

**CHROMATOGRAPHIC STUDIES AND COMPARISON
BETWEEN THE CHEMICAL CONSTITUENTS OF TAIF,
FRENCH, SPANISH AND EGYPTIAN ROSE OIL**

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ABSTRACT

Rose oils from Taif in Saudi Arabia, France, Spain and Egypt have been qualitatively and quantitatively analyzed by GC and GC/MS. Seventy, 56, 69 and 56 compounds were identified in these four rose oils, respectively. The main chemical constituents of all these rose oils are citronellol, geraniol, β -phenyl ethyl alcohol, and 5-methyloctadecane.

Some commercial additives were detected such as glycols and phthalate compounds, for increasing the quantities, odor fixation, color development and etc.. Percentages of such additives are zero, 38.38, 19.92 and 8.91% in Taif, French, Egyptian and Spanish rose oils, respectively. All additives and most of chemical components of these oils have been identified and determined by GC-MS technique. Because of different constituents and contents the odor of these oils are delicately different.

INTRODUCTION

Rose oil is used as one of the most important perfume oils in the world due to its characteristic smell, which distinguishes it from other perfume oils. Taif rose oil is a key issues in perfumes industries. Factories of perfumes in Saudi Arabia always indicate that Taif rose oil is one of the components of such perfumes. The characteristic and chemical composition for Taif rose oil is important to distinguish and compare it with other rose oils like French, Egyptian, and Spanish rose oil. Also it is used as flavor in some foods.

In history *Damask rose* is a fertile hybrid of *Rosa gallica* with either *Rosa phoenicia* or *Rosa moschata*, which is known since antiquity. *Damask rose* is known in Western Asia since the Bronze Age and its cultivation later spread to Greece and Rome. *Damask rose* is grown in large scale. Main production countries are Meshed (Iran), Kazanluk valley (Bulgaria), Isparta (Turkey) and France. Literatures screening indicate that oils such as jasmine oil, salvia oil and zingier oil have been distilled with different methods and analysed with different chromatographic equipments to identify the chemical components of these different types of roses. Damascena is considered as one of the best localities for production of rose oil. The original of *Damascena rose* is belonging to Alsham (Damascus), its rose is known with *Damask rose*. The merchants were brought it to Turkey and Taif in the seventeenth century (Bayrak and Akgul).

Several thousand compounds have been identified from various floral fragrances. Most of these compounds are terpenoidal, ester, alcohols, aldehydes, ketones or alkanes. An excellent review of the useful literature on floral scents was given by Knudsen et al., and there have been some reports on the fragrance compositions of rose flowers. Dobson et al. found a total of 31 fragrance compounds including 2-phenylethanol, citronellol, benzyl alcohol, methyleugenol and geraniol from *Rosa rugosa*. Some other workers [Bu et al, Chen et. al, Sirikulvadhana et. al, Mookherjee et. al, Li et. al, Wu et. al al, and Pogorel'skaya et. al] also reported fragrance components of Rosaceae species including *Rosa chinensis* and *Rosa damascene*.

The purpose of this study is to determine the chemical composition of Taif rose oil which has a special characteristic for its smell and price over the others rose oils such as French, Spanish and Egyptian rose oil. The extraction was carried out by steam distillation and the analysis was carried out by gas chromatography-mass spectrometer GC-MS, supplied with a capillary column and a NIST library.

EXPERIMENTAL

Isolation of rose oil

Steam distillation apparatus has been used for distillation. One thousand and four hundred fresh rose battles were put in a round-bottom flask connected to a steam generator, the steam was allowed to pass

through the flask which contains the rose. Oils were collected from the distillate.

The mass spectrum of a separated compound is compared with those of the NIST Library. Also comparison has been done with some authentic samples injected in the instrument under the same conditions. Finally the mass spectrum was compared with spectra of Robert Adams book "Identification of Essential oils by Ion-Trap mass spectrometer".

Isolation By Al-Gadi Rose Oil Laboratory in Taif.

There are five steps for producing Taif rose oil starting from picking the rose battles early in the morning before sun rise and brought to the distillation factories, weighed, put in a basket and transferred to a huge cupric pots, used for the distillation process. About sixteen to twenty thousands rose battles are put in each pots and covered with water; the pots are covered with a concave lid which operates as a condenser. These pots were subjected to heat using flame underneath. The resulting steam condenses in the concave lid and passes through a tube, which passes through a barrel filled with water for condensation. The oil with a large quantity of water was collected in containers. The containers were left for a while. The oil was separated on the top of the water and collected by a syringe. Taif factories in Saudi Arabia using this steps are producing about (200 kg) of rose oil per year.

