Original Article

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Volatile composition analysis of five different *Commiphora mukul* (Hook. ex Stocks) Engl. gum samples

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Abstract

Commiphora mukul (Hook. ex Stocks) Engl. (from the family Burseraceae) is well known for the clinical applications of its gummy compositions. The gum possesses many pharmacological activities such as antiseptic, astringent, anti-inflammatory, and antimicrobial activities. To outline the chemical compositions of this medicament, current study has evaluated the essential oil extracted from different *C. mukul* gum samples found in medicinal plant markets in Iran. Five different samples were purchased from medicinal plant market in Shiraz and were coarsely milled and subjected to a Clevenger-based hydrodistillation. Subsequently GC/MS analysis was performed for each sample by means of a gas chromatograph (Agilent Technologies 7890) coupled with a mass detector (Agilent Technologies model 5975C). Identification of the constituents was performed based on a comparison of their mass spectra with Willey (nl7) and Adams libraries spectra, as well as with those reported in literature. The yield of extracted colorless but turbid essential oil from those samples was calculated at the range of 0.5-1% (V/W). Totally, 41 different components were identified for those collected samples. The major constituent (more than 5%) found in all samples was alpha-cadinol (7.25-14.49%). Results of the current procedure can be considered as a reference for the analysis and control of different *C. mukul* samples in market.

Keywords: *Commiphora mukul*; Volatile oil, GC/MS, Essential oil.

1. Introduction

Known as Guggul tree, *Commiphora mukul* (Hook. ex Stocks) Engl. is a popular flowering plant from the family Burseraceae. Guggul is a small, bushy tree with thorny branches and is growing in arid areas of India, Bangladesh, and Pakistan (1). The yellowish resinous part or oleo-gum, secreted from the plant, is traditionally administered in eastern and south eastern countries. The gum has been widely used for weight loss, rheumatoid arthritis, osteoarthritis, and sciatica (2, 3).

In line with the ethnopharmacological and traditional application, current studies have also revealed many related pharmacological properties for this medicament. Lipid lowering and hypolipidemic activities of Guggul have been repeatedly evaluated and proved by researchers (4, 5), in ad-

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dition to other pharmacological activities such as analgesic, anti-inflammatory, anti-arthritic, antioxidant, cardioprotective, cytotoxic, antihyperglycemic, antimicrobial, and antifertility activities (6-10).

Despite these beneficial properties, no extensive investigation has been performed on the composition of the gum essential oil (11). To screen and analyse the chemical composition of Guggul gum essential oil, current work investigated different samples marketed in medicinal plants stores located in Fars province (south of Iran).

2. Materials and methods

Five different gum samples (S_1-S_5) were purchased from herbal markets around Shiraz and Fars province. Samples were authenticated by the botanist of Department of Phytopharmaceuticals (Traditional Pharmacy) in School of Pharmacy, Shiraz University of Medical Sciences, Shiraz, Iran. A voucher number was specified for each sample. Samples were then coarsely milled and subjected to hydrodistillation for 4 hrs., using a Clevenger. The yielded essential oils were then collected, dehydrated and kept in -20 °C for further investigations.

GC/FID analysis of those yielded essential oil samples was done on a gas chromatograph (Agilent technologies-7890A) with a HP-5 column (25 m length×0.32 mm i.d.; film thickness 0.52 µm) connected to a flame ionization detector (FID). Nitrogen was selected as the carrier gas (flow rate: 1 ml/min, split ratio: 1:30). Temperatures of injector and detector were adjusted at 250 and 280 °C, respectively. Column temperature was programmed linearly from 60 to 250 °C (ramp ~5 °/min) and was consequently held at 250 °C for 15 min. Essential oils of four mentioned samples were diluted in n-Hexane (~1%) and were consecutively injected to the system.

The GC/FID method and condition were employed for the analysis. The process was carried out via a gas chromatograph (Agilent technologies-7890A) equipped with a HP-5MS capillary column (phenyl methyl siloxane, 30 m×0.25 mm i.d.), connected to a mass detector (Agilent technologies model-5975C). The carrier gas (Helium) flow rate was selected as for the GC/FID. In a mass range of 30-600 m/z, the mass spectrometer was acquired in EI mode (70 eV). The temperature of the interface was adjusted at 280 °C.

The data from GC and GC/MS were used to identify the essential oil constituents of the samples. Resulting Kovats indices (KI) calculated by employing a homologous series of n-alkanes C_8-C_{30}, as well as mass spectral data were used to confirm the calculated KI for each composition and predicted structures. These data were rechecked with those mentioned in the previous related papers (12).

Subsequently, principal component analysis (PCA) methods were carried out to cluster the five samples based on the composition of essential oils. In this context, the percentage of essential oil composition was considered as the variable. A vector was accordingly generated for each sample. The resulted matrix was then subjected to MATLAB (Math works Inc.) to perform HCA. Cluster definition was carried out by means of Euclidean distance as a measure of similarity using unweighted pair group method (UPGMA).

3. Results and conclusion

In this work, five different Guggul samples were purchased from medicinal plants markets around Shiraz (Fars province, south of Iran). The extracted colorless essential oil samples were yielded in less than 1% (v/w). It is believed that various fingerprint assessments may be proper procedures in standardization and quality control of different plants preparations.

