

Chemical examination of *Averrhoa bilimbi* L. Fruit

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Abstract

The chemical constituents of the petroleum ether extract of the fruits of *Averrhoa bilimbi* L. were identified through GC-MS. Thirty nine compounds were identified. Among them, seven compounds viz., Oleic acid (42.8%), n-Hexadecanoic acid (39.71%), n-Hexane, 3-methyl- (3.42%), Nonanal (2.2%), Cyclohexane (1.87%), Tetradecanoic acid (1.7%) and 4-Trifluoroacetoxytridecane (1.09%) showed high peaks in the chromatogram.

Keywords: *Averrhoa bilimbi*, GC-MS, essential oil, chemical constituents, petroleum ether extract, Oleic acid, n-Hexadecanoic acid, Hexane 3-methyl, Nonanal, Cyclohexane, Tetradecanoic acid and 4-Trifluoroacetoxytridecane

INTRODUCTION

Averrhoa bilimbi L. which is commonly known as *Bilimbi*, Tamil Nadu, India, belongs to the family Oxalidaceae [Gamble, 1921]. It is locally known as 'Kochittamarattai, *Bilimbi*, *Pulichakkay* and *Vilimbi*'. It is widely cultivated in the tropics (Singh, 1969); but its origin is not yet clear. It is cultivated in the gardens, mostly near the fencings in India. It yields fruits throughout the year and in abundance during the summer season. The *bilimbi* has also been cultivated in some states of Brazil but their fruit yield is less (De lima *et al.*, 2001).

A. bilimbi is a small tree growing up to 15 m in height. Fruits are fairly cylindrical with five broad rounded longitudinal lobes, and produced in clusters. The external green color of the fruit changes in to light yellow when it attains maturity. *Bilimbi* fruits are very sour and used in the production of pickles. Medicinal uses such as cure for febrile excitement, haemorrhoids, piles and scurvy are attributed to *Bilimbi*, (Kritikar and Basu, 1984). Pickles prepared from the *Bilimbi* fruits are used to treat gastric problems and digestion in children by the tribal people Southern of India (Prasad and Rengamani, 2002). The fruit juice has more amount of oxalic acid, and therefore may be used to remove iron-rust stains from clothes and impart shine to brassware (Joseph and Mendonca, 1989). Due to these importances of this fruit, chemical constituents of the petroleum ether extract of the fruits were studied and reported in this paper.

MATERIALS AND METHODS

Unripened fruits of *Averrhoa bilimbi* L. were collected from the herbal garden of A.V.C College (Autonomous), Mannampandal, Tamil Nadu, India.

Extraction

The powdered material was subjected to hot extraction with petroleum ether at 60-80°C through Soxhlet

apparatus. The extract was filtered and condensed under water bath and used for the present study.

Identification of compounds

The chemical constituents were identified by Gas Chromatography (GC) comparing their Kovats indices with those of authentic standards available in the laboratory. Further identification was done by GC-MS. The fragmentation patterns of mass spectra were compared with those stored in the spectrometer data base using NIST libraries and with those published in the literature. The percentage of each component is calculated from the relative peak area of each component in the chromatogram.

GC-MS analysis

Analysis in GC-MS was carried out on a GC clarus 500 Perkin Elmer instrument. GC column used was Elite-1 100% methyl Polysiloxane with the following dimension: 30 µm x 0.25 µm film thickness.

GC Programme

Injector temperature: 250 deg centigrade; Sample injected: 0.5µl.

Carrier gas flow : Helium 1ml/min; Split folw:-1:50

Oven Programme

110 deg centigrade–2 min hold, Up to 270 deg centigrade, 5 deg centigrade/minute – 9 min hold.

MS Programme

Intel line temperature: 200 deg centigrade; Source temperature: 200 deg centigrade

Electron Energy: 70eV; Mass scan 25-400;

RESULTS AND DISCUSSION

The essential oil of the *Averrhoa bilimbi* fruit contained 39 compounds belonging to different categories, which were identified by comparing GC-MS data with those given in library and reported in literature (Admas, 1989).

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The chemical components identified, the percentage of each constituent and their retention times are summarized in Table 1. Among the 39 compounds, Oleic acid (42.8 %); n-Hexadecanoic acid (39.71%); n-Hexane, 3 methyl-(3.42%), Nonanal (2.2%), Cyclohexane(1.87%), Tetradecanoic acid (1.7%) and 4-Trifluoroacetoxytridecane (1.09%) were the seven major constituents of the essential oil. The volatile components of the *A. bilimbi*

have also been reported earlier by Wong and Wong (1995). The ethanol extract of the leaves of this plant was reported to show hypoglycemic and hypolipidemic activities (Pushparaj *et al.*, 2000; Pushparaj and Tan, 2001). Hence, this fruit should contain the hypoglycemic properties, which should be ascertained by testing the efficacies of the compounds identified and reported in this paper.

