GC-MS Study On The Potentials Of *Syzygium aromaticum*

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Abstract: Cloves (*Syzygium aromaticum*, syn. *Eugenia aromaticum* or *Eugenia caryophyllata*) are the aromatic dried flower buds of a tree in the family Myrtaceae. Cloves are native to Indonesia and used as a spice in cuisines all over the world. Eugenol comprises 72-90% of the essential oil extracted from cloves, and is the compound most responsible for the cloves' aroma. Other important essential oil constituents of clove oil include acetyl eugenol, beta-caryophyllene and vanillin; crategolic acid; tannins, gallotannic acid, methyl salicylate (painkiller); the flavonoids eugenin, kaempferol, rhamnetin, and eugenitin; triterpenoids like oleanolic acid, stigmasterol and campesterol; and several sesquiterpenes. Eugenol has pronounced antiseptic and anaesthetic properties. Of the dried buds, 15 - 20 percent is essential oils, and the majority of this is eugenol. A kilogram (2.2 lbs) of dried buds yields approximately 150 ml (1/4 of pint) of eugenol. Eugenol can be toxic in relatively small quantities, as low as 5 ml.
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INTRODUCTION

Cloves (*Syzygium aromaticum*, syn. *Eugenia aromaticum* or *Eugenia caryophyllata*) are the aromatic dried flower buds of a tree in the family Myrtaceae. Cloves are native to Indonesia and used as a spice in cuisines all over the world.

Cloves are used in Indian Ayurvedic medicine, Chinese medicine, and western herbalism and dentistry, where the essential oil is used as an anodyne (painkiller) for dental emergencies. Clove posses antibacterial activity.[1] Clove oil has been used for anaesthesia.[2] Cloves are used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis. Cloves are also said to be a natural anthelmintic.[3] The essential oil is used in aromatherapy when stimulation and warming are needed, especially for digestive problems. Topical application over the stomach or abdomen are said to warm the digestive tract. The use of a clove in toothache is also said to decrease pain. It also helps to decrease infection in the teeth due to its antiseptic properties. Clove oil, applied to a cavity in a decayed tooth, also relieves toothache.[4]

In Chinese medicine cloves are considered acrid, warm and aromatic, entering the kidney, spleen and stomach meridians, and are notable in their ability to warm the middle, direct stomach downward, to treat hiccough and to fortify the kidney yang.[5] Because the herb is so warming it is contraindicated in any persons with fire symptoms and according to classical sources should not be used for anything except cold from yang deficiency. As such it is used in formulas for impotence or clear vaginal discharge from yang deficiency, for morning sickness together with ginseng and patchouli, or for vomiting and diarrhea due to spleen and stomach coldness.[5] This would translate to hypochlorhydria. Clove oil is used in various skin disorders like acne, pimples etc. It is also used in severe burns, skin irritations and to reduce the sensitiveness of skin.

Cloves may be used internally as a tea and topically as an oil for hypotonic muscles, including for multiple sclerosis. This is also found in Tibetan medicine.[6] Some recommend avoiding more than occasional use of cloves internally in the presence of pitta inflammation such as is found in acute flares of autoimmune diseases.[7]

In West Africa, the Yorubas use cloves infused in water as a treatment for stomach upsets, vomiting and diarrhea. The infusion is called Ogun Jedi-jedi.

Western studies have supported the use of cloves and clove oil for dental pain. However, studies to determine its effectiveness for fever reduction, as a mosquito repellent and to prevent premature ejaculation have been inconclusive. Clove may reduce blood sugar levels.[8]

Tellimagrandin II is a ellagitannin found in S. aromaticum with anti-herpesvirus properties.[9]

MATERIAL AND METHODS

Plant material

Syzygium aromaticum was collected from the retail stores at Thanjavur Dist. of Tamilnadu.

Plant Sample Extraction

5 gm powdered plant material was soaked in 20ml of absolute alcohol overnight and then filtered through Whatmann filter paper No.41 along with 2gm Sodium sulfate to remove the sediments and traces of water in the filtrate. Before filtering, the filter paper along with sodium sulphate was wetted with absolute alcohol. The filtrate is then concentrated by bubbling nitrogen gas into the solution and was concentrated to 1ml. The extract contains both polar and non-polar phytocomponents.

