



# GAS CHROMATOGRAPHY – MASS SPECTROSCOPIC ANALYSIS OF *LAWSONIA INERMIS* L., *ERUCA SATIVA* MILL., *SIMMONDSIA CHINESIS* (LINK) SCHNEIDER AND *BOSWELLIA* SPP.

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## Abstract

Due to the importance of jojoba seed oil, watercress seed oil, henna leaves and frankincense in popular medicine for the treatment of many diseases as well as its economic importance for its entry as raw materials in some industries, the study was conducted to determine the chemical components from the previous plants by using Gas Chromatography – Mass Spectroscopic analysis. The results of analysis showed that in jojoba seed oil, watercress seed oil, henna leaves and frankincense the most prevailing compounds were cis-Vaccenic acid, Diethyl Phthalate and 1-[2-Hydroxyethyl]-4-[4-[7-chloro-4-quinolylamino]benzoyl] piperazine.

**Key words** : jojoba seed oil, watercress, cis-Vaccenic acid, Gas Chromatography-Mass Spectroscopic.

## Introduction

Watercress plant *Eruca sativa* Mill. belongs to the family “Brassicaceae”, it is believed to be native to Central Asia and Eastern Europe and can be classified as medical plant due to various curative uses, for example the treatment of dermatitis, local burns, poor digestion, hair loss and hypoglycemia for people with diabetes, by working to slow the absorption of sugar into the intestines. The oil of the plant is used to improve liver function, increase fertility by improving the effectiveness of sexual hormones, in additions, it considers as anti-inflammatory and anti-foot fungus and stomach disease (Bhandari and Chaderl, 1996; Merza *et al.*, 2000 ; Hila *et al.*, 2009).

Each 100 g of watercress leaves contains 2.6 g protein, 0.7 g fat, 3.6 g carbohydrates and 1.6 g fiber as well as vitamin A, C, sodium, potassium, calcium, iodine, iron, zinc and sulfur, in addition to thiamin, riboflavin, niacin and other substances (Al-Dujoi, 1996).

Henna *Lawsonia inermis* L. belongs to the family Lythraceae, an evergreen shrub native to the Arabian Peninsula and Iran. its dried leaves used as dye of hair, treatment of skin diseases and wounds, and the flowers used in Perfume Industries. The plant contains many compounds such as flavonoids, tannins, alkaloids and terpenoids (Cowan, 1999; Kamel, 2004; Mansour, 2004;

Chandhary *et al.*, 2010).

Recent studies showed the effectiveness of henna compounds as anti-bacterial and fungal, as well as anti-inflammatory and cancers (Dasgupta *et al.*, 2003).

Jojoba *Simmondsia chinensis* (Link) Schneider is an evergreen shrub, belongs to family Simmondsiaceae. It is known as jojoba, which originates from the deserts of USA native to southwestern Arizona, California and northern Mexico (Stone, 1993), However, it is now planted in many other deserts across the world. The importance of this plant is due to its content of protein glycosides, esters, fatty acids and alcohols with a high oil content of the seeds about 50% of their weight (Naqvi and Ting, 1990; Tada *et al.*, 2005; Evans, 1999).

Jojoba seed oil consists of 97% wax and 3% free fatty acids and contains anti-oxidants and inhibits some types of bacteria, viruses and anti-inflammatory. Its molecules consist of a long carbon chain, unlike vegetable oils that consist of fatty acids and glyceritol, making it a liquid wax without purification and has a high viscosity rate and high degree of stability (Verschuren, 1989; Naqvi and Ting, 1990).

Frankincense (olibanum) a tree of the genus *Boswellia* (family Burseraceae), has been spread in some countries of the Arabian Peninsula, such as Yemen and