Gas chromatography-mass spectrometry

A Shimadzu QP 5050 apparatus was used to determine the chemical composition of the volatile oil samples. The gas chromatograph (GC) equipped with a fused-silica DB-5 fused silica column (J&W Scientific, Folsom, CA), 30 m × 0.25 mm i.d., and film thickness 0.25 μm . Carrier gas, helium flow rate 1.1 ml min⁻¹; injector temperature 260°C., detector temperature, 250°C., column temperature programmed from 50°C (5 min hold) to 250°C at 10°C min⁻¹ (19 min hold); split ratio 1: 50; sample injected, 1 μl ., ionization energy, 70 eV; scan time 1 s; mass range, 40 – 600 amu.

RESULTS AND DISCUSSION

The study of Taif rose oil by GC/MS afforded sixty-five compounds were separated; most of them have been identified. The classification to these compounds according to their chemical families as:

Monoterpene alcohols: beta-citronellol, linalool, terpinen 4-ol, alpha-terpineol, geraniol, nerol oxide, isogeraniol,

Sesquiterpene alcohols: trans, cis farnesol, trans nerolidol, viridiflorol, gamma- eudesmol, trans-longipinocarveol, tau-muurolol

Aromatic alcohols: Phenyl ethyl alcohol, eugenol, o-cymene, benzyl alcohol,

Aldehydes: beta-citral

Ketones : 6-methyl-5-heptene -2- one

Esters : nerol acetate , geraniol acetate, citronellyl acetate, geraniol formate, methyl geranate, citronellyl butyrate

Cyclo monoterpenes : alpha-pinene, beta-pinene, D-limonene, gamma-terpinene, terpinolen

Cyclo sesquiterpenes : gamma- caryophyllene, delta- cadinene, azulene, alpha- caryophyllene, germacrene D,

Long-chain hydrocarbon: n-nonadecane, 9-nonadecene, hexadecane, 8-heptadecene, heptadecane, (E)-3-octadecene, octadecane, eicosane, (E)-9- eicosene, octacosane, hexatriacontane.

The study indicated the presence of three compounds represent 61.07% of the Taif rose oil components. They are citronellol (31.27%), geraniol (19.52), and 5-methyl octadecane (10.25%). Where as phenyl ethyl alcohol which has high percentage in the other rose oil represents 3.13 %. About twelve compounds have percentage between 1% and 10%. Others compounds which (about fifty) are less than 1% .

Study of the Taif rose oil and some rose oil available in the local market such as: French, Spanish, and Egyptian by GC/MS at the same conditions (Table 1). Some commercial additives were found such as glycols and phthalate compounds, for increasing the quantities, odor fixation and color development. Percentages of the additives found are 38.38, 19.92 and 8.91% in French, Egyptian and Spanish rose oils, respectively. All additives and most of chemical components of these oils have been identified. The comparative data concerning the chemical composition of Taif rose oil with other French, Spanish and Egyptian rose oil were found in Table 2. The main composition of Taif, French, Spanish and Egyptian Rose oil represented in Table 3.

Table 1: GC-MS analysis of Talf, Spanish, Egyptian and French rose oil.

