J. Indian Chem. Soc.,
Vol. 87, October 2010, pp. 1235-1240

Perfumery components of two Indian flowers *Artabotrys odoratissimus* and *Alstonia scholaris* having an unusual floral tone

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Manuscript received 6 August 2009, revised 26 April 2010, accepted 28 April 2010

Abstract : GC-MS study of aroma components present in two popular flowers *Artabotrys odoratissimus* and *Alstonia scholaris* with unusual floral tone was done and reported in the text. The hexane extract of the flowers were studied and found that these flowers contain certain unusual components along with some common fragrance molecules.

Keywords : *Artabotrys odoratissimus*, *Alstonia scholaris*, aroma molecules, essential oil, GC-MS.

Introduction

Fragrance of different flowers like rose, jasmine, tube rose etc. has attracted attention since long because of their commercial importance. A number of other sweet smelling flowers of the western world have been subjected to rigorous chemical analysis[1-3] but many flowers in the tropical world have not yet been studied in detail.

The flower *Artabotrys odoratissimus* has an unusual fragrance like ripe jack fruit and due to this similarity it is locally known as kathali champa. Gas Chromatography-Mass spectrometry (GC-MS) study of leaf oil of *A. odoratissimus* was done by Mehta *et al.* and they reported that some biologically active compounds are present in it[4]. A typical floral tone is also observed in *Alstonia scholaris*, family *Apocynaceae*, locally known as Chatim, which is an important tree widely used in traditional medicine. The extracts of bark and leaves have been studied for its pharmacological importance[5]. The bark of the tree is a source of different alkaloids used as medicine. The small fragrant flowers are white, yellow or green and have a very unusual strong fragrance which has not found in other flowers and not yet been studied extensively.

Steam distillation, solvent extraction, enfleurage methods are the common methods for extraction of volatile oils from aromatic plants[6,7]. There are usually several components present in any aromatic oil and their identification and quantification after extraction is a critical study. GC-MS is a useful tool for qualitative and quantitative analysis for volatile compounds and is used widely in biological and medicinal research[8-10].

The objective of the present study was to identify some compounds which are responsible for the unusual tones of these flowers. All fragrant molecules were extracted by solvent extraction method and the chemical composition of the oils was analyzed using GC-MS method.

Results and discussion

Chemical composition of A. odoratissimus (Fig. 1) extract in hexane :

Only 9 compounds could be detected as the chemical component present in this oil. The major compounds are isogeraniol (16.85%) and isopulegol acetate (19.87%). *A. odoratissimus* extract also contains two esters - propanoic acid-2-methyl-2-ethyl-3-hydroxy hexyl ester (4.78%) and 2-octen-1-ol-3,7-dimethyl isobutyrate (2.5%). Table 1 shows the chemical composition of the oil extract of *A. odoratissimus*.

Chemical composition of A. scholaris (Fig. 2) extract in hexane :

We have examined the hexane extract of this flower

Table 1. Some of the aroma components present in *A. odoratissimus* obtained from GC-MS study