**Table 1:** Components Identified in jojoba.

Peak Area %	MW	Molecular Formula	Name of the compound	RT	No.
0.93	394	C26H50O2	Cyclopropane tetradecanoic acid, 2-octyl-,methyl ester	4.106	1
4.12	222	C12H14O4	Diethyl Phthalate	13.870	2
1.33	530	C34H58O4	1,2-Benzenedicarboxylic acid, ditridecyl ester	14.016	3
1.06	222	C12H14O4	Diethyl Phthalate	14.120	4
2.70	254	C18H38	Hexadecane	14.288	5
2.29	390	C24H38O4	Phthalic acid, ethyl tetradecyl ester	14.529	6
1.49	177	C8H7N3O2	Pyrido[3,2-d]pyrimidin-4(3H)-one, 3-hydroxy-2-methyl	14.666	7
0.61	542	C31H28Cl2N4O	2,4-Bis[4-chloro-trans-styryl]-6-[(3-pyrrolidinomethyl-4-hydroxyphenyl)amino]pyrimidine	14.700	8
1.11	680	C38H37N2O6PS	Carbamic acid, [2-[[1-(diphenoxyphosphinyl)-2-phenylethyl]amino]-2-oxo-1-[[phenylmethyl]thio]methyl]ethyl]-, phenylmethyl ester	14.814	9
1.81	742	C42H54N4O8	3,7,12-Triazabicyclo[13.3.1]nonadeca-1(19),15,17-triene-2-acetic acid, 3,7-diacetyl-12-[3-(benzoylamino)propyl]-16-methoxy-14-[(4-methoxyphenyl)]	14.920	10
0.42	248	C14H16O4	Phthalic acid, cyclobutyl ethyl ester	15.007	11
0.77	298	C18H18O4	Phthalic acid, ethyl 3,4-dimethylphenyl ester	15.073	12
27.99	242	C15H30O2	Pentadecanoic acid	28.151	13
0.76			1-Octadecanol	30.590	14
0.31	322	C21H38O2	11,14-Eicosadienoic acid, methyl ester	30.673	15
0.61	294	C19H34O2	10-Octadecenoic acid, methyl ester	30.809	16
8.39	280	C18H32O2	9,12-Octadecadienoic acid (Z,Z)-	31.494	17
29.94	282	C18H34O2	cis-Vaccenic acid	31.622	18
5.47	372	C22H44O4	Octadecanoic acid, 2-(2-hydroxyethoxy)ethyl ester	32.043	19
0.26	284	C18H36O2	1-Hexadecanol, acetate	32.695	20
0.62	324	C21H40O2	Methacrylic acid, heptadecyl ester	33.332	21
1.25	340	C23H32O2	Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl-	35.465	22
1.12	530	C26H18Cl4N2O2	2,6-Naphthalenediol, 1,5-bis[(2,4-dichlorobenzylimino)methyl]-	38.645	23
0.33	562	C28H62O5Si3	Octadecanoic acid, 9,10,18-tris[(trimethylsilyloxy]-, methyl ester	38.740	24
0.67	348	C22H36O3	3.beta.-Hydroxy-bisnorallocholanic acid	38.773	25
0.40	390	C24H38O4	Isophthalic acid, 2-ethylhexyl octyl ester	38.880	26
0.68	398	C24H46O4	Lauroyl peroxide	38.985	27
0.21	506	C34H66O2	9-Hexadecenoic acid, octadecyl ester, (Z)-	39.020	28
0.94	409	C25H47NO3	Adipic acid, monopiperidide, tetradecyl ester	39.139	29
1.42	410	C30H50 CAS: 111-02-4	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-hexamethyl-, (all-E)-	40.379	30

Oman are of economic importance, as extracted from the stems of the sap (frankincense) by making of wounds on the stems and then dried and used in the popular medicine to treat many diseases such as tumors, sores, dysentery and chest diseases such as cough, asthma, heart attack in addition to manufacture of incense. Frankincense consists of 56-65% colloidal acids, 20-36% resin, and 4-8% essential oils (Huang *et al.*, 2000).

## Materials and Methods

### Plant Sample Extraction

The method described in Hema *et al.*, (2010) was

used to extract henna leaves and the method mentioned in Biggs *et al.*, (2016) was used to extract frankincense while oil was extracted from watercress and jojoba seeds according to AOAC (2000).