Talf Rose Oil					Spanish Rose Oil				Egyptian Rose Oil				French Rose Oil			
Peak	Compound Name	M. Wt.	Formula	%	Compound Name	M. Wt.	Formula	%	Compound Name	M. Wt.	Formula	%	Compound Name	M. Wt.	Formula	%
1	Alpha.-Pinene	136	C ₁₀ H ₁₆	1.11 - 1.87	Bis(2-hydroxypropyl) ether	134	C ₈ H ₁₄ O ₂	1.54	Bis(2-hydroxypropyl) ether	134	C ₈ H ₁₄ O ₂	8.69	2-(2-ethoxyethoxy) ethanol	134	C ₈ H ₁₄ O ₃	30.87
2	beta.-Pinene	136	C ₁₀ H ₁₆	0.36 - 0.49	Bis(2-hydroxypropyl) ether	134	C ₈ H ₁₄ O ₂	2.60	Benzyl Alcohol	108	C ₇ H ₈ O	7.12	Bis (2-hydroxypropyl) ether	134	C ₈ H ₁₄ O ₂	3.69
3	6-methyl-5-heptene-2-one	126	C ₈ H ₁₄ O	0.02 - 0.03	Dipropylene glycol	134	C ₈ H ₁₄ O ₂	0.51	Bis(2-hydroxypropyl) ether	134	C ₈ H ₁₄ O ₂	3.95	Dipropylene glycol	134	C ₈ H ₁₄ O ₂	2.57
4	beta.-Myrcene	136	C ₁₀ H ₁₆	0.89 - 1.04	Tripropylene glycol	192	C ₉ H ₁₆ O ₃	1.86	Dipropylene glycol	134	C ₈ H ₁₄ O ₂	2.85	Tripropylene glycol	192	C ₉ H ₁₆ O ₃	2.14
5	(+)-2-Carene	136	C ₁₀ H ₁₆	0.06 - 0.08	Tripropylene glycol	192	C ₉ H ₁₆ O ₃	1.40	Tripropylene glycol	192	C ₉ H ₁₆ O ₃	10.28	3,3'-oxybis-2-Butanol	162	C ₈ H ₁₆ O ₂	0.41
6	o-Cymene	134	C ₁₀ H ₁₄	0.03 - 0.05	3,3'-oxy bis-2-Butanol	162	C ₈ H ₁₆ O ₂	0.32	Tripropylene glycol	192	C ₉ H ₁₆ O ₃	6.36	Linalool	154	C ₁₀ H ₁₈ O	0.32
7	D-Limonene	136	C ₁₀ H ₁₆	0.14 - 0.22	Linalool	154	C ₈ H ₁₆ O	1.66	3,3'-oxybis-2-Butanol	162	C ₈ H ₁₆ O ₂	0.14	Phenyl ethyl Alcohol	122	C ₈ H ₁₀ O	3.72
8	Benzyl Alcohol	108	C ₇ H ₈ O	0.03	Phenylethyl Alcohol	122	C ₈ H ₁₀ O	16.94	3,3'-oxybis-2-Butanol	162	C ₈ H ₁₆ O ₂	1.85	dis-p-Menthan-3-one	154	C ₁₀ H ₁₈ O	0.20
9	trans-Ocimene	136	C ₁₀ H ₁₆	0.03 - 0.05	tetrahydro-4-methyl-2-(2-methyl-1-propenyl)-2H-Pyran (Rose Oxide)	154	C ₁₀ H ₁₆ O	0.10	Linalool	154	C ₁₀ H ₁₈ O	0.05	not detected	—	—	0.42
10	Ocimene	138	C ₁₀ H ₁₆	0.06 - 0.09	beta.-Phenylethyl formate	150	C ₈ H ₁₂ O ₂	0.42	Phenylethyl Alcohol	122	C ₈ H ₁₀ O	19.15	6-5-methyl-2-(1-methylethenyl)-4-Hexen-1-ol	154	C ₁₀ H ₁₈ O	0.21
11	gamma.-Terpinene	136	C ₁₀ H ₁₆	0.09 - 0.15	alpha - Terpineol	154	C ₁₀ H ₁₈ O	0.16	2-Methyl-2-pentanol	102	C ₈ H ₁₆ O	0.13	Carbitol acetate	178	C ₈ H ₁₆ O ₄	0.69
12	Terpinolen	136	C ₁₀ H ₁₆	0.06 - 0.09	alpha - Citronellol	156	C ₁₀ H ₁₈ O	0.24	alpha.-alpha.-dimethyl-Benzeneethanol	150	C ₁₀ H ₁₆ O	0.07	(5)- 3,7-dimethyl-1-Octanol	158	C ₁₀ H ₂₀ O	0.38