Sl. no.	R_t (min)	Compds.	Molecular mass	Molecular formula	Amount present (% w/w)	MS fragments
1.	7.287	Propanoic acid-2-methyl-2-ethyl-3-hydroxy hexyl ester	216	$C_{12}H_{24}O_3$	4.78	56, 71, 89
2.	9.939	β-Pinene	136	$C_{10}H_{16}$	tr	67, 79, 91, 93, 107, 121
3.	10.256	α-Methyl-α-[4-methyl-3-pentenyl]-oxiranemethanol	170	$C_{10}H_{18}O_2$	tr	-
4.	11.25	Linalool	154	$C_{10}H_{18}O$	1.36	41, 55, 71, 80, 93, 131, 136
5.	13.56	Verbenol	152	$C_{10}H_{16}O$	1.40	53, 55, 69, 79, 91, 94, 109, 119, 136
6.	13.71	Isogeraniol	154	$C_{10}H_{18}O$	16.85	67, 69, 81, 85, 93, 111, 121, 123, 139
7.	13.98	2-octen-1-o1-3,7-dimethyl isobutyrate	226	$C_{14}H_{26}O_2$	2.49	57, 59, 71, 84, 85, 137, 109, 119, 152
8.	13.99	Neral/geranial	152	$C_{10}H_{16}O$	tr	-
9.	14.57	Indole	117	C_8H_7N	tr	51, 63, 89, 90, 116, 117
10.	15.49	Isopulegol acetate	196	$C_{12}H_{20}O_2$	19.87	41, 43, 69, 81, 91, 93, 107, 121, 136
11.	16.20	Caryophyllene	204	$C_{15}H_{24}$	5.188	41, 69, 79, 91, 93, 105, 107, 119, 133, 161, 189
12.	17.46	Benzoic acid-4-ethoxy ethyl ester	194	$C_{11}H_{14}O_3$	2.49	39, 65, 93, 121, 122, 138, 149, 150, 166, 194
13.	19.36	Octadecane	254	$C_{18}H_{38}$	3.37	57, 71, 85, 55, 69

Table 2. Some of the aroma components present in *A. scholaris* obtained from GC-MS study

Sl. no.	R_t (min)	Compds.	Molecular mass	Molecular formula	Percent present (w/w)	MS fragments
1.	10.478	Eucalyptol	154	$C_{10}H_{18}O$	0.96	154, 139, 125, 111, 108, 93, 71, 55
2.	11.175	α-Methyl-α-[4-methyl-3-pentenyl)oxirane methanol	170	$C_{10}H_{18}O_2$	1.021	137, 111, 97, 93, 57, 153, 84
3.	11.652	Linalyl isobutyrate	224	$C_{14}H_{24}O_2$	3.667	136, 121, 107, 92, 93
4.	12.799	2*H*-Pyran-3-ol-6-ethenyl-tetrahydro-2,2,6-trimethyl-	170	$C_{10}H_{18}O_2$	0.411	155, 59, 111, 94, 79, 59
5.	13.191	3-Cyclohexene-1-methanol, α,4-trimethyl-	154	$C_{10}H_{18}O$	1.302	136, 121, 107, 93, 81, 80, 59
6.	15.55	6,7-Dimethyl-3*H*-isobenzofuran-1-one	162	$C_{10}H_{10}O_2$	0.698	162, 134, 133, 105, 51, 77
7.	16.953	1,2-Benzenediol, (1,1-dimethyl ethyl-)	166	$C_{10}H_{14}O_2$	0.21	151. 152, 123, 77
8.	17.56	Benzoic acid-4-ethoxy ethyl ester	194	$C_{11}H_{14}O_3$	0.7313	194, 166, 149, 150, 138, 121, 122, 93, 65

Table-2 (contd.)

9.	18.617	2-Cyclohexene-1-one, 4-ethyl-3,4-dimethyl-	152	$C_{10}H_{16}O$	0.3	110, 96, 95, 81, 67
10.	19.528	1(2*H*)-Naphthalenone, 7-(1,1-dimethyl-ethyl)-3,4-dihydro-	202	$C_{14}H_{18}O$	0.22	202, 187, 159, 131
11.	22.04	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	276	$C_{17}H_{24}O_3$	0.261	261, 218, 233, 205, 189, 177
12.	24.343	Linoleic acid ME	294	$C_{10}H_{34}O_2$	0.647	263, 164, 150, 135, 109, 95, 81, 67, 54
13.	36.726	Thunbergol	290	$C_{20}H_{34}O_2$	0.808	257, 229, 175, 160, 107, 81, 95

collected from two different trees. Both the sample extract contain same compounds identified by mass spectral analysis. We detected 22 compounds but only some of these have been identified with a reasonable certainty. Two compounds Eucalyptol and 1(2*H*)-naphthalenone, 7-(1,1-dimethyl-ethyl)-3,4-dihydro (0.22%) are unusual compounds and were not detected in the aroma of other studied flowers. Fig. 2 shows the gas chromatogram of the hexane extract of the flower and Table 2 shows the components present and identified by GC-MS analysis of the hexane extract of the Chatim flower.

