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# Gas Chromatography-Mass Spectrometry (GC-MS) Analysis of Extracted Oil from Whole Garden Cress (Rashaad) Seeds

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***ABSTRACT:*** *The fine powderfrom whole Garden Cress seeds, which is widely known as Rashaad seed and Thufa'a in Middle East area and Arabic countries, was extracted with methanol to yield the essential oil. The chemical composition of extracted oil was analyzed by electron ionization Gas Chromatography-Mass Spectrometry (EI-GC/MS) technique using full scan method within mass range from 30 – 500 mass to charge ratio (m/z). A total of 83 compounds were identified using Agilent MassHunter Unknown analysis software and NIST14 library with match factor ≥ 85 of mass spectrums. Derivatization with N,O-Bis(trimethylsilyl)-trifluoroacetamide (BSTFA) with 1% trimethylchlorosilane (TMCS) was used for confirmation the presence of compounds with active hydrogen, improve chromatographic shape and increasing sensitivity. The highest twelve abundance of presented components in extracted oil were Gamma-Tocopherol (36.11%), Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester (10.3%), Palmitic acid (5.44%), cis-13,16-Docasadienoic acid (5.08%), Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, methyl ester (4.88%), 1-Glyceryl stearate (4.56%), (Z)-13-Docosenamide (3.01%), α-Cyanotoluene (2.93%), 11,14-Eicosadienoic acid, methyl ester (2.43%), Meadowlactone (1.68%), Hexadecanoic acid, methyl ester (1.57%) and Bis(2-ethylhexyl) phthalate (1.27%).*

***Keywords:*** *BSTFA, Chemical composition, Extracted oil, Rashad seed, Tocopherol*

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## I. INTRODUCTION

Thegarden cress is an annual herb, botanically named as (Lepidiumsativum Linn.), is widely known as Rashaad and Thufa′a in Middle East area and Arabic countries. The garden cress belongs to Cruciferae family, is an Asian origin, then spread to Western Europe and worldwide and now it is cultivated all over the world[1, 2].The lepidiumsativum has common names in different languages : cress, garden cress and pepper cress (English); mastuerzo, lepidio (Spain); berro de sierra (Argentina); escobilla (Costa Rica); morritort, morrisà (Catalan); masturco, herba do esforzo (Portuguese and Galician); Chandrashoor, Chandrasur (India); Halim (Bengali and Urdu); Holan (Punjabi) and Alian (Kashmiri) [3, 4, 5]. Garden cress can cultivate in any condition of soil or climate as culinary vegetable all over Asia [5, 6]. The Garden seed is cultivated as vegetable, its leaves used in salad, cooking and garnish [7].

The seeds of garden cress are bitter, thermogenic, galactogogue, tonic, ophthalmic and antihistaminic [8]. Garden cress seed, plant and oil are used in traditional or folk medicine in most countries as a result of its effective and useful treatment of different body pains. The garden cress used in many medicinal treatment, whole plant used for asthma, cough and bleeding piles [9], seeds are used for healing of bone fracture [2], relief pain of rheumatic joints, sore throats, headaches [10], depurative, aphrodisiac chronic enlargement of liver and spleen [11], roots are used for secondary syphilis and tenesmus [12] and leaves are stimulant [13], diuretic, antiscorbutic [14].

Various extraction methods of garden cress seed had been reported for identification of chemical composition, using cold press, supercritical $CO_2$ extraction [4, 8], solvent extraction with petroleum ether andsoxhlet extraction [15, 16].Acute toxicity and subchronic toxicity study was investigated by administration of garden seed powder on rats, results revealed no symptoms of toxicity or mortality [17].

## II. EXPERIMENTAL

### a. Methods and Materials

The seeds of Garden cress (Lepidiumsativum L.) werepurchased from the local herbs market in Riyadh, Saudi Arabia. N,O-Bis(trimethylsilyl)trifluoroacetamide(BSTFA) with 1% Trimethylchlorosilane (TMCS) was collected from United Chemical Technologies incorporation (USA). HPLC grade Methanol and Ethylacetatewere obtained from Fisher Scientific (UK). MS PTFE syringe filter with pore size 0.22 µm and diameter 25 mm was purchased from Membrane Solutions, USA. Orbital shaker model GFL 3017 was obtained from GesellschaftfürLabortechnik (GFL), Germany.Evaporation and Concentration System was purchased from Horizon Technology, USA.

