Chromatograph interfaced to a Mass Spectrometer Analysis of *Cinnamomum verum*

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ABSTRACT: Due to uniqueness of *Cinnamomum verum* property in curing different ailments this part was selected for the study. Hence the present investigation was carried out to determine the possible chemical components from *Cinnamomum verum* by GC-MS. This analysis revealed that *Cinnamomum verum* contain mainly Cinnamaldehyde, (E)- [61.57%] and Coumarin [11.60%], which were used in curing oral bacterial growth caused due to Environmental Pollution of Water.
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INTRODUCTION

Cinnamon (*Cinnamomum verum*, synonym C. zeylanicum) is a small evergreen tree belonging to the family Lauraceae, native to Sri Lanka, (*Encyclopaedia Britannica*. 2008). The name cinnamon comes from Phoenician through the Greek kinnámōmon. The botanical name for the spice - *Cinnamomum zeylanicum*—is derived from Sri Lanka's former name, Ceylon.(BBC) Cinnamon has been known from remote antiquity. The Old Testament makes specific mention of the spice many times: first when Moses is commanded to use both sweet cinnamon and cassia in the holy anointing oil; (Exodus 30:22-25) in Proverbs for perfuming with myrrh, aloe and cinnamon; (Proverbs 7:17)

Cinnamon' trees are 10–15 metres (32.8–49.2 feet) tall. The leaves are ovate-oblong in shape, 7–18 cm (2.75–7.1 inches) long. The flowers, which are arranged in panicles, have a greenish color, and have a distinct odor. The fruit is a purple 1-cm berry containing a single seed.
According to the International Herald Tribune, in 2006 Sri Lanka produced 90% of the world's cinnamon, followed by China, India, and Vietnam.

The name cinnamon is correctly used to refer to Ceylon cinnamon, also known as "true cinnamon"[citation needed] (from the botanical name *Cinnamomum zeylanicum*). However, the related species, Cassia (*Cinnamomum aromaticum*), Saigon Cinnamon (*Cinnamomum loureiroi*), and *Cinnamomum burmannii* are sometimes sold labeled as cinnamon, sometimes distinguished from true cinnamon as "Chinese cinnamon", "Vietnamese cinnamon", or "Indonesian cinnamon"; many websites, for example, describe their "cinnamon" as being cassia. *(Encyclopaedia Britannica*. 2008)

Ceylon cinnamon, using only the thin inner bark, has a finer, less dense, and more crumbly texture, and is considered to be less strong than cassia. Cassia has a much stronger (somewhat harsher) flavour than cinnamon, is generally a medium to light reddish brown, hard and woody in texture, and thicker (2–3 mm thick), as all of the layers of bark are used. (BBC)

Cinnamon bark is widely used as a spice. It is principally employed in cookery as a condiment and flavoring material. It is used in the preparation of chocolate, especially in Mexico, which is the main importer of true cinnamon. (FAO)

Its flavor is due to an aromatic essential oil that makes up 0.5% to 1% of its composition. This oil is prepared by roughly pounding the bark, macerating it in seawater, and then quickly distilling the whole. It is of a golden-yellow color, with the characteristic odor of cinnamon and a very hot aromatic taste. The pungent taste and scent come from cinnamic aldehyde or cinnamaldehyde (about 60 % of the bark oil) and, by the absorption of oxygen as it ages, it darkens in color and develops resinous compounds.

Other chemical components of the essential oil include ethyl cinnamate, eugenol (found mostly in the leaves), beta-caryophyllene, linalool, and methyl chavicol.

In medicine it acts like other volatile oils and once had a reputation as a cure for colds. It has also been used to treat diarrhea and other problems of the digestive system. (Felter, *et. al*., 2007) Cinnamon is high in antioxidant activity. (Shan *et. al*., 2005; Mancini-Filho, *et. al*., 1998) The essential oil of cinnamon also has antimicrobial properties, (Lopez *et. al*., 2005) which can aid in the preservation of certain foods. (Wondrak *et. al*., 2010)

Pharmacological experiments suggest that the cinnamon-derived dietary factor cinnamic aldehyde (cinnamaldehyde) activates the Nrf2-dependent antioxidant response in human epithelial colon cells and may therefore represent an experimental chemopreventive dietary factor targeting colorectal carcinogenesis. [14]

Cinnamon has been proposed for use as an insect repellent, although it remains untested. Cinnamon leaf oil has been found to be very effective in killing mosquito larvae. The compounds cinnamaldehyde, cinnamyl acetate, eugenol, and anethole, that are contained in cinnamon leaf oil, were found to have the highest effectiveness against mosquito larvae.

It is reported that regularly drinking of Cinnamomum zeylanicum tea made from the bark could be beneficial to oxidative stress related illness in humans, as the plant part contains significant antioxidant potential.. Cinnamon may also be an aphrodisiac.

MATERIALS AND METHODS

Plant material - *Cinnamomum verum* was collected from the retail stores at Thanjavur Dist. of Tamilnadu.