Table 1. Chemical constituents in the *Averrhoa bilimbi* L. fruits

S.No	Name of the compound	RT	Molecular Formula	Molecular Weight	Area (%)
1	Cyclohexane	2.08	C ₆ H ₁₂	84	1.87
2	n-Hexane, 3-methyl-	3.42	C ₇ H ₁₆	100	3.42
3	Cyclohexane, methyl-	2.41	C ₇ H ₁₄	98	0.24
4	N-hydroxymethyl-2-Phenylacetamide	2.64	C ₉ H ₁₁ NO ₂	165	0.04
5	Hexanal	2.73	C ₆ H ₁₂ O	100	0.33
6	Tridecane, 4- methyl-	2.88	C ₁₄ H ₃₀	198	0.13
7	Pentanoic acid, methyl-	4.77	C ₆ H ₁₂ O ₂	116	0.11
8	1,2- Cyclopentanediol, trans-	5.41	C ₅ H ₁₀ O ₂	102	0.04
9	Pentolactone	5.85	C ₆ H ₁₀ O ₃	130	0.04
10	Pentanoic acid, 3-Methyl	6.67	C ₆ H ₁₂ O ₂	116	0.04
11	Nonanal	7.50	C ₉ H ₁₈ O	142	2.20
12	Octanoic acid	8.95	C ₈ H ₁₆ O ₂	144	0.18
13	Disulphide, ethyl hexyl	9.21	C ₇ H ₁₆ S ₂	164	0.04
14	Hydroxylamine, O-decyl	10.15	C ₁₀ H ₂₃ NO	173	0.04
15	Disulphide, bis (1-methylpropyl)	10.51	C ₈ H ₁₈ S ₂	178	0.30
16	3-Oxo-4 phenylbutyronitrile	10.17	C ₁₀ H ₉ NO	178	0.33
17	6-Tridecene,(Z)	11.29	C ₁₃ H ₂₆	182	0.10
18	Nonanoic acid	11.41	C ₉ H ₁₈ O ₂	158	0.29
19	1-Butanol,4,4-hexyloxy)	12.78	C ₁₀ H ₂₂ O ₂	174	0.05
20	Decane, 2,4,6-trimethyl	13.13	C ₁₃ H ₂₈	184	0.07
21	3-Hexadecyloxycarbonyl-5-(2hydroxyethyl)-4-methylimidazolium ion	13.88	C ₂₄ H ₄₅ N ₂ O ₃	409	0.15
22	Diodecyl phthalate	15.20	C ₃₂ H ₅₄ O ₄	502	0.09
23	9-Oxononanoic acid	16.31	C ₉ H ₁₆ O ₃	172	0.16
24	4-Trifluoroacetoxytridecane	17.53	C ₁₅ H ₂₇ F ₃ O ₂	296	1.09
25	Cyclooctane acetic acid, 2-oxo-	18.14	C ₁₀ H ₁₆ O ₃	184	0.10
26	9,9 Dimethoxybicyclo{3.3.1}nona-2,4-dione	19.25	C ₁₁ H ₁₆ O ₄	212	0.16
27	9,9 Dimethoxybicyclo{3.3.1}nona-2,4-dione	20.01	C ₁₁ H ₁₆ O ₄	212	0.05
28	Hexadecenoic acid, Z-11-	20.19	C ₁₆ H ₃₀ O ₂	254	0.20
29	Z-10 Tetradecen-1-ol acetate	20.63	C ₁₆ H ₃₀ O ₂	254	0.10
30	Z-8-Methy-9-tetradecenoic acid	21.05	C ₁₅ H ₂₈ O ₂	240	0.10
31	2-Trifluoroacetoxyptadecane	21.43	C ₁₇ H ₃₁ F ₃ O ₂	324	0.10
32	Tetradecanoic acid	23.30	C ₁₄ H ₂₈ O ₂	270	1.70
33	Z-10 Tetradecen-1-ol acetate	25.54	C ₁₆ H ₃₀ O ₂	254	0.30
34	Hexadecenoic acid, methyl ester	26.72	C ₁₇ H ₃₄ O ₂	270	0.70
35	n-Hexadecanoic acid	27.66	C ₁₆ H ₃₂ O ₂	256	39.71
36	11-Octadecenoic acid, methylester	30.10	C ₁₉ H ₃₆ O ₂	296	0.93
37	Oleic acid	31.07	C ₁₈ H ₃₄ O ₂	282	42.8
38	Octadecanal, 2-bromo	33.87	C ₁₈ H ₂₅ BrO	346	0.42
39	Z-8-Methyl-9-teradecenoic acid	34.84	C ₁₅ H ₂₈ O ₂	240	0.70

RT – Retention time.

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