Totally, 41 different chemical components were identified for those collected samples (Table 1). The identified percentages were 52.07, 77.91, 80.98, 83.36, and 92.14% for S_3, S_4, S_1, S_5, and S_2, respectively. The major constituent (more than 5%) found in all samples was alpha-cadinol (7.25-14.49%). Although, beta-caryophyllene was also found in all samples, but it was represented as the major constituent in four samples. Among the studied populations, sample number 3 was the mostly identified. Based on the chemical compositions, this sample contained some major constituents, such as thunbergol (8.72%) and cembrene A (8.15%), which were not seen in other samples.
According to the PCA method, it was concluded that the components in sample 3 were different

Table 1. Chemical compositions of five purchased gum samples.

No.	Compound	S_1	S_2	S_3	S_4	S_5	KI
1	Alpha-Pinene	1.98	3.03	**5.02**	2.21	2.48	928
2	Alpha-Thujene	-	-	-	0.17	1.22	969
3	Sabinene	-	1.11	0.24	0.13	-	975
4	Beta-Myrcene	-	-	0.88	-	-	976
5	Beta-Pinene	0.35	-	0.49	0.21	-	980
6	Delta-Carene	0.54	-	-	0.46	0.24	995
7	Beta-Phellandrene	1.63	2.18	1.16	-	2.15	1015
8	Para-cymene	-	-	-	0.17	-	1026
9	dl-Limonene	-	-	-	1.27	-	1030
10	Gama-Terpinene	-	-	-	0.18	-	1062
11	Menthol	-	0.09	-	0.21	1.77	1171
12	Cycloisosativene	1.26	1.29	-	0.73	1.06	1340
13	Delta-Elemene	1.22	1.33	-	0.4	1.12	1340
14	Alpha-Cubebene	4.32	0.49	0.69	0.81	**5.49**	1351
15	Beta-Elemene	2.95	2.49	1.31	-	3.03	1366
16	Alpha-Copaene	0.23	**7.01**	-	**10.06**	0.51	1385
17	Beta-Bourbonene	-	-	-	0.2	-	1390
18	Beta-Caryophyllene	**20.82**	**17.38**	**5.16**	2.71	**14.99**	1393
19	Beta-Cubebene	-	-	-	0.24	0.34	1398
20	Alpha-Gurjunene	1.79	0.96	-	0.71	0.76	1415
21	Beta-Gurjunene	4.59	4.29	1.85	-	3.82	1425
22	Neo-alloocimene	-	2.7	0.22	-	-	1431
23	Trans-Caryophyllene	2.45	-	-	**9.93**	2.53	1431
24	Aromadendrene	1.71	1.52	-	0.52	1.41	1446
25	Germacrene-D	1.18	2.39	0.16	1.11	1.49	1453
26	Alpha-Humulene	3.03	2.09	-	**8.93**	3.15	1461
27	Alpha-Amorphene	**7.63**	-	0.67	**5.08**	**7.56**	1485
28	Beta-Selinene	-	2.09	0.28	3.33	-	1493
29	Alpha-Selinene	0.11	3.19	0.21	3.80	**9.34**	1501
30	Alpha-Muurolene	**8.08**	1.64	-	1.04	0.73	1505
31	Gamma-Cadinene	-	**8.61**	-	-	-	1515
32	Delta-Cadinene	-	**9.85**	1.30	**11.44**	-	1530
33	Alpha-Cadinene	-	0.56	-	0.36	-	1544
34	Germacrene B	0.41	-	-	0.53	0.82	1560
35	Selin-4,7(11)-diene	0.75	0.44	-	-	1.45	1576
36	Caryophyllene oxide	-	2.36	2.79	0.72	1.41	1592
37	Carotol	2.22	1.23	0.20	-	-	1590
38	Alpha-Cadinol	**11.03**	**11.82**	**7.25**	**10.26**	**14.49**	1617
39	Cembrene	0.67	-	**5.31**	-	-	1930
40	Cembrene A	-	-	**8.15**	-	-	1942
41	Thunbergol	-	-	**8.72**	-	-	2047
	Identified amount	**80.95**	**92.14**	**52.02**	**77.92**	**83.36**	

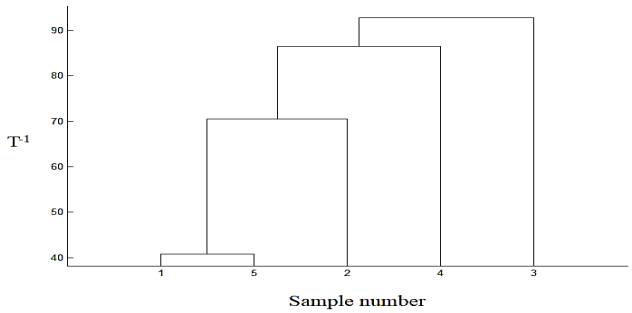

Figure 1. Hierarchical Cluster Analysis (HCA) method for different gum samples (1-5 as samples).

from other samples. On the other hand, samples 1 and 5 had similar compositions in regard to the essential oil (Figure 1).

It is noteworthy that content and yield of essential oil extracted from different samples of a specific plant or related preparations can be introduced as a criterion to select a fresh and authentic sample among various samples of that plant in market (13). Results of the current procedure can be considered as a reference method for the analysis and control of different *C. mukul* samples in market.

Conflict of interest

None declared.

4. References

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