In most European flowers the common aroma components are linalool, nerol, geraniol etc. Linalool is known as important attractant for many insects and is used in perfume industry as an aromatic in optimum concentration.

In local nomenclature, *A. odoratissimus* flower bears a synonym with kanthal or jackfruit due to the similarity in odour tone in both of them. Durian is a fruit unique to Southeast Asia. Durian is very similar to jackfruit in strong smell, taste and appearance. The odour of durian is absolutely offensive to Westerners and this repulsive odour is probably due to a large number of sulphur compounds as more than 18 sulphur containing compounds had been detected in Durian of Indonesia such as 3,5-dimethyl-1,2,4-trithiolane, 3,5-dimethyl-1,2,4-trithiolane, *S*-methyl thiohexanoate, 5-methyl-4-mercapto-2-hexanone etc.[10]. But the fragrance of *A. odoratissimus* is quite pleasant to our olfactory sense and no sulphur containing compound was detected in the oil. Similarly, GC-MS study of leaf oil of *A. odoratissimus* done by Mehta *et al.* did not show presence of any sulphur compound[4]. We observed that the hexane extract of the flower contains 16.85% isogeraniol and 19.87% isopulegol acetate as major components but only a trace amount of indole was detected which may be the reason for the more diffusive nature of this aroma. In addition to other aroma compounds, propanoic acid, 2-methyl-2-ethyl-3-hydroxy hexyl ester (4.75%) and 2-octen-1-ol, 3,7-dimethyl isobutyrate (2.5%) were identified in aroma of *A. odoratissimus*. The unusual fruity smell of this flower may be due to the presence of such esters.

The flower of *A. scholaris* has an exceptional strong odor. Two unusual compounds eucalyptol (~1%) and 1-(2*H*-naphthalenone, 7-(1,1-dimethyl ethyl)-3,4-dihydro (0.22%) were detected in the extract. The unusual strong aroma may be due to the presence of these compounds.

Experimental

Materials :

Collection of flowers : *A. odoratissimus* and *A. scholaris* both are seasonal flowers. Flowers were collected from the tree of different places, Garden of Alipore Horticultural Society, Kolkata and village gardens in the month of their full blooming condition.

Methods :

Extraction and separation of aroma components : The fresh flowers were immersed in HPLC grade hexane for minimum 2 h at room temperature and then the hexane layer was separated. The solvent layer was dried over

