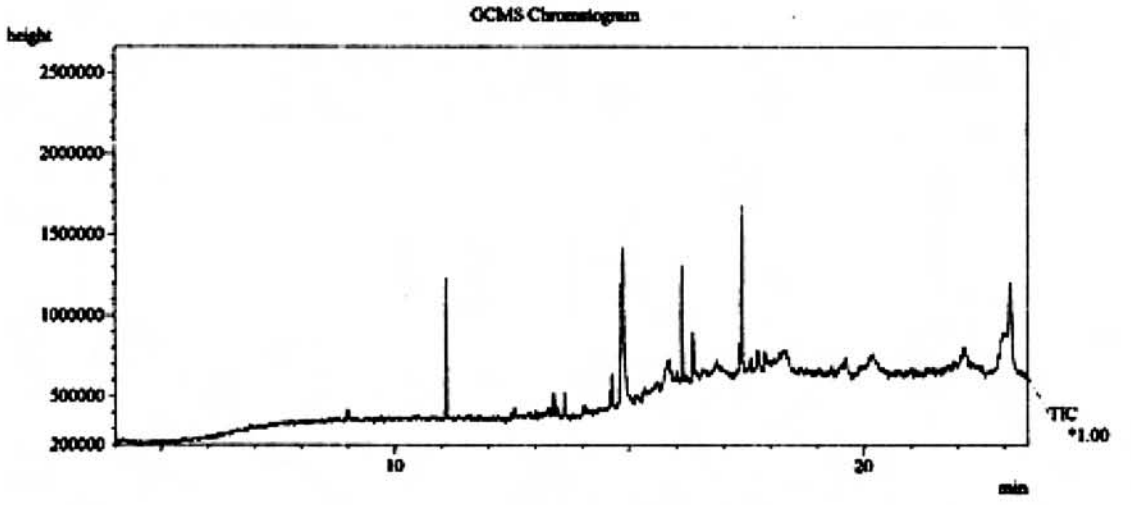

Figure9. GC-MS Chromatogram of semivolatile oil of *Mentha longifolia*(L.) Hudson

Table 5. List the names of components of *Ocimum basilicum*L. (pin sein)

S. N	Name of Compounds	Retention time	Retention Index	Molecular formula
1.	1,8-cineole	9.001	1035	$C_{10}H_{18}O$
2.	Linalool	10.350	1100	$C_{10}H_{18}O$
3.	Camphor	11.500	1146	$C_{10}H_{16}O$
4	terpinen-4-ol	12.301	1180	$C_{10}H_{18}O$
5	methyl chavicol	12.512	1203	$C_{10}H_{12}O$
6	trans-α-bergamotene	12.801	1437	$C_{15}H_{24}$
7	α-humulene	13.002	1455	$C_{15}H_{24}$
8	germacrene-D	13.213	1482	$C_{15}H_{24}$
9	germacrene-A	13.300	1504	$C_{15}H_{24}$
10	γ-cadinene	13.678	1511	$C_{15}H_{24}$
11	trans-α-bisabolene	13.913	1544	$C_{15}H_{24}$
12	Spathulenol	14.341	1579	$C_{15}H_{24}O$
13	caryophyllene oxide	15.218	1584	$C_{15}H_{24}O$
14	humulene epoxide II	15.713	1610	$C_{15}H_{24}O$
15	epi-α-cadinol	16.002	1643	$C_{15}H_{26}O$
16	β-eudesmol	17.289	1652	$C_{15}H_{26}O$