### b. Sample preparation

Whole seeds of garden cress were milled to fine powder using coffee grinder. 1.0 g of powder was extracted with 20 mL of HPLC methanol using orbital shaker at velocity 300 rpm for 3 hrs. Methanolic extract was filtered using syringe filter, 0.22 µm and evaporated under nitrogen till oil residue. After evaporation, the extracted oil residue was dissolved with 3 mL ethyl acetate and 1 ml transferred to GC vial for GC/MS analysis.

### c. Derivatization with BSTFA

1 mLof dissolved extracted oil residuewas evaporated to dryness under nitrogen, then sample dissolved in 50 µL of ethyl acetate and 50 µL of BSTFA was added. Tube was capped, mixed and incubated for 30 min at 70℃ in heater block. Samplewas removed from heater block, allowed to cool at room temperature, and evaporated to dryness under nitrogen.Samplewas reconstituted with 50 µL ethyl acetate and transferred to GC vial insert for GC/MS analysis.

### d. Instrumentation (GC/MS)

Gas chromatograph (7890B GC)coupled with mass spectrometer (5977A MSD) and autosampler(7693) from (Agilent Technologies, USA) were used for identification the chemical composition of extracted oil from garden cress (Lepidiumsativum L.) seed.

The Gas chromatograph (GC) was equipped with an Agilent HP-5MS (5% Phenyl methyl siloxane) capillary column (30 m × 0.25 mm I.D × 0.25 µm film thickness). The sample volume injected 1.0 µL was made in splitless mode.Helium with high purity 99.999% was used as carrier gas with constant flow rate of 1 mL/min. The temperature of injector and mass selective detector (MSD) transfer line were 250℃ and 280℃ respectively. Operating GC conditions within run time 25 min and column temperature was programmed as follows: initial column temperature was 50℃ hold time 2 min with multiple ramp rates of 25℃ /min to 200℃ hold time 2 min and rate of 10℃/min to 280℃ hold time 7 min.

The mass spectrometer (MS) operating parameters were used in electron ionization (EI) mode with ion source temperature 230℃ and quadruple temperature 150℃. The MS acquisition mode was in Full scan with mass range 30 – 500 mass to charge ratio (m/z). The ionization mode was electron ionization with 70 eV.

## III. RESULTS and DISCUSSION

Qualitative and quantitative analysis of compounds in TMS-derivative sample and underivatized sample of extracted oil from garden cress seeds was performed using Agilent MassHunterQualitative Analysis software version B.07.00 and Agilent MassHunter Workstation Unknown Analysis version B.07.01.

The results of chemical composition from methanolic extract of garden cress seeds revealed 83 components present in oil residues of extract as illustrated in total ion chromatogram (TIC)Fig. 1 which shows the separated peaks of components according to their abundance versus the retention time. Identification of each component was conducted by interpretation of mass spectrums according to mass to charge ratio (m/z) and using Agilent MassHunter Workstation Unknown Analysis to carry out mass spectrum search of component withdatabase of National Institute Standard and Technology (NIST) library which contains242,466 spectra as main library. Reported results were based on matching mass spectrums with match factor ≥ 85includingpresence of base peak with other principal m/z ions as represented in Table 1 and detection within signal-to-noise (S/N) ratio ≥ 3.

The various information results about each component in garden cress (Raahaad) seedsare mentioned in Table 1 such as retention time ($t_R$), compound name, chemical formula, molecular weight (MW), chemical abstract service registry number(CAS No.), retention index (RI), peak area, percentage (%) area and mass spectrum (MS) principal ions (m/z).The relative percentage amount of each component was calculated by comparing its average peak area with the total area.

Derivatization of reactive hydroxyl groups present in some components in extracted sample withN,O-Bis(trimethylsilyl)trifluoroacetamide(BSTFA) with 1% Trimethylchlorosilane (TMCS) was performed to improve the chromatographic shape , sensitivity and confirmation.

The most main compoundsfound in extracted oil from garden cress seeds were Gamma-Tocopherol (36.11%), Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester (10.3%), Palmitic acid (5.44%), cis-13,16-Docasadienoic acid (5.08%), Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, methyl ester (4.88%), 1-Glyceryl stearate (4.56%), (Z)-13-Docosenamide (3.01%), α-Cyanotoluene (2.93%), 11,14-Eicosadienoic acid, methyl ester (2.43%), Meadowlactone (1.68%), Hexadecanoic acid, methyl ester (1.57%) and Bis(2-ethylhexyl) phthalate (1.27%).