### GC-MS Analysis

GC-MS analysis was carried out on a gas chromatograph interfaced to a mass spectrometer (GC-MS) instrument type GC MS QP210 Ultra, SHIMADZU, APAN supplied with capillary column DB-MS5( 5% phenyl, 95% methyl polysiloxane) as stationary phase in addition to use helium gas (99.9%) employing the following

**Table 2:** Components Identified in henna.

Peak Area %	MW	Molecular Formula	Name of the compound	RT	No.
0.69	198	C14H30	Dodecane, 4,6-dimethyl-	10.312	1
0.78	184	C13H28	Nonane, 5-(2-methylpropyl)-	11.003	2
0.52	173	C12H15N	Quinoline, 1,2-dihydro-2,2,4-trimethyl-	12.727	3
0.60	282	C20H42	Eicosane	13.320	4
0.60	254	C18H38	Heptadecane, 2-methyl-	14.017	5
5.28	96	C6H8O	But-1-ene-3-yne, 1-ethoxy-	14.900	6
4.70	206	C11H14N2O2	Benzonitrile, 2-amino-4,5-diethoxy-	15.013	7
3.20	222	C12H14O4	Diethyl Phthalate	15.074	8
16.89	242	C15H30O2	Pentadecanoic acid	28.124	9
0.84	256	C16H32O2	n-Hexadecanoic acid	28.293	10
0.90	332	C24H44	15-Isobutyl-(13.alpha.H)-isocopalane	30.754	11
0.92	388	C23H32O5	Fumaric acid, dodecyl 2-formylphenyl ester	30.818	12
0.62	298	C19H38O2	Octadecanoic acid, methyl ester	31.345	13
4.66	280	C18H32O2	Ethyl 9,12-hexadecadienoate	31.504	14
22.90	282	C18H34O2	cis-Vaccenic acid	31.607	15
2.11	304	C22H40	Cyclodecacyclotetradecene, 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20-eicosahydro-	31.860	16
3.21	340	C22H44O2	Octadecanoic acid, 2-methylpropyl ester	32.050	17
2.11	284	C18H36O2	Octadecanoic acid	32.080	18
0.49	268	C19H40	Octadecane, 5-methyl-	32.536	19
2.59	340	C22H44O2	Eicosyl acetate	32.694	20
1.52	227	C14H29NO	N,N-Dimethyldodecanamide	33.340	21
0.64	332	C24H44	15-Isobutyl-(13.alpha.H)-isocopalane	33.773	22
1.30	370	C22H42O4	Diisooctyl adipate	35.229	23
0.44	438	C27H50O4	Fumaric acid, 3,3-dimethylbut-2-yl heptadecyl ester	35.392	24
13.70	340	C23H32O2	Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl-	35.467	25
0.71	169	C10H19NO	3-Cyclopentylpropionamide, N,N-dimethyl-	36.160	26
0.67	296	C21H44	Heptadecane, 2,6,10,15-tetramethyl-	36.649	27
0.58	733	C40H80NO8P	3,5,9-Trioxa-4-phosphapentacosan-1-aminium, 4-hydroxy-N,N,N-trimethyl-10-oxo-7-[(1-oxohexadecyl)oxy]-, hydroxide, inner salt, 4-oxide	37.846	28
0.69	396	C30H36	Naphthalene, 2-(1-adamantyl)-7-(2-adamantyl)-	38.027	29
1.52	834	C53H102O6	Octadecanoic acid, 2-[(1-oxotetradecyl)oxy]-1,3-propanediyl ester	38.123	30
1.13	524	C26H36O11	5H-Cyclopropa[3,4]benz[1,2-e]azulen-5-one, 9,9a-bis(acetyloxy)-3-[(acetyloxy)methyl]-1,1a,1b,2,3,4,4a,7a,7b,8,9,9a-dodecahydro-2,3,4a,7b	38.972	31
0.91	436	C31H64	Heneicosane, 11-decyl-	40.255	32
1.57	410	C30H50	2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23-hexamethyl-, (all-E)-	40.376	33

conditions for gas Chromatography: Column Oven Temp. :50.0 °C, Injection Temp. :250.00 °C, Injection Mode :Split, Flow Control Mode :Pressure, Pressure : 90.0 kPa, Total Flow :79.2 mL/min, Column Flow :1.53 mL/min, Linear Velocity :44.8 cm/sec, Purge Flow :6.0 mL/min, Split Ratio :46.9 and for mass spectrometer: Ion Source Temp :200.00 °C, Interface Temp. :250.00 °C, Solvent Cut Time :4.00 min, Detector Gain Mode :Relative, Detector Gain :0.84 kV +0.40 kV, Start Time :4.00min, End Time :41.71 min, ACQ Mode :Scan, Event Time :0.40sec, Scan Speed

:2000, Start m/z :35.00, End m/z :800.00.