13	Linalool	154	C ₁₀ H ₁₆ O	3.65 5.16	beta-Citronellol	156	C ₁₀ H ₁₆ O	22.9 1	Benzyl acetate	150	C ₁₁ H ₁₈ O ₂	2.16	not detected	—	—	0.08
14	Phenylethyl Alcohol	122	C ₈ H ₁₀ O	3.13	beta-Citral	152	C ₁₀ H ₁₆ O	0.26	beta-Phenylethyl formate	150	C ₁₁ H ₁₈ O ₂	0.52	Alpha-Citronellol	156	C ₁₀ H ₁₆ O	0.48
15	(E)-3,3-dimethyl-1,5-heptadiene	124	C ₉ H ₁₆	4.06	Ellythphenyl acetate	164	C ₁₀ H ₁₆ O ₂	0.06	not detected	—	—	0.03	beta-Citronellol	156	C ₁₀ H ₁₆ O	34.06
16	tetrahydro-4-methyl-2(1H)-propanoyl-2H-Pyran (Rose Oxide)	154	C ₁₀ H ₁₆ O	0.13 0.14	1,2,3-Propanetriol diacetate	178	C ₁₁ H ₁₈ O ₃	0.13	(S)-3,7-dimethyl-1-Octanol	158	C ₁₀ H ₁₆ O	1.04	beta-Citral	152	C ₁₀ H ₁₆ O	0.25
17	Nerol oxide	170	C ₁₀ H ₁₆ O ₂	0.06 0.08 0.15	Geraniol	154	C ₁₁ H ₁₈ O	16.4 3	4-tert-Butylcyclohexanol	156	C ₁₀ H ₁₆ O	0.87	1-Octanol, 3,7-dimethyl-	156	C ₁₀ H ₁₆ O	0.11
18	1-Terpinen-4-ol	154	C ₁₀ H ₁₆ O	0.81	Decylene Alcohol	156	C ₁₀ H ₁₆ O	0.20	alpha-Citronellol	156	C ₁₁ H ₁₈ O	1.22	Geraniol	154	C ₁₀ H ₁₆ O	6.17
19	alpha-Terpinol	164	C ₁₀ H ₁₆ O	1.20 31.2	alpha-Citral	152	C ₁₀ H ₁₆ O	0.42	beta-Citronellol	156	C ₁₀ H ₁₆ O	14.12	alpha-Citral	152	C ₁₀ H ₁₆ O	0.42
20	beta-Citronellol	166	C ₁₀ H ₁₆ O	7- 24.4	Citronellyl formate	184	C ₁₁ H ₁₈ O ₂	0.72	beta-Citral	152	C ₁₀ H ₁₆ O	0.21	Citronellyl formate	184	C ₁₁ H ₁₈ O ₂	0.78
21	Isogeraniol	154	C ₁₀ H ₁₆ O	0.04 0.09	Geraniol formate	162	C ₁₁ H ₁₈ O ₂	0.19	not detected	—	—	0.18	Geraniol formate	182	C ₁₁ H ₁₈ O ₂	0.78
22	Geraniol	154	C ₁₀ H ₁₆ O	19.5 2- 19.5	Linalool formate	182	C ₁₁ H ₁₈ O ₂	0.68	Geraniol	154	C ₁₀ H ₁₆ O	3.14	not detected	—	—	0.10
23	beta-Citral	152	C ₁₀ H ₁₆ O	1.06 0.96	6,6-Dimethyl-2-(3-oxobutyl)bicyclo[3.1.1]heptan-3-one	208	C ₁₁ H ₁₈ O ₂	0.34	not detected	—	—	0.06	Linalool formate	182	C ₁₁ H ₁₈ O	0.26
24	Geranyl vinyl ether	180	C ₁₂ H ₂₀ O	0.05	1-methyl-4-(2-methylbut-3-enyl)oxabicyclo[4.1.0]heptane	168	C ₁₁ H ₁₈ O ₂	0.07	Decylene Alcohol	156	C ₁₀ H ₁₆ O	0.2	Benzene ethanol, alpha, beta-dimethyl-	192	C ₁₁ H ₁₈ O ₂	0.13
25	Geraniol formate	152	C ₁₁ H ₁₈ O ₂	0.64 0.06	Citronellyl acetate	198	C ₁₂ H ₂₀ O ₂	0.86	alpha-Citral	152	C ₁₀ H ₁₆ O	0.27	not detected	—	—	0.08
26	Methyl geranate	182	C ₁₁ H ₁₈ O ₂	0.04	Eugenol	164	C ₁₁ H ₁₈ O ₂	0.23	Citronellyl formate	184	C ₁₁ H ₁₈ O ₂	0.4	not detected	—	—	0.32