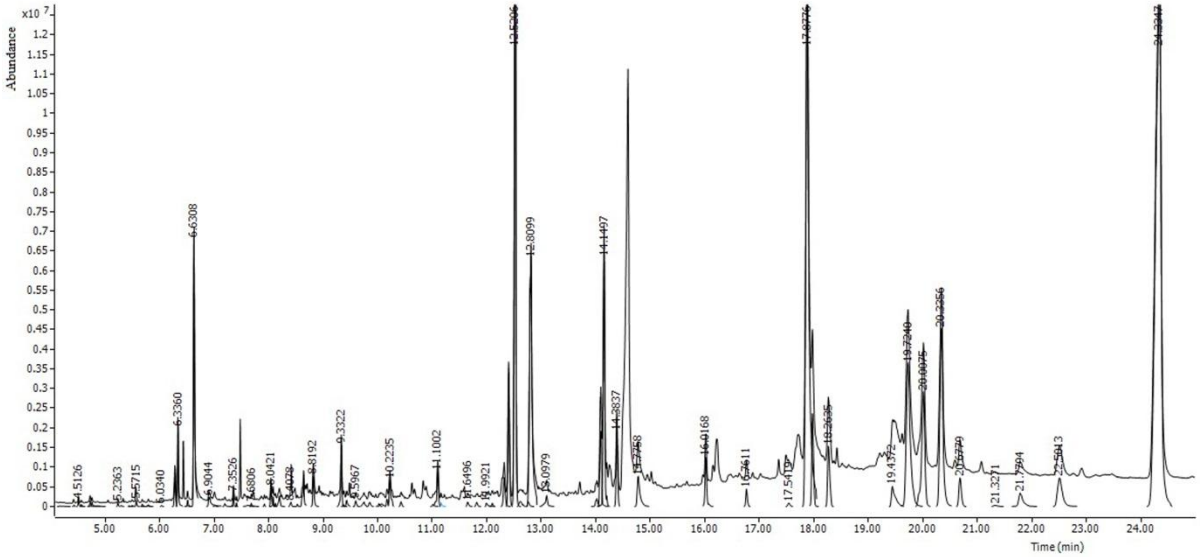


**Fig. 1: GC-MS Total ion chromatogram of extracted oil from Garden cress (Rashaad) seeds**

**Table 1: GC/MS results of chemical composition (%) of extracted oil from Garden cress (Rashaad) seeds**

| No. | $t_R$ (min) | Compound name | Formula | MW | CAS # | RI | Peak area | % Area | Mass spectrum principal ions (m/z) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.17 | Furfural ; 2-Furaldehyde | $C_5H_4O_2$ | 96 | 98-01-1 | 833 | 17907 | 0.01 | 96, 95, 39, 38, 29 |
| 2 | 4.43 | Ethylbenzene | $C_8H_{10}$ | 106 | 100-41-4 | 855 | 28028 | 0.02 | 91, 106, 51, 65, 77 |
| 3 | 4.51 | o-Xylene | $C_8H_{10}$ | 106 | 95-47-6 | 887 | 126651 | 0.09 | 91, 106, 105, 77, 51 |
| 4 | 4.56 | 1,3-trans,5-cis-Octatriene ; Sarohornene C | $C_8H_{12}$ | 108 | 40087-61-4 | 900 | 55949 | 0.04 | 79, 108, 77, 91, 93 |
| 5 | 4.73 | Nonane | $C_9H_{20}$ | 128 | 111-84-2 | 900 | 150959 | 0.1 | 43, 57, 41, 85, 71 |
| 6 | 4.76 | Heptanal | $C_7H_{14}O$ | 114 | 111-71-7 | 901 | 85771 | 0.06 | 70, 41, 44, 43, 55 |
| 7 | 5.24 | (Z)-2-Heptenal ; cis-Hept-2-enal | $C_7H_{12}O$ | 112 | 57266-86-1 | 958 | 56672 | 0.04 | 41, 27, 55, 83, 57 |
| 8 | 5.30 | Benzene, 1-ethyl-2-methyl- | $C_9H_{12}$ | 120 | 611-14-3 | 970 | 21625 | 0.01 | 105, 120, 91, 106, 77 |
| 9 | 5.44 | 1,2,3-trimethylbenzene ; Hemimellitene | $C_9H_{12}$ | 120 | 526-73-8 | 1013 | 14617 | 0.01 | 105, 120, 77, 119, 91 |
| 10 | 5.50 | 2-Pentylfuran | $C_9H_{14}O$ | 138 | 3777-69-3 | 993 | 33719 | 0.02 | 81, 82, 138, 53, 41 |
| 11 | 5.57 | 1,2,4-trimethylbenzene ; psi-Cumene | $C_9H_{12}$ | 120 | 95-63-6 | 990 | 95162 | 0.07 | 105, 120, 77, 119, 91 |