## Results and Discussion

Results presented in table 1 and figure 1 indicated to the identification of 29 compounds in jojoba seeds oil. The results indicated that the cis-Vaccenic acid was superior to the rest of the compounds with 29.94% followed by Pentadecanoic acid with 27.9% followed by 9, 12-Octadecadienoic acid with 8.39% and Octadecanoic acid, 2-hydroxyethoxy ethyl ester with

**Table 3:** Components Identified in frankincense.

Peak Area %	MW	Molecular Formula	Name of the compound	RT	No.
9.67	222	C12H14O4	Diethyl Phthalate	15.088	1
4.11	242	C15H30O2	Pentadecanoic acid	28.162	2
4.82	292	C19H32O2	Nerolidol isobutyrate	31.471	3
8.19	282	C18H34O2	6-Octadecenoic acid, (Z)-	31.640	4
3.70	348	C23H40O2	8,11,14-Docosatrienoic acid, methyl ester	31.772	5
0.90	340	C23H32O2	Phenol, 2,2'-methylenebis[6-(1,1-dimethylethyl)-4-methyl-	32.707	6
6.09	184	C13H28	Dodecane, 4-methyl-	35.469	7
1.47	422	C21H36Cl2O4	Fumaric acid, 2,2-dichloroethyl pentadecyl ester	36.027	8
2.80	492	C31H53ClO2	Stigmastan-3-ol, 5-chloro-, acetate, (3.beta.,5.alpha.)-	36.541	9
1.56	678	C47H82O2	Stigmast-5-en-3-ol, oleate	36.673	10
1.36	502	C32H54O4	D:A-Friedo-2,3-secooleanane-2,3-dioic acid, dimethyl ester, (4R)-	37.907	11
0.91	562	C33H46N4O4	4,6-Cholestadiene-3-one, 2,4-dinitrophenylhydrazone	37.960	12
6.90	474	C33H62O	Z,Z-6,24-Tritriacontadien-2-one	38.068	13
5.32	350	C15H24F6O2	1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoromethyl)-, cis	38.113	14
0.46	376	C26H48O	4,8-Dimethyl-4Z,8E-tetracosadienal	38.213	15
1.00	208	C12H16O3	Acetic acid, 10-oxotricyclo[4.2.1.1(2,5)]dec-9-yl ester	38.260	16
1.14	508	C34H68O2	Tetradecanoic acid, eicosyl ester	38.307	17
0.72	186	C11H22O2	Hexyl isovalerate	38.353	18
1.01	565	C30H31NO10	Spiro[2-cyclohexene-1,2'(1'H)-cyclopenta[de]naphthacene]-9'-carboxamide, 7',7'a,8',11',11'a,12'-hexahydro-5',6',7'a,10',11'a,12'-hexahydroxy-3'-	38.413	19
0.80	401	C27H47NO	5.alpha.-Cholestan-2-one, oxime	38.447	20
1.24	550	C40H54O	Anhydrolutein II	38.476	21
2.34	476	C30H56O2Si	Silane, dimethyl(6-methyl-2-tert-butylphenoxy)heptadecyloxy-	38.580	22
0.77	252	C16H28O2	Sclaral (sclareolide lactol)	38.632	23
0.62	350	C15H24F6O2	1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoromethyl)-, cis-	38.660	24
1.74	636	C12H18Br6	1,2,5,6,9,10-Hexabromocyclododecane	38.820	25
0.68	422	C26H46O4	Fumaric acid, 2-methylallyl octadecyl ester	38.913	26
1.66	470	C28H58O3Si	Tetracosanoic acid, 2-[(trimethylsilyl)oxy]-, methyl ester	38.992	27
1.24	222	C14H26N2	Tetraonerine T4	39.047	28
0.52	346	C20H42O2S	Di-n-decylsulfone	39.127	29
1.67	702	C50H102	Triacontane, 11,20-didecyl-	39.553	30

5.47%.