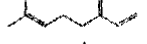






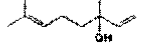



27	Citronellyl acetate	198	C ₁₂ H ₂₀ O ₂	0.05 0.72 1.58	Nerol acetate	196	C ₁₂ H ₂₀ O ₂	0.29	Geraniol formate	182	C ₁₁ H ₁₈ O ₂	0.15	Citronellyl acetate	198	C ₁₂ H ₂₀ O ₂	0.28
28	Eugenol	164	C ₁₀ H ₁₂ O ₂	1.3 2.24	2,3 epoxy-Geranyl acetate	212	C ₁₇ H ₃₀ O ₂	0.25	Linalool formate	182	C ₁₁ H ₁₈ O ₂	0.1	Eugenol	164	C ₁₀ H ₁₂ O ₂	0.19
29	Nerol acetate	196	C ₁₂ H ₂₀ O ₂	0.51 0.39	Geraniol acetate	196	C ₁₂ H ₂₀ O ₂	1.80	Benzeneethanol, alpha, alpha-dimethyl-, acetate	162	C ₁₂ H ₁₈ O ₂	3.48	Nerol acetate	196	C ₁₂ H ₂₀ O ₂	0.33
30	Geraniol acetate	196	C ₁₂ H ₂₀ O ₂	2.24 2.25	2-isopropenyl-5-methylhex-4-enal	152	C ₁₀ H ₁₈ O	0.17	not detected	—	—	2.32	4-tert-Butylcyclohexyl acetate	198	C ₁₄ H ₂₂ O ₂	0.18
31	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S]- (1 alpha, 2 beta, 4 beta)-	204	C ₁₃ H ₂₄	0.13 0.18	Eugenol methyl ether	178	C ₁₁ H ₁₆ O ₂	0.86	1-Tridecyne	180	C ₁₃ H ₂₆	0.03	Geraniol acetate	196	C ₁₂ H ₂₀ O ₂	0.45
32	Eugenol methyl ether	178	C ₁₁ H ₁₆ O ₂	0.8 0.73	1,6 dimethyl-2,7-Octadiene	170	C ₁₀ H ₁₈ O ₂	0.07	1-methyl-4-(2-methyloxiran-yl)-7-Oxabicyclo[4,1.0]heptane	168	C ₁₀ H ₁₆ O ₂	0.05	Ophenyl ether	170	C ₁₁ H ₁₆ O	1.00
33	gamma-Caryophyllene	204	C ₁₅ H ₂₄	0.78 0.8	Azulene, 1,2,3,4,5,6,7,8-octahydro-1,4-dimethyl-7-(1-methylethenyl)-, [1S]- (1 alpha, 4 alpha, 7 alpha)-	204	C ₁₅ H ₂₄	0.06	Citronellyl acetate	198	C ₁₂ H ₂₀ O ₂	0.31	gamma-Caryophyllene	204	C ₁₅ H ₂₄	0.07
34	1H-Cyclopenta[1,3]cycloprope[1,2]benzene, octahydro-7-methyl-3-methylene-4-(1-methylethyl)	204	C ₁₃ H ₂₄	0.04 0.05	Mandelic acid	162	C ₈ H ₁₀ O ₂	0.45	not detected	—	—	0.07	Aristofene	204	C ₁₅ H ₂₄	0.32
35	Azulene, 1,2,3,4,5,6,7,8-octahydro-1,4-dimethyl-7-(1-methylethenyl)-, [1S]-	204	C ₁₅ H ₂₄	0.58 0.62	Azulene, 1,2,3,4,5,6,7,8,8a-octahydro-1,4-dimethyl-7-(1-methylethenyl)-, [1S]-	204	C ₁₅ H ₂₄	0.04	Nerol acetate	196	C ₁₂ H ₂₀ O ₂	0.1	Geranyl propanoate	210	C ₁₃ H ₂₂ O ₂	0.06

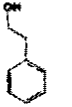
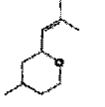
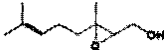


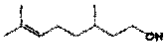
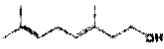
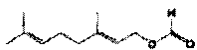
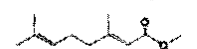
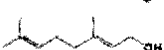
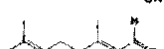
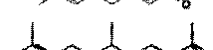
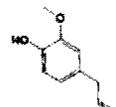
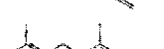

	(1 alpha ,4.alpha a ,7.alpha)]:				(1.alpha ,7.alpha na ,8a.beta)]:												
36	4-(2,6,6- Trimethyl- cyclohex-1- enyl)-butan-2-ol	199	C ₁₂ H ₂₄ O	0.03 - 0.05	4,8-dimethyl- 1,7-Nonadien- 4-ol	168	C ₁₁ H ₂₀ O	0.26	4-tert- Butylcyclohe- xyl acetate	198	C ₁₂ H ₂₂ O ₂	4.93	alpha- Isomethyl ionone	208	C ₁₁ H ₂₀ O	0.13	
37	alpha- Caryophyllene	204	C ₁₉ H ₃₄	0.47 -0.6	Hydroxycitron ellol	174	C ₁₉ H ₃₂ O ₂	0.48	trans- Limonene oxide	166	C ₁₈ H ₃₄ O	0.05	Mandelic acid	152	C ₉ H ₈ O ₂	1.17	
38	Germacrene D	204	C ₁₉ H ₃₄	1.17 - 1.48	2-Propenoic acid,2-methyl- 3-methyl-2- methylene-3- butenyl ester	166	C ₁₆ H ₃₀ O ₂	0.07	Geraniol acetate	196	C ₁₇ H ₃₀ O ₂	0.19	4-(2,5,6,6- tetramethyl- 2- cyclohexen- 1-yl)-3- Buten-2-one	208	C ₁₁ H ₂₂ O	0.21	
39	Pentadecane	212	C ₁₅ H ₃₂	0.78 - 0.83	2- Furanmethano 1,5- etheryltetrahy- dro- alpha ,alpha , 5-trimethyl- cis-	170	C ₁₆ H ₃₄ O ₂	0.29	2,7-dimethyl- 2,6-Octadien- 1-ol	154	C ₁₆ H ₃₄ O	0.05	Caronefai hydrate	172	C ₁₆ H ₃₀ O ₂	0.18	
40	Azulene,1,2,3,4 ,5,6,7,8,8a- octahydro-1,4- dimethyl-7-(1- methylphenyl)- (1S- (1.alpha ,7.alpha a ,8a.beta)]:	204	C ₁₅ H ₂₄	0.63 - 0.69	Rose acetate	266	C ₁₆ H ₂ Cl ₂ O ₂	1.89	2,8-dimethyl- 1,7-Octadien- 3-ol	154	C ₁₉ H ₃₈ O	0.29	Citronellyl butyrate	226	C ₁₄ H ₂₆ O ₂	0.20	
41	delta-Cadinene	204	C ₁₅ H ₂₄	0.06 - 0.08	trans-Nerolidol	222	C ₁₅ H ₂₆ O	0.04	3-Tridecene	180	C ₁₃ H ₂₆	0.05	alpha-Irona	206	C ₁₄ H ₂₂ O	0.15	
42	trans- Nerolidol	222	C ₁₅ H ₂₆ O	0.08 - 0.1	Caryophyllene oxide	220	C ₁₅ H ₂₄ O	0.12	trans-Undec- 4-enal	168	C ₁₁ H ₂₀ O	0.03	Rose acetate	266	C ₁₆ H ₂ C ₁₆ O ₂	0.81	
43	not detected	---	---	0.04 - 0.15	Diethylphthalat e	222	C ₁₇ H ₁₆ O ₄	2.56	1-[3-methyl- 3-(4-methyl- 3- pentenyl)]Eth anone	182	C ₁₁ H ₁₈ O ₂	0.05	1,3,3- trimethyl-2- (1- methylbut-1- en-3-on-1- yl)-1- Cyclohexen o	206	C ₁₄ H ₂₂ O	0.06	
44	Hexadecane	226	C ₁₆ H ₃₄	0.17 - 0.09	12- Oxabicyclo[9.1 0]dodeca-3,7- diene, 1,5,5,8- tetramethyl	220	C ₁₅ H ₂₆ O	0.12	2,3- epoxyGerany l acetate	212	C ₁₂ H ₂₀ O ₂	0.06	(E)-2- Butenoic acid,2- methyl-, 2- phenylethyl ester	204	C ₁₃ H ₁₈ O ₂	0.14	