| 12 | 5.68 | 2,4-Heptadienal, (E,E)- | $C_7H_{10}O$ | 110 | 4313-03-5 | 1012 | 53638 | 0.04 | 81, 110, 41, 53 , 39 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 13 | 5.78 | Butanedioic acid, dimethyl ester ; Methyl succinate | $C_6H_{10}O_4$ | 146 | 106-65-0 | 1030 | 25991 | 0.02 | 115, 55, 59, 114, 87 |
| 14 | 5.79 | (1-methylethyl)benzene ; Cumene | $C_9H_{12}$ | 120 | 98-82-8 | 921 | 22758 | 0.02 | 105, 120, 77, 79, 51 |
| 15 | 6.03 | Benzene, 1,4-diethyl- | $C_{10}H_{14}$ | 134 | 105-05-5 | 1041 | 20241 | 0.01 | 119, 105, 134, 91, 120 |
| 16 | 6.28 | (Z,Z)-3,6-Nonadienal | $C_9H_{14}O$ | 138 | 21944-83-2 | 1100 | 725734 | 0.5 | 67, 41, 55, 79, 39 |
| 17 | 6.34 | Nonanal | $C_9H_{18}O$ | 142 | 124-19-6 | 1104 | 1034118 | 0.71 | 57, 41, 43, 56, 44 |
| 18 | 6.50 | Ethanone, 1-(4-methylphenyl)- | $C_9H_{10}O$ | 134 | 122-00-9 | 1183 | 52596 | 0.04 | 119, 91, 134, 65, 63 |
| 19 | 6.52 | Pentanedioic acid, dimethyl ester | $C_7H_{12}O_4$ | 160 | 1119-40-0 | 1135 | 78369 | 0.05 | 59, 100, 55, 129, 101 |
| 20 | 6.63 | Benzyl nitrile ; α-Cyanotoluene | $C_8H_7N$ | 117 | 140-29-4 | 1144 | 4279604 | 2.93 | 117, 90, 116, 89, 51 |
| 21 | 6.90 | Ethanol, 2-(2-butoxyethoxy)- | $C_8H_{18}O_3$ | 162 | 112-34-5 | 1192 | 252264 | 0.17 | 45, 57, 29, 41, 31 |
| 22 | 7.01 | Azulene | $C_{10}H_8$ | 128 | 275-51-4 | 1319 | 22372 | 0.02 | 128, 127, 102, 129, 51 |
| 23 | 7.20 | Hexanedioic acid, dimethyl ester | $C_8H_{14}O_4$ | 174 | 627-93-0 | 1243 | 74021 | 0.05 | 59, 114, 55, 111, 101 |
| 24 | 7.33 | Decane, 1-iodo- | $C_{10}H_{21}I$ | 268 | 2050-77-3 | 1433 | 18906 | 0.01 | 43, 57, 41, 85, 71 |