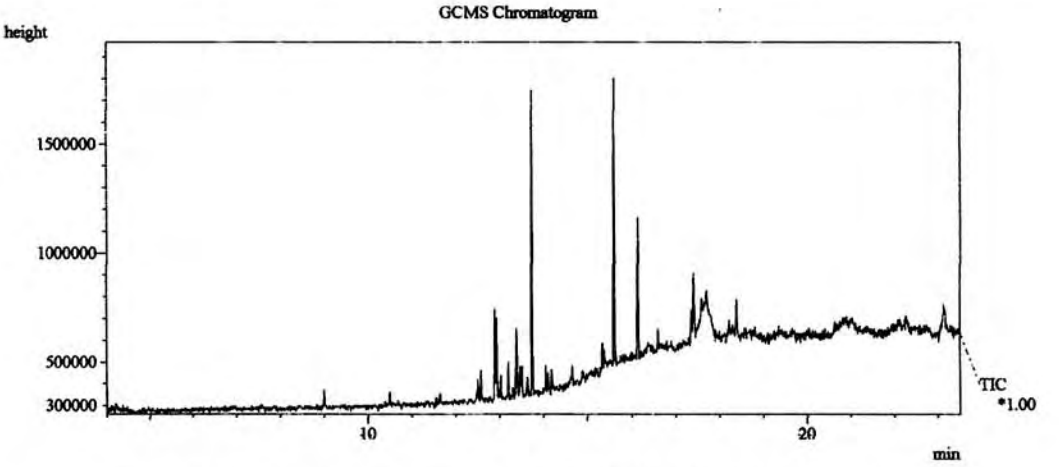

Figure10. GC-MS Chromatogram of semivolatile oil of *Ocimum basilicum*L.

Antimicobial activity

Screening of antimicrobial activities of semi-volatile oils from five different aromatic plant species were done by agar well diffusion method test on six pathogenic microorganisms. According to these results, semi-volatile oils of all plant species showed antimicrobial activities except*Pseudomonas aeruginosa*. The highest antimicrobial activity of all semi-volatile oils showed against *Staphylococcus aureus* and *Bacillus pumilus*. All semi-volatile oils showed moderately against *Candida albicans* and *Escherichia coli*. Among them*Mentha longifolia* L. (Hudson) and *Ocimum basilicum* L. semivolatile oils were showed highest antimicrobial activities on test microorganisms. Semi-volatile oils of *Coriandrum sativum* L. were showed secondary antimicrobial activities on test microorganism.

Table6. Inhibition zone were shown by (mm) that treated with semi-volatile oils from five different aromatic plant species

Aromatic plants	Solvent	Organisms					
		Bacillus pumilus	***Bacillus subtilis***	***Escherichia coli***	***Pseudomonas aeruginosa***	***Staphylococcus aureus***	***Candida albicans***
Mentha longifolia L. (Hudson)	EtOH	15mm	13 mm	13 mm	11 mm	15 mm	13 mm
Ocimum basilicum L.	EtOH	13 mm	12 mm	13 mm	-	15 mm	12 mm
Anethum graveolens L.	EtOH	13mm	12 mm	11 mm	-	13 mm	12 mm
Apium graveolens L.	EtOH	11 mm	11 mm	12 mm	-	12 mm	12mm
Coriandrum sativum L.	EtOH	13 mm	12 mm	14 mm	-	13 mm	14 mm

Agar well – 10 mm

EtOH – Ethanol

Table7. Score of taste panel evaluation

Attributes	**Max-score**	**Control**	***Ocimum basilicum* L.**	***Mentha longifolia* L. (Hudson)**
Appearance	30	25	30	25
Texture	15	15	15	15
Size	20	15	15	15
Taste	25	20	30	10
Aroma	10	10	20	5
Total score	100	85	95	70

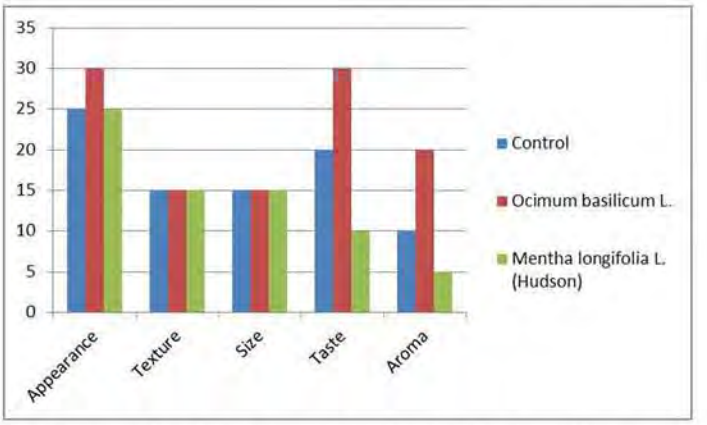

Figure11. The result of taste panel evaluation by panelists was shown.