GC-MS Analysis

GC-MS analysis was carried out on a GC Clarus 500 Perkin Elmer system and gas chromatograph interfaced to a mass spectrometer (GC-MS) instrument employing the following conditions: Column Elite-1 fused silica capillary column (30mm×0.25mm ID ×1 µMdf, composed of 100% Dimethyl poly siloxane), operating in electron impact mode at 70 eV; Helium (99.999%) was used as carrier gas at a constant flow of 1ml/min and an injection volume of 2 µl was employed (split ratio of 10:1); Injector temperature 250°C; Ion-source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 min.), with an increase of 10°C/min, to 200°C, then 5°C/min to 280°C, ending with a 9 min. isothermal at 280°C. Mass spectra were taken at 70 eV; a scan interval of 0.5 seconds and fragments from 45 to 450 Da. Total GC running time was 36 min.

IDENTIFICATION OF COMPONENTS

Interpretation on mass spectrum GC-MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The Name, Molecular weight and Structure of the components of the test materials were ascertained.

RESULTS AND DISCUSSION

The retention times and chemical composition of Phytocomponents persent in Syzygium aromaticum are presented in Fig. 1 and Table 1.

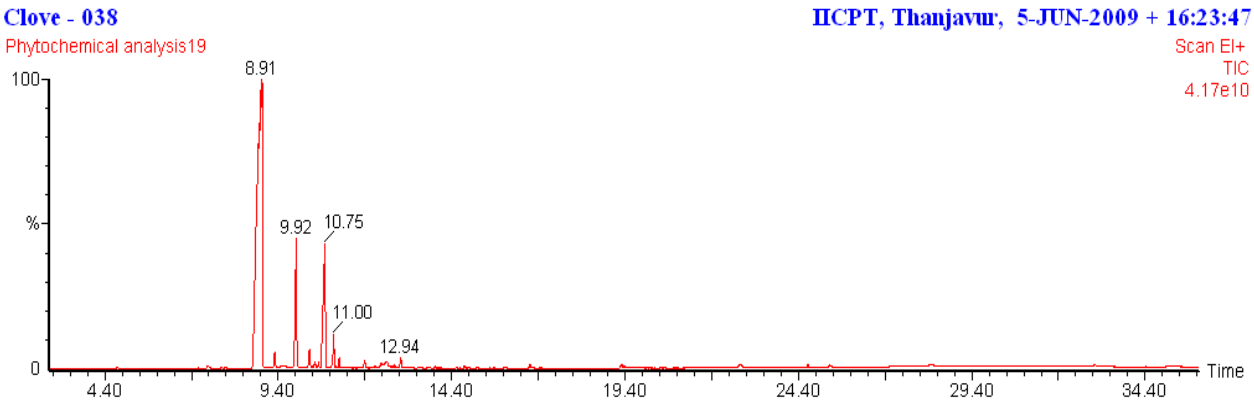

Fig 1: Chromatogram of *Syzygium aromaticum*

Table 1: Phytocomponents identified in *Syzygium aromaticum*

No	RT	Name of the compound	Molecular Formula	MW	Peak Area %
1.	3.37	Pentane, 1,1-diethoxy-	$C_9H_{20}O_2$	160	0.04
2.	3.80	Hexanoic acid, ethyl ester	$C_8H_{16}O_2$	144	0.04
3.	4.77	Propane, 1,1,3-triethoxy-	$C_9H_{20}O_3$	176	0.10
4.	6.03	Cyclohexanecarboxylic acid, 2-hydroxy-, ethyl ester	$C_9H_{16}O_3$	172	0.02
5.	6.37	Benzoic Acid	$C_7H_6O_2$	122	0.02
6.	6.61	Methyl Salicylate	$C_8H_8O_3$	152	0.03
7.	7.10	6-Acetyl-á-d-mannose	$C_8H_{14}O_7$	222	0.10
8.	7.37	Phenol, 4-(2-propenyl)-	$C_9H_{10}O$	134	0.29
9.	7.76	Anisole, p-allyl-	$C_{10}H_{12}O$	148	0.04
10.	7.87	Butanedioic acid, hydroxy-, (S)-	$C_4H_6O_5$	134	0.12
11.	8.91	Phenol, 2-methoxy-3-(2-propenyl)- [Eugenol]	$C_{10}H_{12}O_2$	164	70.88
12.	9.31	Copaene	$C_{15}H_{24}$	204	0.94
13.	9.92	Caryophyllene	$C_{15}H_{24}$	204	8.31
14.	10.30	à-Caryophyllene	$C_{15}H_{24}$	204	1.06
15.	10.75	Phenol, 2-methoxy-4-(2-propenyl)-, acetate	$C_{12}H_{14}O_3$	206	11.98
16.	11.00	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-	$C_{15}H_{24}$	204	1.55
17.	11.89	Caryophyllene oxide	$C_{15}H_{24}O$	220	0.47
18.	12.94	2',3',4' Trimethoxyacetophenone	$C_{11}H_{14}O_4$	210	0.54