| 25 | 7.35 | Manganese, tricarbonyl[(1,2,3,4,5-.eta.)-1-methyl-2,4-cyclopentadien-1-yl]- | $C_9H_7MnO_3$ | 218 | 12108-13-3 | - | 173306 | 0.12 | 55, 134, 56, 79, 162 |
| 26 | 7.41 | Undecane, 3,8-dimethyl- | $C_{13}H_{28}$ | 184 | 17301-30-3 | 1228 | 39485 | 0.03 | 57, 43, 71, 85, 70 |
| 27 | 7.61 | p-Cymen-7-ol ; Cuminol | $C_{10}H_{14}O$ | 150 | 536-60-7 | 1289 | 126933 | 0.09 | 135, 150, 105, 107, 79 |
| 28 | 7.68 | Undecane, 3,7-dimethyl- | $C_{13}H_{28}$ | 184 | 17301-29-0 | 1222 | 77603 | 0.05 | 43, 57, 71, 85, 41 |
| 29 | 7.92 | 3-Methyldodecane | $C_{13}H_{28}$ | 184 | 17312-57-1 | 1271 | 56729 | 0.04 | 57, 43, 71, 56, 41 |
| 30 | 8.04 | (Isothiocyanatomethyl)benzene ;Benzyl mustard oil | $C_8H_7NS$ | 149 | 622-78-6 | 1361 | 444412 | 0.3 | 91, 149, 65, 92, 39 |
| 31 | 8.08 | 1-Dodecene | $C_{12}H_{24}$ | 168 | 112-41-4 | 1190 | 241633 | 0.17 | 41, 43, 55, 56, 69 |
| 32 | 8.12 | Nonane, 1-iodo- | $C_9H_{19}I$ | 254 | 4282-42-2 | 1342 | 98721 | 0.07 | 43, 71, 57, 85, 41 |
| 33 | 8.20 | Dodecanal ; Lauraldehyde | $C_{12}H_{24}O$ | 184 | 112-54-9 | 1409 | 315350 | 0.22 | 41, 57, 55, 43, 82 |
| 34 | 8.41 | Decane, 6-ethyl-2-methyl- | $C_{13}H_{28}$ | 184 | 62108-21-8 | - | 160390 | 0.11 | 57, 43, 71, 41, 85 |
| 35 | 8.52 | Sulfurous acid, 2-ethylhexyl undecyl ester | $C_{19}H_{40}O_3S$ | 348 | 1000309-19-4 | - | 39766 | 0.03 | 57, 71, 43, 113, 41 |
| 36 | 8.64 | Hexadecane | $C_{16}H_{34}$ | 226 | 544-76-3 | 1600 | 650087 | 0.44 | 57, 43, 71, 85, 41 |
| 37 | 8.82 | 2,4-Di-tert-butylphenol | $C_{14}H_{22}O$ | 206 | 96-76-4 | 1519 | 431668 | 0.3 | 191, 57, 41, 206, 192 |
| 38 | 9.33 | 1-Hexadecene ; Cetene | $C_{16}H_{32}$ | 224 | 629-73-2 | 1592 | 1843475 | 1.26 | 43, 41, 55, 57, 69 |