4 Discussion and Conclusion

Sipailiene and Venskutonis (2005) stated that the major components of the essential oil of *Apium graveolens* L. leaves were limonene and carvone, but in the present study limonene was found as the major components and carvone was seen only as trace element.According to Diederichsen (1996), the major components of the volatile oil of *Cariandrum sativum* L. were α-pinene, ϒ-terpinene, geranylacetate and Geraniol, in this results α-pinene, β- pinene,α-limonene, β –phellandrene, ϒ-terpinene, 3, 7-dimethyl-6-octenal and geranylacetate were appeared as main components.Sharopov *et al.*, (2013) described that the main chemical components of *Anethum graveolens* L. were α-phellandrene, Dill ether and Trans dihydrocarvone, however the present results showed Dill ether was major compound and others were seem to be trace compounds.

According to Sajjadi (2006), the major components of *Ocimum basilicum* L. were methyl chavicol, geranial, neral and caryophyllene oxide but in the result of recent investigation, trans-α-bisabolene, humulene epoxide II and epi-α-cadinol were seen as major constituents and methyl chavicol and caryophyllene oxide were appeared as trace components.Mehran Moradalizadeh *et al.* (2014) described that the main chemical components of *Mentha longifolia* (L.) Hudson were Piperitenone, 1,8-Cineole and Piperitenone oxide, nevertheless present study showed sabinene, cis hydrate de sabine, α – terpineol and piperitone as the major compounds and piperitenone, 1,8-cineole and piperitenone oxide were noticed as the trace compounds.

According to these results, semi-volatile oils of five investigated species showed antimicrobial activities on five pathogenic microorganisms, except *Pseudomonas aeruginosa.* They showed strongly effect on *Staphylococcus aureus* and *Bacillus pumilus* and moderately against *Candida albicansBacillus subtilis* and *Escherichia coli*.Essential oil of *Ocimum basilicum* L. (Rajesh, 2014), *Mentha longifolia* L. (Hudson)(Unnithan *et al.*, 2013) and leaf extract of *Apium graveolens*(Sipailiene *et al.*,2005) showed biological activitiesagainst gram positive *Staphylococcus aureus* and gram negative *Escherichia coli* bacteria.Essential oil of *Anethum graveolens* L. (Sharopov *etal.*, 2013)and *Coriandrum sativum* L.(Cantore *et al.*, 2004) showed biological activity against *Escherichia coli.* Nonetheless, current results indicated *Mentha longifolia* L. (Hudson) was the highest inhibitor for six pathogenic microorganisms and *Ocimum basilicum* L. was the second highest inhibitor. Hence, semivolatile components of *Mentha longifolia* L. (Hudson) and *Ocimum basilicum* L. were selected fortaste panel test on chicken roast base study.

Today consumers are discerning, demanding and more knowledgeable about food and expect products which are save, good value, and of high sensory quality. Therefore, knowing consumers preference and perceptions of the sensory characteristic of food products is very important to food manufacturing and retailers alike (Hashmi, 2997). In this research, food panel evaluation was done with real consumers and collected the information. According to the result of food panel evaluation, *Ocimum basilicum* L. could be the food safety herbal preservative for the delicious chicken roast and it will be the new product for chicken roast preferred consumers.

Acknowledgement

This work was supported financially by a grant from ARC which is gratefully acknowledged.

References

Aligiannis N., Kalpotzakis E., Mitaku S. & Chinou I. B. 2001. Composition and antimicrobial activity of the essential oil of two *Origanum* species.J Agric Food Chem 40: 4168-4170.

Alzoreky, N. S., & Nakahara, K. 2002. Antimicrobial activity of extracts from some edible plants commonly consumed in Asia. InternationalJournal of Food Microbiology, 80, 223–230.

Canillac, N. & Mourey A. 2001. Antimicrobial activity of the essential oil of *Picea excelsa* on Listeria, Staphylococcus aureus and coliform bacteria. Food Microbiol, 18, 261–268.

Cantore L. P., N. S. Iacobellis , A. De Marco , F. Capasso ,and F. Senatore 2004. Antibacterial Activity of Coriandrum sativum L. and Foeniculum vulgare Miller Var. vulgare (Miller) Essential Oils. J. Agric. Food Chem., 52 (26), 7862–7866.