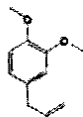

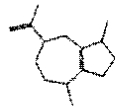
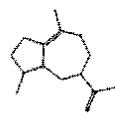
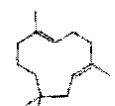
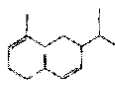

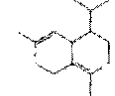

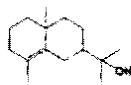
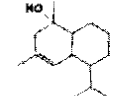
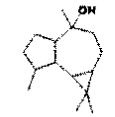

45	gamma - Eudesmol	222	C ₁₅ H ₂₆ O	0.06 - 0.08	Lodol	222	C ₁₅ H ₂₆ O	0.06	Citronellal hydrate	172	C ₁₅ H ₂₆ O ₂	0.97	Guaiol	222	C ₁₅ H ₂₆ O	0.08
46	lau-Murolol	222	C ₁₅ H ₂₆ O	0.06 - 0.1	8-Heptadecene	238	C ₁₇ H ₃₄	0.09	2-Furanmethanol, 5-ethoxytetrahydro-, alpha, alpha, 5-trimethyl-, cis-	170	C ₁₉ H ₃₂ O ₂	0.09	not detected	—	—	0.11
47	viridiflorol	222	C ₁₅ H ₂₆ O	0.21 - 0.28	Heptadecane	240	C ₁₇ H ₃₄	0.38	Danzenebutanoic acid	184	C ₁₆ H ₃₂ O ₂	0.08	5-Azulenemethanol, 1,2,3,3a,4,5,6,7-octahydro-, alpha, alpha, 3,8-[3S-(3.alpha.,3a.beta.,5.alpha.)]	222	C ₁₅ H ₂₆ O	0.06
48	8-Heptadecene	238	C ₁₇ H ₃₄	0.3 - 0.35	(Z,E)-Farnesol	222	C ₁₅ H ₂₆ O	0.63	Benzophenone	182	C ₁₃ H ₁₀ O	1.23	Geranyl tiglate	238	C ₁₉ H ₃₄ O ₂	0.14
49	trans-Longipinocarveol	220	C ₁₅ H ₂₆ O	0.06 - 0.07	Benzyl Benzoate	212	C ₁₄ H ₁₈ O ₂	0.88	Benzene, (3-ethenyl-5,5-dimethylhexyl-)	218	C ₁₆ H ₂₆	0.07	Benzoic acid, 3-hydroxybutyl ester	194	C ₁₇ H ₂₀ O ₂	0.07
50	Heptadecane	240	C ₁₇ H ₃₄	2.53 - 2.73	2-Allyl-1,4-dimethoxy-3-methylbenzene	192	C ₁₂ H ₁₆ O ₂	0.09	alpha-Santalol	220	C ₁₄ H ₂₆ O	0.04	Benzyl Benzoate	212	C ₁₄ H ₁₈ O ₂	1.48
51	(Z,E)-Farnesol	222	C ₁₅ H ₂₆ O	0.04 - 0.1	Musk xylene	297	C ₁₂ H ₁₄ N ₂ O ₅	0.10	1,3-Dioxolane, 4-ethyl-4-methyl-2-pentadecyl-	326	C ₂₁ H ₄₂ O ₂	0.03	not detected	—	—	0.22
52	(E,E)-Farnesol	222	C ₁₅ H ₂₆ O	1.55 - 1.71	(E)-9-Eicosene	280	C ₂₀ H ₄₀	0.87	Musk xylene	297	C ₁₂ H ₁₄ N ₂ O ₅	0.39	Beta-Phenyl ethyl phenyl acetate	240	C ₁₈ H ₁₆ O ₂	1.16
53	not detected	—	—	0.08	not detected	—	—	1.58	Hexadecane	226	C ₁₆ H ₃₄	0.02	Citronellyl propanoate	212	C ₁₈ H ₃₀ O ₂	0.10
54	(E)-3-Octadecane	252	C ₁₈ H ₃₆	0.07 - 0.08	Benzeneacetic acid, 2-Phenylethyl ester	240	C ₁₆ H ₁₈ O ₂	1.16	not detected	—	—	0.02	Neryl phenyl acetate	272	C ₁₈ H ₂₄ O ₂	0.12
55	Octadecane	254	C ₁₈ H ₃₈	0.22 - 0.3	Octyl phenyl phthalate	276	C ₁₈ H ₂₂ O ₄	0.69	2,2,4-Trimethyl-3-phenylhex-5-en-3-ol	218	C ₁₅ H ₂₂ O	0.17	Diisodcyl phthalate	390	C ₂₄ H ₄₀ O ₄	0.10