Plant Sample Extraction - 5gm 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

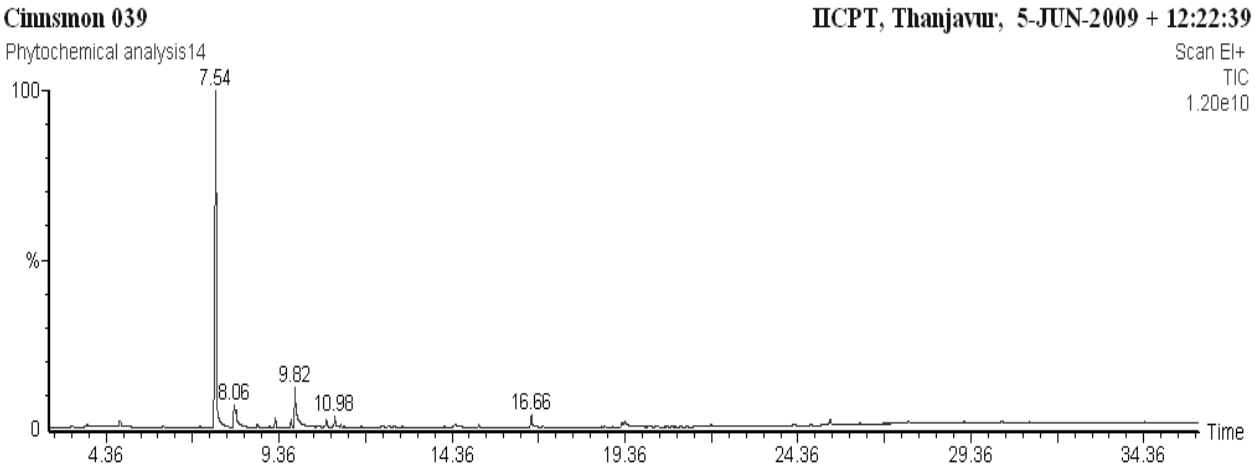

Fig 1: Chromatogram of *Cinnamomum verum*

Table 1: Phytocomponents identified in *Cinnamomum verum*

No	RT	Name of the compound	Molecular Formula	MW	Peak Area %
1	3.37	Butane, 1,1-diethoxy-3-methyl-	C9H20O2	160	0.51
2	3.81	Hexanoic acid, ethyl ester	C8H16O2	144	3.03
3	4.77	Propane, 1,1,3-triethoxy-	C9H20O3	176	1.30
4	6.01	2-Propen-1-ol, 3-phenyl-	C9H10O	134	0.57
5	6.43	4,7-Methano-1H-indene-1,8-dione, 3a,4,7,7a-tetrahydro-	C10H8O2	160	0.22
6	7.09	Benzenepropanol	C9H12O	136	0.39
7	7.54	Cinnamaldehyde, (E)-	C9H8O	132	61.57
8	8.06	2-Propen-1-ol, 3-phenyl- (Synonym: Cinnamyl alcohol)	C9H10O	134	3.98
9	8.74	Eugenol	C10H12O2	164	0.53
10	9.26	Copaene	C15H24	204	1.58
11	9.71	2-Propen-1-ol, 3-phenyl-, acetate	C11H12O2	176	1.01
12	9.82	2H-1-Benzopyran-2-one (Synonym: Coumarin)	C9H6O2	146	11.60
13	10.46	Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-	C15H24	204	0.21
14	10.73	Cedrene	C15H24	204	1.18
15	10.98	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-	C15H24	204	1.88
16	11.75	2-Methyl-Z,Z-3,13-octadecadienol	C19H36O	280	0.28
17	12.54	tau.-Muurolol	C15H26O	222	0.54
18	14.15	12-Methyl-E,E-2,13-octadecadien-1-ol	C19H36O	280	0.10
19	14.45	n-Butyl-á-phenylpropionate	C13H18O2	206	0.96
20	15.15	1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester	C16H22O4	278	0.41
21	16.66	n-Hexadecanoic acid	C16H32O2	256	2.36
22	16.99	Hexadecanoic acid, ethyl ester	C18H36O2	284	0.24

23	17.86	Oleic Acid	C18H34O2	282	0.09
24	18.78	E-11-Hexadecenoic acid, ethyl ester	C18H34O2	282	0.29
25	19.28	9,12-Octadecadienoic acid (Z,Z)-	C18H32O2	280	0.88
26	19.36	Oleic Acid	C18H34O2	282	2.25
27	21.84	Cyclopent-2-enone, 2-methyl-3,4-diphenyl-	C18H16O	248	0.68
28	25.29	1,2-Benzenedicarboxylic acid, diisooctyl ester	C24H38O4	390	1.33

DISCUSSION

Twenth-Eight different compounds were identified in *Cinnamomum verum* by GC-MS analysis. The active principles with their Retention time(RT), Molecular formula, Molecular weight (MW) and Concentration (%) are presented in (Table 1 and Fig 1).The prevailing compounds was Cinnamaldehyde, (E)- [61.57%] and Coumarin [11.60%]

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