

## Gas Chromatographic Evaluation of Turmeric Essential Oils

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### ABSTRACT

Gas chromatographic evaluation of 9 *Curcuma domestica*, 4 *C. aromatica* cultivars and 2 *C. domestica* selections is carried out. The range of variation in essential oil yield is more or less similar in two species. Out of the 14 components of essential oil, 8 are identified to be limonene, cineole, curcumene, zingiberene, bisabolene,  $\beta$ -sesqui-phellandrene, ar-turmerone, turmerone.

Out of the various turmeric species viz., *Curcuma domestica* val., *C. aromatica* Salisb., *C. xanthorrhiza* Roxb., *C. amada* Roxb., *C. caesia* Roxb., *C. zedoaria* Roscoe. essential oil of *C. domestica* is economically more important and can be called as a by-product in curcumin extraction. As these oils interfere in pigment extraction, rhizomes are depleted of this oil by solvent extraction. The present study is aimed at major chemical constituents of flavour profiles of turmeric oil in representative cultivars of *C. domestica*, *C. aromatica* species and in two *C. domestica* selections.

### MATERIALS AND METHODS

Mature rhizomes of representative cultivars of *C. domestica*, *C. aromatica* and two improved selections of *C. domestica* as given in Table 2 were sun dried and essential oil yield determined by steam distillation using a clevanger trap and curcumin content was determined as per the method of ASTA<sup>1</sup>.

The essential oil was subjected to Gas chromatographic analysis on Hewlett Packed 5730A Gas chromatograph under following conditions: FID temperature 250°C, Injection port temperature 200°C and oven temperature 130°C, carrier gas N<sub>2</sub> 40 ml mt, column 6 10% Carbowex 20 M on chromosorb AWS 60-80, chart speed at 5 cm mt for the first 2.5 mts and subsequently reduced to 1 cm/mt for 12.5 mts. The emergent peaks were identified as per the rt values of Govindarajan<sup>2</sup> and Kelker and Rao<sup>3</sup> who have used authentic compounds. The order of the emergence of peaks by the above method are linonenes (0.2 mt), cineole (0.23 mt), curcumene (0.26 mt), zingiberene (1 mt), bisbolene (12.0 mt), turmerone (15.0 mt). Six components at the retention times 2.4 mt, 2.56 mt, 7.0 mt, 7.25 mt, 8.50 mt and 9.0 mt remained unidentified. In *C. aromatica* species in addition to the peaks at the above rts peaks at 0.5 mt and 1.4 mt were observed. The areas of indivi-

dual peaks were calculated by peak triangulation and the sum of the areas added, quantity of individual compounds were calculated and expressed as % of the total.

### RESULTS AND DISCUSSION

The variation in the essential oil content in both these species is 4.0 to 8.0% and in curcumin content from 5.4 to 8.7% in *C. domestica* cultivars and 3.2 to 8.0% in *C. aromatica* cultivars. Gas chromatographic analysis was confined to these cultivars alone as range of variation of essential oil content was more or less similar even though marked variation in curcumin content was observed. Fourteen compounds could be resolved by this method out of which eight could be identified on the basis of retention times, six others remain to be identified (Table 1). One interesting aspect in the chromatograms of two essential oils of *C. domestica* and *C. aromatica* is the presence of high proportion of 2 components (rt 0.5 mt and 1.4 mt) in *C. aromatica*.

In *C. domestica* in cv. Amalapuram of Andhra Pradesh, cv. Tura, Garo hills of Assam the components identified as Zingiberene, bisbolene and  $\beta$ -sesqui phellandrene are present in minor traces, probably, due to *in vitro* degradation of these minor terpenes on storage. Similar results were observed by Govindarajan and Raghuvver (unpublished) where in turmeric oils were categorised into (i) relatively high in limonens, cineole, high in sesqui terpenoid hydrocarbons and moderate in turmerones, (ii) poor in limonene, cineole low in sesquiterpene hydrocarbons and moderate turmerones, (iii) no low boiling components, low sesqui terpene hydrocarbons and

very high turmerones. PCT-2 belongs to class (i), cvs. Amalapuram; and Tura, Garo hills and PCT-8 belongs to class (ii) and cvs. Vontimitta, Amrithapani Kothapeta, Amrithapani and Dibrugarh can be categorised to class (iii); Threshold limits of these terpinic hydrocarbons is not yet established. However, turmerones are found to contribute to turmeric odour. Gas chromatographic data can be divided into four distinct portions for easy discussion of aroma profile of turmeric essential oils; limonene, curcumene, sesqui terpenoid hydrocarbons and turmerones. Limonene varied from 7 to 19% in *C. domestica*, 8 to 40% in *C. aromatica* and 26 to 30% in *C. domestica* selections. The selections, even though belong to *C. domestica* species, contain high limonene and cineole contents. Sesquiterpenoids vary from 1.2 to 16.7% in *C. domestica*, 13.2 to 17.6% in *C. aromatica* and 5.3 to 16.9% in *C. domestica* selections. Turmerones range from 3.9 to 54.9% in *C. domestica*, 14.9 to 59.4 in *C. aromatica* and 20.6 to 28.9% in *C. domestica* selections. Generally the selections contained moderate quantities of turmerones.