Thirty three compounds were identified in henna leaf extract (table 2 and fig. 2). The prevailing compound were cis-Vaccenic acid with (22.9 %), Pentadecanoic acid (16.89%), Phenol, 2,2-methylenebis[6-(1,1-dimethylethyl)-4-methyl- with (13.7%) and But-1-ene-3-yne, 1-ethoxy- with ( 5.28%).

Results obtained from table 3 and figure 3 indicated to identification of thirty compounds by GC-MS analysis of frankincense. Diethyl Phthalate was the most prevailing compound with (9.67%) followed by 6-Octadecenoic acid, (Z)- with (8.19%), Z,Z-6,24-Tritriacontadien-2-one with (6.9%) and Dodecane, 4-methyl- with ( 6.09%).

Table 4 and figure 4 showed that thirty compounds were identified in watercress seeds oil (HS4) which were 1 - [ 2 - H y d r o x y e t h y l ] - 4 - [ 4 - [ 7 - c h l o r o - 4 - q u i n o l y l a m i n o ] b e n z o y l ] p i p e r a z i n e , E t h y l 2 - a c e t a m i d o - 3 , 3 , 3 - t r i f l u o r o - 2 - ( 4 - f l u o r o a n i l i n o ) p r o p i o n a t e , O c t a d e c a n o i c a c i d , 1 2 - o x o - , t r i m e t h y l s i l y l e s t e r a n d D i e t h y l P h t h a l a t e w i t h t h e P e a k A r e a s o f ( 8 % , 7 . 4 0 % , 6 . 5 8 % a n d 5 . 6 2 % ) r e s p e c t i v e l y .

Vaccenic acid, also known as (11E)-octadec-11-enoic acid is a naturally occurring trans fatty acid found in dairy products such as milk. It is also the predominant fatty acid comprising trans fat in human milk. Pentadecanoic acid (CH<sub>3</sub>(CH<sub>2</sub>)<sub>13</sub>COOH) is a saturated fatty acid. It is rare in nature, being found at the level of 1.2% in the

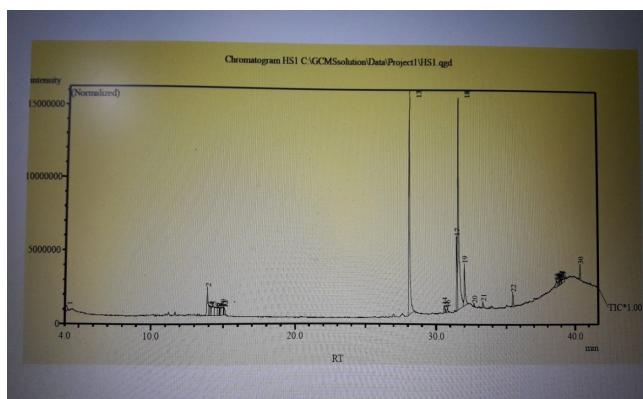
**Table 4:** Components Identified in watercress.