19.	13.93	2,5-Octadecadiynoic acid, methyl ester	$C_{19}H_{30}O_2$	290	0.09
20.	14.78	2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-, acetate, (E,E)-	$C_{17}H_{28}O_2$	264	0.14
21.	14.91	1-Naphthalenol, 1,2,3,4,4a,5,6,8a-octahydro-4a,8-dimethyl-2-(2-propenyl)-	$C_{15}H_{24}O$	220	0.08
22.	15.14	1,2-Benzenedicarboxylic acid, butyl octyl ester	$C_{20}H_{30}O_4$	334	0.06
23.	15.93	4,4,8-Trimethyltricyclo[6.3.1.0(1,5)]dodecane-2,9-diol	$C_{15}H_{26}O_2$	238	0.11
24.	16.67	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256	0.30
25.	16.99	Hexadecanoic acid, ethyl ester	$C_{18}H_{36}O_2$	284	0.02
26.	19.30	9,12-Octadecadienoic acid (Z,Z)-	$C_{18}H_{32}O_2$	280	0.27
27.	19.71	Octadecanoic acid	$C_{18}H_{36}O_2$	284	0.10
28.	21.67	Ethyl iso-allocholate	$C_{26}H_{44}O_5$	436	0.01
29.	22.75	Tetradecanoic acid, hexadecyl ester	$C_{30}H_{60}O_2$	452	0.63
30.	24.68	Pregn-5-en-20-one, 3-(acetyloxy)-16,17-epoxy-6-methyl-, (3á,16à)-	$C_{24}H_{34}O_4$	386	0.21
31.	25.31	1,2-Benzenedicarboxylic acid, diisooctyl ester	$C_{24}H_{38}O_4$	390	0.24
32.	28.25	Hexadecanoic acid, octadecyl ester	$C_{34}H_{68}O_2$	508	0.59
33.	31.74	9-Octadecenoic acid (Z)-, 9-octadecenyl ester, (Z)-	$C_{36}H_{68}O_2$	532	0.17
34.	32.96	Hexadecanoic acid, hexadecyl ester	$C_{32}H_{64}O_2$	480	0.44

DISCUSSION

In Syzygium aromaticum (Table1), 34 compounds were identified. The major component was Phenol, 2-methoxy-3-(2-propenyl)- [70.88%] menthol (40.50%), other components present in appreciable contents were: Phenol, 2-methoxy-4-(2-propenyl)-, acetate [11.98%] and Caryophyllene [8.31%].

CONCLUSION

Eugenol comprises 72-90% of the essential oil extracted from cloves, and is the compound most responsible for the cloves' aroma. Other important essential oil constituents of clove oil include acetyl eugenol, beta-caryophyllene and vanillin; crategolic acid; tannins, gallotannic acid, methyl salicylate (painkiller); the flavonoids eugenin, kaempferol, rhamnetin, and eugenitin; triterpenoids like oleanolic acid, stigmasterol and campesterol; and several sesquiterpenes.[11]

Eugenol has pronounced antiseptic and anaesthetic properties. Of the dried buds, 15 - 20 percent is essential oils, and the majority of this is eugenol. A kilogram (2.2 lbs) of dried buds yields approximately 150 ml (1/4 of pint) of eugenol.[12]

Eugenol can be toxic in relatively small quantities, as low as 5 ml.[13]

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