Another important observation made in the present study is on the ratio of terpenoids to curcumin, a dicinnomyl methane. The ratio of terpenoids to curcumin varied from 6.39 to 10.97% in *C. domestica*, 7.72 to 22.14% in *C. aromatica* and 7.68 to 11.37% in *C. domestica* selections. Studies are on progress for identifying two odd peaks in *C. aromatica* (rt values 0.5 and 1.4 mt) and also for elucidating its significance in the production of characteristic odour in *C. aromatica* oils and its constitution of secondary or back ground aroma.

Table 2 : Name of the cultivar, place of origin, % oil and curcumin contents of some selected species.

Sl. No.	Name of the cultivar	Place of origin	% Essential oil content	% Curcumin
<i>C. domestica</i> Val				
1.	Vontimitta	Andhra Pradesh	6.5	5.4
2.	Amalapuram	Andhra Pradesh	8.0	6.0
3.	Duggirala	Andhra Pradesh	5.0	7.5
4.	Amrithapani Kothapeta	Andhra Pradesh	4.0	7.0
5.	Amrithapani	Andhra Pradesh	7.0	7.0
<i>C. aromatica</i> Salisb.				
6.	Chayapasupu	Andhra Pradesh	8.0	6.0
7.	Kasturi	Andhra Pradesh	7.0	3.2
8.	Tura, Garo hills	Assam	4.0	4.3
9.	Dibrugarh	Assam	6.5	8.0
<i>C. domestica</i> Selections				
10.	PCT-2	Kerala	5.0	7.0
11.	PCT-S	Assam	7.0	8.7

## REFERENCES

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3. Kelkar, N.L. and Rao, B.S. 1934. Indian Essential Oils V. Essential oils from the rhizomes of *Curcuma longa* L. *J. Indian Inst. Sci.* 17, A : 7.
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Table 1 : Essential oil composition of some selected turmeric species (Expressed in % as total volatile oil).

Sl. No.	Name of the cultivars	% Limonene	% Cineole	% Curcumene	% Zingiberene	% Bisbolene	B- Sesqui phellandrene	ar-turmerone	Turmerone	Unidentified	Unidentified	Unidentified	Unidentified	Unidentified	Unidentified
<i>C. domestica</i> Val.															
1.	Vontimitta	6.92	1.11	0.86	1.60	1.64	1.64	24.87	20.78	4.80	1.52	0.79	13.00	5.60	19.33
2.	Amalapuram	10.50	1.19	1.20	t	t	t	1.65	2.28	—	—	—	—	—	—
3.	Duggirala	19.28	2.58	1.72	1.23	0.22	1.21	22.03	30.70	1.15	9.76	7.87	2.20	—	—
4.	Amrithapani														
	Kothapeta	10.76	0.94	3.57	2.99	7.37	2.75	24.98	12.38	5.76	9.39	19.22	—	—	—
5.	Amrithapani	7.43	1.45	2.12	1.25	0.35	1.30	26.96	28.02	4.24	3.58	2.64	9.20	5.18	6.20
	<i>C. aromatica</i> Salisb.														
6.	Chayapasupu	8.45	3.56	4.15	4.98	3.27	5.23	10.06	6.64	21.25	30.99	—	2.01	—	—
7.	Kasturi	27.23	6.44	1.66	12.78	7.47	0.33	4.98	9.96	1.39	6.57	17.93	3.22	—	—
8.	Tura														
	Garro hills	40.00	4.85	t	t	t	t	18.20	4.12	6.06	6.79	14.44	5.46	—	—
9.	Dibrugarh	16.99	4.05	0.81	4.63	5.25	2.54	23.17	36.21	0.93	2.93	1.27	1.15	—	—
	<i>C. domestica</i> Selections														
10.	PCT-2	30.06	12.02	2.29	1.71	1.94	10.99	10.30	10.30	1.29	29.37	—	—	—	—
11.	PCT-8														
	Maran	26.49	6.02	2.40	2.98	t	t	4.51	24.45	33.12	—	—	—	—	—

t=traces

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