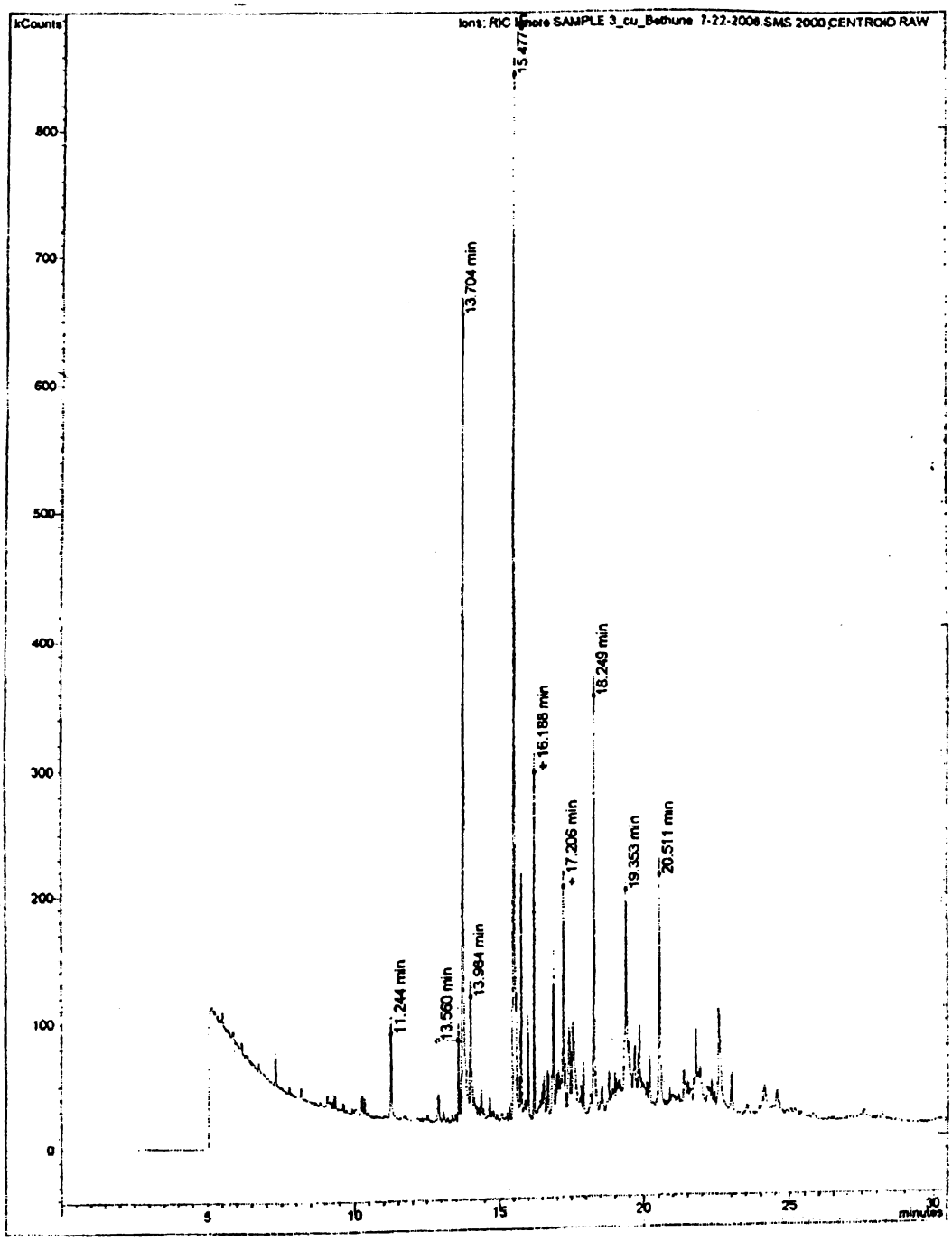


Fig. 1. Gas-Chromatogram of hexane extract of the flower *Artabotrys odoratissimus*.

anhydrous sodium sulphate and stored at –20 °C for analysis. The presence of aromatic components in hexane layer was confirmed by taking the extract on filter paper and sniffing after evaporation of hexane.

Analysis of chemical composition of oil samples using Gas Chromatography-Mass Spectrometry (GC-MS) : A Varian Saturn 2200 GC-MS instrument equipped with DB-5 capillary column (30 m × 0.25 mm × 0.25 μm