Peak Area %	MW	Molecular Formula	Name of the compound	RT	No.
5.62	222	C12H14O4	Diethyl Phthalate	15.085	1
5.14	356	C21H40O4	9-Octadecenoic acid (Z)-, 2-hydroxy-1-(hydroxymethyl)ethyl ester	31.633	2
2.12	565	C27H46F7NO3	l-Valine, n-heptafluorobutyl-, octadecyl ester	39.527	3
1.59	564	C30H49F5O2Si	Behenic acid, dimethyl(pentafluorophenyl)silyl ester	39.566	4
3.74	564	C33H48N4O4	1-Coprosten-3-one 2,4-dinitrophenylhydrazone	39.913	5
1.89	338	C22H42O2	Cyclopropanedecanoic acid, 2-octyl-, methyl ester	39.965	6
1.86	196	C13H24O	1,5,9,9-Tetramethyl-spiro[3.5]nonan-5-ol	40.012	7
2.99	420	C27H48O3	Tetrahydrosmilagenin	40.080	8
1.23	142	C6H10N2O2	4-Methylimidazole-2,5-diethanol	40.107	9
2.00	346	C22H31FO2	[1,1'-Bicyclohexyl]-4-carboxylic acid, 4'-propyl-, 4-fluorophenyl ester	40.133	10
1.67	518	C23H34O13	alpha.-D-Glucofuranose, 3-O-(2,3,5-O-acetyl-.beta.-D-lyxofuranosyl)-1,2:5,6-DI-O-isopropylidene-	40.173	11
1.49	181	C8H8FN3O	3-Fluorobenzaldehyde semicarbazone	40.208	12
1.42	562	C33H46N4O4	4,6-Cholestadiene-3-one, 2,4-dinitrophenylhydrazone	40.233	13
2.93	574	C36H47ClN2O2	N,N'-Bis-(4-octyloxybenzylidene)-2-chloro-1,4-phenylenediamine	40.280	14
2.43	264	C14H17FN2O2	Pyrrolidine-3-carboxamide, N-(4-fluorophenyl)-1-isopropyl-5-oxo- N-(4-Fluorophenyl)-1-isopropyl-5-oxo-3-pyrrolidinecarboxamide	40.320	15
5.04	578	C30H42O11	9-Desoxo-9-xi-hydroxy-3,7,8,9,12-pentaacetate ingol	40.380	16
7.40	322	C13H14F4N2O3	Ethyl 2-acetamido-3,3,3-trifluoro-2-(4-fluoroanilino)propionate	40.513	17
5.25	508	C25H50Br2	erythro-9,10-Dibromopentacosane	40.593	18
4.65	370	C21H38O5	Methyl 10-methoxycarbonyl-17-oxooctadecanoate	40.670	19
3.33	562	C11H3F17N4O3	Propanamide, 2,3,3,3-tetrafluoro-2-[2-(perfluoropropoxy) perfluoropropoxy]-N-(1,2,4-triazol-3-yl)-	40.700	20
1.98	430	C29H50O2	Cholestan-3-ol, acetate, (3.beta.)-	40.747	21
8.00	410	C22H23ClN4O2	1-[2-Hydroxyethyl]-4-[4-[7-chloro-4-quinolylamino]benzoyl]piperazine	40.793	22
2.44	452	C28H52O4	Fumaric acid, 2,4-dimethylpent-3-yl heptadecyl ester	40.882	23
3.79	208	C12H20N2O	5,7-Diethyl-1,3-diazaadamantan-6-one	40.922	24
4.67	240	C15H28O2	Tetrahydroionyl acetate	40.994	25
6.58	370	C21H42O3Si	Octadecanoic acid, 12-oxo-, trimethylsilyl ester	41.049	26
1.17	564	C38H76O2	9-Octadecene, 1-[2-(octadecyloxy)ethoxy]-	41.127	27
3.82	582	C36H42N2O5	6-[(7-Isopropyl-1,4a-dimethyl-1,2,3,4,4a,9,10,10a-octahydrophenanthren-1-ylmethyl)carbonyl]-6'-methyl-2'-nitrobiphenyl-2-carboxy-	41.193	28
2.16	562	C32H51F5O2	Stigmastanol, pentafluoropropionate	41.227	29
1.58	346	C20H42O2S	Di-n-decylsulfone	41.280	30

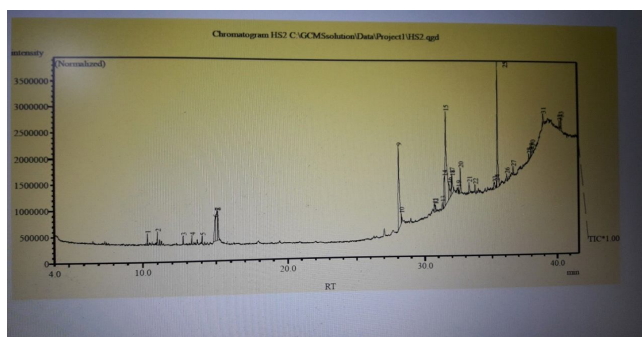
milk fat from cows, while Octadecadienoic acid is a doubly unsaturated fatty acid, occurring widely in plant glycosides. Diethyl phthalic acid also known as diethyl phthalate, 1, 2-diethyl phthalic acid or 1, 2-benzenedicarboxylic acid diethyl ester, is classified as a member of the benzoic acid esters (Precht and Molkenin, 1999 ; Wolff, 2005; Friesen and Innis, 2006).