56	9-Nonadecane	256	C ₁₉ H ₃₈	3.56 3.94	Citronellyl butyrate	226	C ₁₇ H ₃₂ O ₂	0.37	Din-octyl phthalate	390	C ₂₁ H ₄₀ O ₄	0.21
58	n-Nonadecane	258	C ₁₉ H ₃₈	10.2 8- 10.4	Eicosane	282	C ₂₀ H ₄₂	0.12				
59	(E)-9-Eicosene	280	C ₂₀ H ₃₈	0.13 0.15	Neryl phenylacetate	272	C ₁₉ H ₃₂ O ₂	0.34				
60	Eicosane	282	C ₂₀ H ₄₀	1- 1.18	not detected	—	—	0.32				
61	cis-10- Heptacosene	294	C ₂₁ H ₄₂	0.19 0.16	2-Benzobicy- 1,1,10- trimethyl-6,9- epidially-7- octalinene	328	C ₂₀ H ₃₆ O ₄	0.08				
62	trans-10- Heptacosane	294	C ₂₁ H ₄₂	0.32 0.23	Phenylidodeca- none	246	C ₁₈ H ₃₆	0.12				
63	not detected	—	—	4.25 4.35	Phenylheicosan- e	358	C ₂₀ H ₃₈	0.12				
64	Citronellyl butyrate	228	C ₁₇ H ₃₀ O ₂	0.04 0.06	not detected	—	—	0.05				
65	not detected	—	—	0.07 -0.1	6,11-Dimethyl- 2,6,10- dodecalin-1- ol	208	C ₁₄ H ₂₆ O	0.11				
66	not detected	—	—	0.14 0.19	not detected	—	—	0.07				
67	Octacosane	354	C ₂₈ H ₅₈	0.67 0.95	(E)-Farnesol	222	C ₁₅ H ₂₆ O	0.07				
68	not detected	—	—	0.02 0.03	not detected	—	—	2.22				
69	not detected	—	—	0.03 0.15	not detected	—	—	5.76				
70	Hexatriacontan- e	300	C ₃₆ H ₇₄	0.15 0.09	—	—	—	—				

Table (2): Comparison between Taif French Egyptian and Spanish Rose Oils.