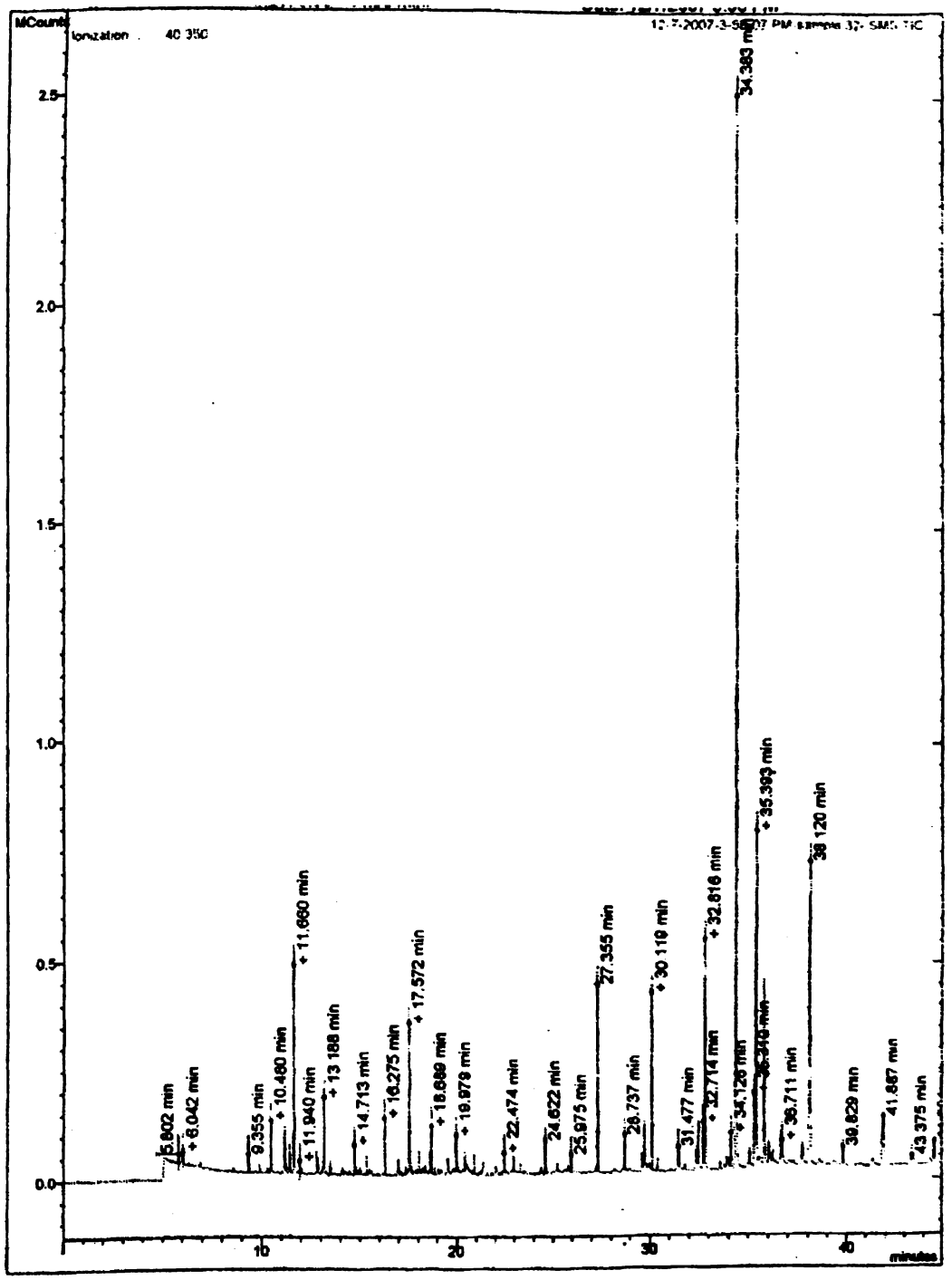


Fig. 2. Gas-Chromatogram of hexane extract of the flower *Alstonia scholaris*.

film thickness) was used for component analysis. The oven temperature was maintained at 50 °C for 5 min, and then programmed to 200 °C at 10 °C min^{-1}. Final temperature was 280 °C at 5 °C min^{-1} and maintained for 20 min. The carrier gas was helium at a flow rate of 0.9 mL min^{-1}, and the injection volume was 1 µL. In mass spectrometry, the electron-impact ionization was performed of electron energy 70 eV. The samples were analysed in

triplicate set and the mean data are presented.

Compound identification : Components of the oil were identified by comparison of their mass spectra and retention indices with those published in the literature[11] and contained in the NBS/NIST computer libraries.

Acknowledgement

The financial support for this work was given by University Grants Commission, India. We acknowledge the kind help of Prof. S. Roy, University of Calcutta for helping in interpreting the GC-MS results and Dr. Tapas Saha and Dr. Suparna Sen of SGS Analytical Services, Kolkata for GC-MS analysis.

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