Chouliara, I., Kontominas, M.G., 2006. Combined effect of thyme essential oil and modified atmosphere packaging to extend shelf life of fresh chicken meat. In: Govil, J.N., Singh, V.K., Almad, K., Sharma, R.Kr (Eds.), Recent Progress in Medicinal Plants: Natural Product (15). Studium Press, LLC, USA, pp. 423–442.

Cruickshank, R., J.P. Duguid, B.P. Marimion and R.H Swain, 1975. Medical Microbiology, the Practice of Medical Microbiology. 12th Edn, Vol. 11, Churchil Livingstone Limited, Edinburgh, London and New York.

Dassanyake, M. D., 1995. Flora of Ceylon. Vol. 9. University of Peradeniya, Department of Agriculture, Sri Lanka.

Diederichsen, A., 1996. Coriander (Coriandrum sativum L.). Promoting the conservation and use of underutilized and neglected crops. 3. Institute of Plant Genetics and Crop Plant Research, Gatersleben/ International Plant Genetic Resources Institute, Rome.

Geethalakshmi R., & D.V.L. Sarada 2013. Evaluation of antimicrobial and antioxidant activity of essential oil of Trianthema decandra L. Journal of Pharmacy Research Vol. 6 101-106.

Hashmi I. 2007. Sensory Evaluation Techniques. 18th Annual IAOM Conference (MEA Destrict) Muscat-Oman.

Hooker, J. D., 1875. The Flora of British India. Vol. 1. L. Reeve & Co., Ltd., London.

Hu Q. M., Wu D. L. & Xia N. H. 2007. Flora of Hong Kong. Vol. 1. Edited by Hong Kong Herbarium, AFCD, SCBG, and Chinese Academy of Science. Published by AFCD, Government of Hong Kong Special Administrative Region.

Kim, J., Marshall, M. R., & Wei, C. 1995. Antimicrobial activity of some essential oil components against Wve food borne pathogens. Journal ofAgricultural and Food Chemistry, 43, 2839–2845.

Lachowicz K. J., G.P. Jones, D.R. Briggs, F.E. Bienvenu,J.Wan, A. Wilcock & M.J. Coventry 1998. The synergistic preservative effects of the essential oils of sweet basil (*Ocimum basilicum* L.) against acid-tolerant food microflora. Letters in Applied Microbiology, 26, 209–214.

MehranMoradalizadeh, Mansooreh Khodashenas, Leyla Amirseifadini1, Mostafa Ganjehkaviri 2014. Identification of chemical compounds in essential oils from stems, leaves and flowers of Mentha longifolia Var. kermanensis by GC/MS. International Journal of Biosciences. Vol. 4 (6): 117-121.

Packiyasothy, E. V., & Kyle, S. 2002. Antimicrobial properties of some herb essential oils. Food Australia, 54, 384–387.

Rajesh, K. J. 2014.Chemical composition and antimicrobial activity of the essential oil of Ocimum basilicum L. (sweet basil) from Western Ghats of North West Karnataka, India. Anc Sci Life. 33(3), 151–156.

Sajjadi, S. E. 2006. Analysis of the essential oils of two cultivated Basil (Ocimum basilicum L.) from Iran. DARU Volume 14 (3): 128-130.

Schuenzel, K. M., & Harrison, M. A. 2002. Microbial antagonists of foodborne pathogens on fresh minimally processed vegetables. Journalof Food Protection, 65, 1909–1915.

Sharopov, F. S., Wink M., Gulmurodov, I. S., Isupov, S. J., Zhang, H., Setzer, W. N., 2013. Composition and bioactivity of the Essential oil of Anethum graveolens L. from Tajikistan. Int. J. Med. Arom. Plants Vol. 3(2) 125-130.

Sipailiene, A. and P.R. Venskutonis 2005. Composition and Antimicrobial Activity of Celery (Apium graveolens) Leaf and Root Extracts Obtained with Liquid Carbon Dioxide. Perspectives in Natural Product Chemistry Vol 3. 71-77.

Skandamis, P., Koutsoumanis, K., Fasseas, K., & Nychas, G. J. E. 2001. Inhibition of oregano essential oil and EDTA on E. coli O157:H7. ItalianJournal of Food Science, 13, 55–65.

Thantsin, K., Zhang, Q., Yang, J. & Wang, Q. 2008. Composition of semivolatile compounds of 10 Cinnamomum species from China and Myanmar. Natural Product Research, Vol. 22 (7) 576-583.