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|---|---|---|---|---|---|---|---|---|---|
| 39 | 9.37 | Diethyl Phthalate ; Phthalic acid, diethyl ester ; Anozol | $C_{12}H_{14}O_4$ | 222 | 84-66-2 | 1594 | 43613 | 0.03 | 149, 177, 150, 105, 176 |
| 40 | 9.43 | 2,8-Dimethylundecane | $C_{13}H_{28}$ | 184 | 17301-25-6 | 1220 | 162196 | 0.11 | 43, 57, 71, 70, 85 |
| 41 | 9.60 | Heneicosane | $C_{21}H_{44}$ | 296 | 629-94-7 | 2100 | 192890 | 0.13 | 57, 71, 43, 85, 41 |
| 42 | 9.75 | 2,6-Dimethylundecane | $C_{13}H_{28}$ | 184 | 17301-23-4 | 1210 | 241079 | 0.16 | 57, 71, 43, 41, 56 |
| 43 | 9.85 | Benzophenone | $C_{13}H_{10}O$ | 182 | 119-61-9 | 1635 | 189902 | 0.13 | 105, 77, 182, 51, 50 |
| 44 | 10.02 | 2-Methyl-6-(4-methylphenyl)-2-hepten-4-one ; Ar-tumerone | $C_{15}H_{20}O$ | 216 | 1000292-71-0 | - | 36074 | 0.02 | 83, 119, 216, 55, 91 |
| 45 | 10.08 | Decane, 2,4-dimethyl- | $C_{12}H_{26}$ | 170 | 2801-84-5 | 1106 | 200337 | 0.14 | 43, 57, 71, 85, 41 |
| 46 | 10.17 | Undecane, 5,7-dimethyl- | $C_{13}H_{28}$ | 184 | 17312-83-3 | 1190 | 245570 | 0.17 | 43, 57, 71, 85, 41 |
| 47 | 10.22 | Octadecane | $C_{18}H_{38}$ | 254 | 593-45-3 | 1800 | 704249 | 0.48 | 57, 43, 71, 41, 85 |
| 48 | 10.43 | Tetradecanoic acid, methyl ester ; Myristic acid, methyl ester | $C_{15}H_{30}O_2$ | 242 | 124-10-7 | 1725 | 95837 | 0.07 | 74, 87, 55, 43, 41 |
| 49 | 11.01 | Methanone, (4-methylphenyl)phenyl- | $C_{14}H_{12}O$ | 196 | 134-84-9 | 1694 | 70961 | 0.05 | 119, 196, 91, 105, 77 |
| 50 | 11.10 | (E)-3-Octadecene | $C_{18}H_{36}$ | 252 | 7206-19-1 | 1785 | 1259073 | 0.86 | 69, 57, 55, 41, 43 |
| 51 | 11.16 | Decane, 2,6,8-trimethyl- | $C_{13}H_{28}$ | 184 | 62108-26-3 | 1104 | 116985 | 0.08 | 57, 43, 71, 41, 56 |
| 52 | 11.65 | 6,10,14-Trimethyl-pentadecan-2-ol | $C_{18}H_{38}O$ | 270 | 69729-17-5 | - | 81364 | 0.06 | 43, 57, 45, 55, 71 |
| 53 | 11.81 | 1,2-Benzenedicarboxylic acid, butyl 2-methylpropyl ester ; Phthalic acid, butyl isobutyl ester | $C_{16}H_{22}O_4$ | 278 | 17851-53-5 | 1924 | 126608 | 0.09 | 149, 150, 223, 41, 104 |
| 54 | 11.99 | Carbonic acid, nonyl vinyl ester | $C_{12}H_{22}O_3$ | 214 | 1000383-25-6 | - | 106716 | 0.07 | 43, 57, 71, 41, 55 |
| 55 | 12.10 | Sulfurous acid, 2-ethylhexyl isohexyl ester | $C_{14}H_{30}O_3S$ | 278 | 1000309-19-0 | - | 76664 | 0.05 | 57, 43, 71, 85, 41 |
| 56 | 12.32 | 7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione | $C_{17}H_{24}O_3$ | 276 | 82304-66-3 | 1923 | 345369 | 0.24 | 57, 205, 55, 175, 217 |
| 57 | 12.40 | Hexadecanoic acid, methyl ester ; Palmitic acid, methyl ester | $C_{17}H_{34}O_2$ | 270 | 112-39-0 | 1926 | 2296431 | 1.57 | 74, 87, 43, 55, 41 |
| 58 | 12.52 | Benzenepropanoic acid, 3,5-bis(1,1-dimethylethyl)-4-hydroxy-, methyl ester | $C_{18}H_{28}O_3$ | 292 | 6386-38-5 | 1943 | 7139784 | 4.88 | 277, 292, 147, 57, 45 |
| 59 | 12.62 | cis-5-Dodecenoic acid | $C_{12}H_{22}O_2$ | 198 | 2430-94-6 | 1561 | 352734 | 0.24 | 55, 41, 69, 43, 67 |
| 60 | 12.76 | Dibutyl phthalate | $C_{16}H_{22}O_4$ | 278 | 84-74-2 | 1965 | 180123 | 0.12 | 149, 150, 41, 76, 104 |
| 61 | 12.81 | n-Hexadecanoic acid ; Palmitic acid | $C_{16}H_{32}O_2$ | 256 | 57-10-3 | 1968 | 7959518 | 5.44 | 43, 73, 60, 41, 57 |
| 62 | 13.10 | Cyclotetradecane | $C_{14}H_{28}$ | 196 | 295-17-0 | 1673 | 567283 | 0.39 | 55, 41, 69, 83, 56 |