Compound	Structure	Taif Rose Oil	French Rose Oil	Egyptian Rose Oil	Spanish Rose Oil
α -Pinene		1.11	-	-	-
β -Pinene		0.36	-	-	-
β -Myrcene		0.69	-	-	-
(+)- α -Caryophyllene		0.06	-	-	-
D-Limonene		0.14	-	-	-
Benzyl Alcohol		0.03	-	7.12	-
Ocimene		0.06	-	-	-
γ -Terpinene		0.09	-	-	-
Terpinolene		0.06	-	-	-
Linalool		3.65	0.32	0.05	1.66
6-Methyl-5-heptene-2-one		0.02	-	-	-
O-Cymene		0.03	-	-	-
<i>trans</i> -Ocimene		0.03	-	-	-

Phenylethyl alcohol		3.13	3.72	19.2	16.9
Rose oxide		0.13	-	-	0.1
Nerol oxide		0.06	-	-	-
l-Terpinen-4-ol		0.15	-	-	-
α-Trpineol		0.78	-	-	0.18
β-Citronellol		31.27	34.96	14.12	22.91
Isogeraniol		0.04	-	-	-
Geraniol formate		0.04	0.78	0.4	0.19
Methyl geranate		0.04	-	-	-
Geraniol		19.52	6.17	3.14	19.43
β-Citral		1.08	0.25	0.21	0.29
Citronellyl acetate		0.72	0.28	0.31	0.86
Eugenol		1.30	0.19	-	0.23
Nerol acetate		0.51	0.33	0.10	0.29
Geraniol acetate		2.24	0.45	0.19	1.80

Eugenol methyl ether		0.80	-	-	0.86
γ -Caryophyllene		0.78	0.07	-	-
1,2,3,4,5,6,7,8-octahydro-1,4-dimethyl-7-(1-methylethenyl) [1S-(1.alpha.,7.alpha)] Azulene.		0.58	-	-	0.04
1,2,3,4,5,6,7,8,8a-octahydro-1,4-dimethyl-7-(1-methylethenyl) [1S-1.alpha.,7.alpha.,8a.beta)] Azulene.		0.63	-	-	0.06
α -Caryophyllene		0.47	-	-	-
Germacrene D		1.17	-	-	-
Pentadecane		0.78	-	-	-
δ -Cadinene		0.06	-	-	-
Hexadecane		0.17	-	-	-
γ -Eudesmol		0.06	-	-	-
τ -Murolool		0.06	-	-	-
Viridiflorol		0.21	-	-	-
8-Heptadecene		0.30	-	-	0.09


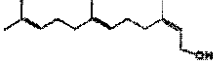

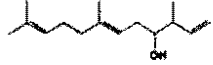
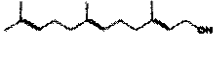











Heptadecene		2.53	-	-	0.36
(Z,E)-Farnesol		0.04	-	-	-
<i>trans</i> -Longipinocarvecol		0.06	-	-	-
<i>trans</i> -Nerolidol		0.08	-	-	0.04
(E, E)-Farnesol		1.55	-	-	0.07
(E)-3-Octadecene		0.07	-	-	-
Octadecene		0.22	-	-	-
<i>Trans</i> -10-Heneicosene		0.23	-	-	-
9-Nonadecene		3.56	-	-	-
n-Nonadecane		10.28	-	-	-
(E)-9-Eicosene		0.13	-	-	-
Eicosane		1.0	-	-	0.12
<i>Cis</i> 10-Heneicosene		0.16	-	-	-
1-Tricosene		0.14	-	-	-
Octacosane		0.67	-	-	-
Hexatriacontane		0.06	-	-	-

Table (3): The main composition of Taif, French, Spanish and Egyptian Rose oil.

	Taif	French	Spanish	Egyptian
Citronellol	31.27	34.96	22.91	14.10
Geraniol	19.52	6.17	19.43	3.14
Phenyl ethyl alcohol	3.13	3.72	16.94	19.20
n-Nonadecane	10.25	-	-	-

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دراسات كروماتوجرافية و مقارنة بين المكونات الكيميائية لزيت الورد
الطائفي و الفرنسي و الأسباني و المصري

تم التحليل كيفاً وكماً باستخدام تقنية كروماتوجرافيا الغاز وكروماتوجرافيا الغاز المقترن بمطياف كتلة لزيت الورد من الطائف بالمملكة العربية السعودية وكذلك من فرنسا وأسبانيا ومصر. تم تعريف سبعين ، ست وخمسين ، تسع وستين وست وخمسين مركباً من هذه الزيوت على الترتيب. واتضح أن المكونات الرئيسية في هذه الزيوت هي ستونيلول ، جيرانيول ، كحول بيتاقنيل إيثايل و ٥-ميثايل أوكتاديكان.

تم إكتشاف بعض الإضافات على هذه الزيوت مثل مركبات الجليكولات والفتالات ، ربما أضيفت لزيادة الكمية أو لتثبيت الرائحة ، وكانت كمياتها صفر ، ٣٨,٣٨ ، ١٩,٩٢ و ٨,٩١% في الورد الطائفي ، الفرنسي ، المصري والأسباني على الترتيب. تم تعريف وتقدير كل الإضافات ومعظم المكونات الكيميائية بجهاز كروماتوجرافيا الغاز المقترن بمطياف كتلة. وقد أعزيت الاختلافات في روائح تلك الزيوت إلى الاختلاف في المكونات وكمياتها.