Present work at the same line with the investigation conducted by Hema *et al.*, (2010) to study gas chromatography-mass spectroscopic analysis of *Lawsonia inermis* leaves which found that henna leaves contain mainly  $\alpha$ -D-Glucopyranoside, methyl (51.73%)

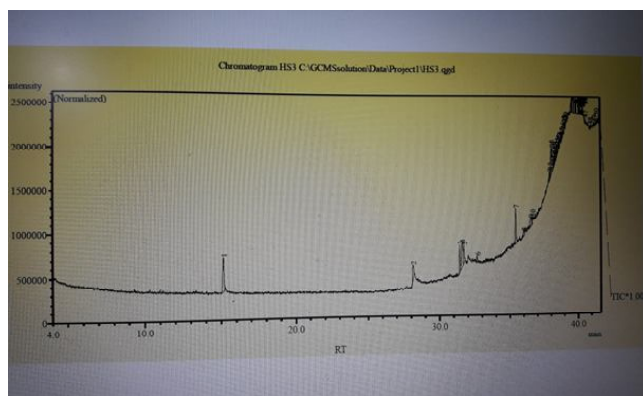
and 1,4-Naphthalenedione, 2-hydroxy-.Also with the study of AL-Qizwini *et al.*, (2014) on Jordanian jojoba (*SIMMONDSIA CHINENSIS*) liquid wax that indicated that the fatty acid  $\alpha$ -linolenic acid was in higher percentages within the Jordanian oil than those of *Jojoba* oil found in other parts of the world. On the other hand, the fatty acids palmitic acid, oleic acid, vaccenic acid, and gondoic acid were in lower percentages within the Jordanian oil. Swami *et al.*, (2016) mentioned that different peaks with low and high molecular weight determining the presence of 51 compounds. Among them predominantly Squalene (19.77%) 9,12,15-



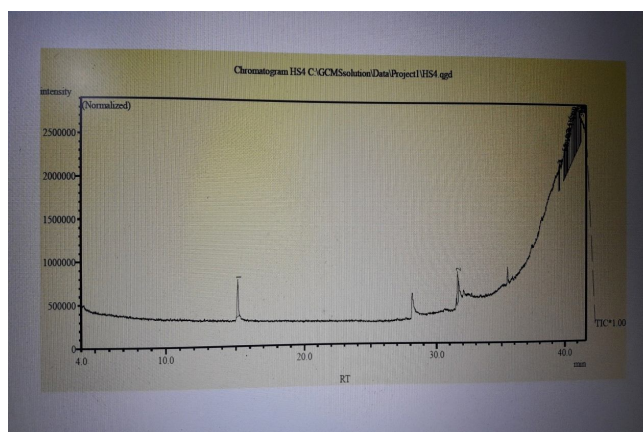
**Fig. 1:** Components Identified in jojoba.



**Fig. 2:** Components Identified in henna.



**Fig. 3:** Components Identified in frankincense.



**Fig. 4:** Components Identified in watercress

Octadecatrienoic acid, (Z,Z,Z)- (14.90%); 9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)- (11.52%); Pentadecanoic acid (10.54%); Vitamin E (6.82); Hexadecanoic acid, methyl ester (5.85%); 9,12-Octadecadienoic acid (Z,Z)-, Methyl ester (4.98%); Stigmast-5-En-3- Ol, (3.Beta.)- (5.67), Phytol (1.77%) were present.

Alghamdi *et al.*, (2017) found that the fatty acid Behenic acid methyl ester (C22:0) and Cis-13, 16 Docosadienoic acid methyl ester (C22:2) were in higher percentages within the Egyptian oil of jojoba. On the other hand, Egyptian oil was found to have lower percentage of the fatty acids; Eliadic acid, YLinolenic acid, Cis-8,11,14 Eieosatrienoic acid, and Lingocernic acid.

## Conclusion

It is concluded from the study that Gas Chromatography – Mass Spectroscopic analysis showed that cis-Vaccenic acid was the most prevailing compound in jojoba seed oil and henna leaves, while Diethyl Phthalate and 1-[2-Hydroxyethyl]-4-[4-[7-chloro-4-quinolylamino]benzoyl]piperazine were most prevailing compound in frankincense and watercress seed oil respectively.

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