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|---|---|---|---|---|---|---|---|---|---|
| 63 | 14.02 | 1-Hexadecanol ; n-Cetyl alcohol | $C_{16}H_{34}O$ | 242 | 36653-82-4 | 1880 | 473490 | 0.32 | 55, 69, 83, 41, 43 |
| 64 | 14.09 | 11,14-Eicosadienoic acid, methyl ester | $C_{21}H_{38}O_2$ | 322 | 2463-02-7 | 2276 | 3549703 | 2.43 | 67, 41, 55, 81, 95 |
| 65 | 14.15 | (9E,12E)-9,12-Octadecadienoyl chloride ; Linoleic acid chloride | $C_{18}H_{31}ClO$ | 298 | 7459-33-8 | - | 7431155 | 5.08 | 67, 41, 81, 55, 79 |
| 66 | 14.38 | Methyl stearate | $C_{19}H_{38}O_2$ | 298 | 112-61-8 | 2128 | 1108765 | 0.76 | 74, 87, 43, 55, 75 |
| 67 | 14.78 | Octadecanoic acid ; Stearic acid | $C_{18}H_{36}O_2$ | 284 | 57-11-4 | 2172 | 750201 | 0.51 | 43, 73, 60, 57, 55 |
| 68 | 16.02 | cis-Methyl 11-eicosenoate | $C_{21}H_{40}O_2$ | 324 | 9/2/2390 | 2306 | 617898 | 0.42 | 55, 69, 41, 43, 74 |
| 69 | 16.40 | Eicosanoic acid, methyl ester; Arachidic acid methyl ester | $C_{21}H_{42}O_2$ | 326 | 1120-28-1 | 2329 | 608548 | 0.42 | 74,87, 43, 55, 41 |
| 70 | 16.76 | Hexanedioic acid, bis(2-ethylhexyl) ester ; Adipic acid, bis(2-ethylhexyl) ester | $C_{22}H_{42}O_4$ | 370 | 103-23-1 | 2398 | 349131 | 0.24 | 129, 57, 112, 55, 70 |
| 71 | 17.54 | Methanone, [1,1'-biphenyl]-4-ylphenyl- | $C_{19}H_{14}O$ | 258 | 2128-93-0 | - | 64239 | 0.04 | 181,258, 152, 77, 105 |
| 72 | 17.88 | Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester ; Palmitic acid β-monoglyceride | $C_{19}H_{38}O_4$ | 330 | 23470-00-0 | 2498 | 15060365 | 10.3 | 43, 57, 41, 98, 55 |
| 73 | 17.97 | Bis(2-ethylhexyl) phthalate | $C_{24}H_{38}O_4$ | 390 | 117-81-7 | 2529 | 1863328 | 1.27 | 149, 167, 57, 279, 71 |
| 74 | 18.26 | Meadowlactone | $C_{20}H_{38}O_2$ | 310 | 110071-67-5 | - | 2462994 | 1.68 | 99, 55, 71, 43, 83 |
| 75 | 19.44 | Heptacosane | $C_{27}H_{56}$ | 380 | 593-49-7 | 2700 | 836426 | 0.57 | 57, 43, 71, 85, 41 |
| 76 | 19.72 | Octadecanoic acid, 2,3-dihydroxypropyl ester ; 1-Glyceryl stearate | $C_{21}H_{42}O_4$ | 358 | 123-94-4 | - | 6662057 | 4.56 | 98, 43, 57, 74, 55 |
| 77 | 20.01 | cis-13,16-Docasadienoic acid | $C_{22}H_{40}O_2$ | 336 | 7370-49-2 | 2566 | 7956208 | 5.44 | 67, 81, 55, 82, 95 |
| 78 | 20.34 | (Z)-13-Docosenamide ; Erucylamide | $C_{22}H_{43}NO$ | 337 | 112-84-5 | 2625 | 4403495 | 3.01 | 59, 72, 55, 41, 43 |
| 79 | 20.68 | Squalene | $C_{30}H_{50}$ | 410 | 111-02-4 | 2832 | 1405612 | 0.96 | 69, 81, 41, 95, 68 |
| 80 | 21.33 | N-Benzylpalmitamide | $C_{23}H_{39}NO$ | 345 | 74058-71-2 | 2880 | 69618 | 0.05 | 149, 91, 106, 345, 162 |
| 81 | 21.78 | Hexacosane | $C_{26}H_{54}$ | 366 | 630-01-3 | 2600 | 1247778 | 0.85 | 57, 71, 43, 85, 55 |
| 82 | 22.50 | delta-Tocopherol ; 8-Methyltocol | $C_{27}H_{46}O_2$ | 402 | 119-13-1 | 2960 | 1654491 | 1.13 | 402, 137, 177, 403, 138 |
| 83 | 24.33 | gamma-Tocopherol | $C_{28}H_{48}O_2$ | 416 | 7616-22-0 | 3065 | 52807308 | 36.1 | 151, 416, 417, 150, 191 |

## IV. CONCLUSION

Some of components found in garden cress seed are similar to that mentioned in literature review for the same plant, and others are sharing with source of plant origin. The selection of methanol for extraction of garden cress seed was suitable solvent for recovering most the components that could be present, and the using of GC/MS technique was reliable and useful for the analysis.

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