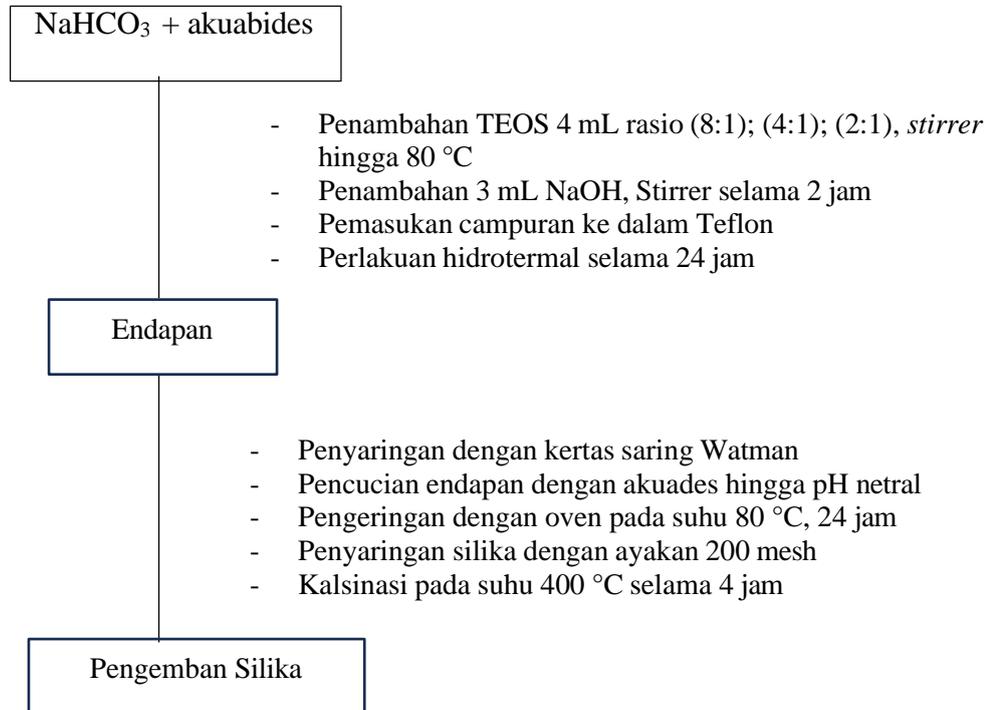
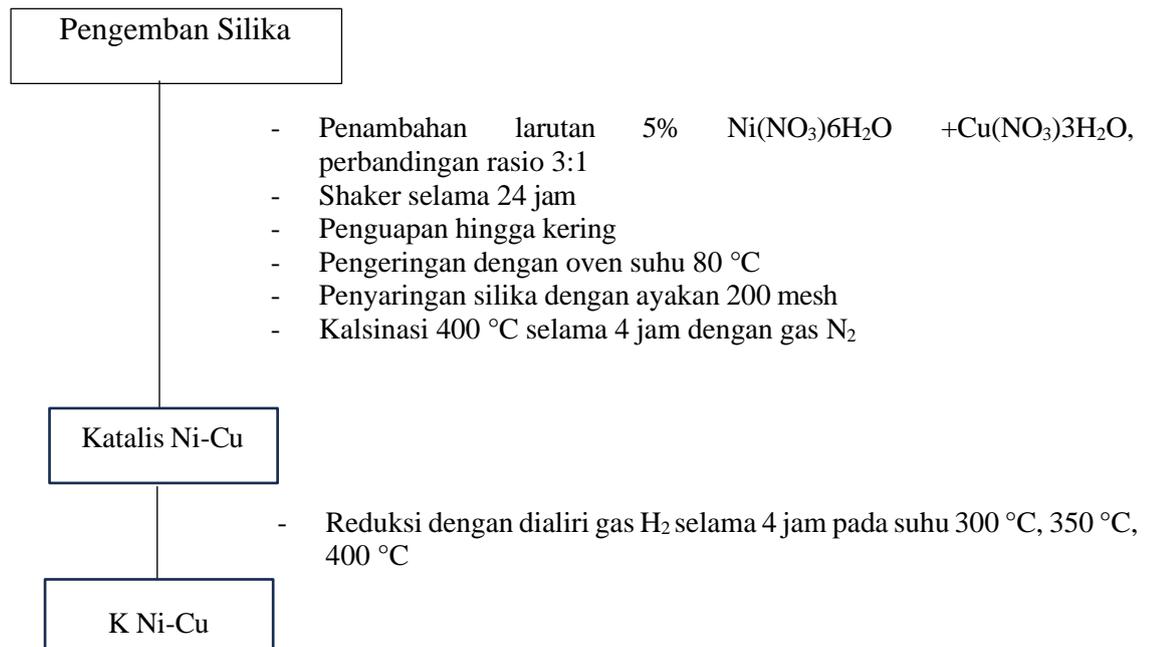


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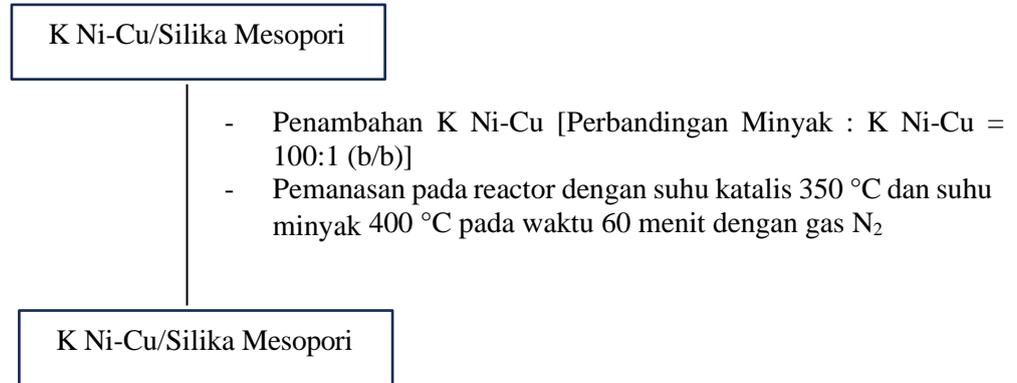
Lampiran 1 Prosedur Kerja 1.1. Sintesis Pengemban Silika



1.2. Sintesis Katalis Ni-Cu/Silika Mesopori



1.3. Proses Hidrorengkah Minyak Jelantah dengan K Ni-Cu



Lampiran 2 Perhitungan

Perhitungan Rasio mol antara TEOS dan Natrium Bikarbonat (8:1), (4:1) dan

(2:1) Perhitungan jumlah TEOS dan Natrium Bikarbonat

- Menghitung massa NaHCO_3

(2,2 mmol) Massa molar

$\text{NaHCO}_3 = 84 \text{ g/mol}$

Jumlah $\text{NaHCO}_3 = 2,2 \text{ mmol} = 0,0022 \text{ mol}$

Massa $\text{NaHCO}_3 = \text{Jumlah } \text{NaHCO}_3 \times \text{Massa molar } \text{NaHCO}_3$

$$= 0,0022 \text{ mol} \times 84 \text{ g/mol}$$

$$= 0,1848 \text{ g}$$

- Menghitung Volume TEOS

Massa molar TEOS = 208,33 g/mol

Massa Jenis TEOS = 0,933 g/mL

- Jumlah TEOS (8:1) = 8 x Jumlah NaHCO_3

$$= 8 \times 0,0022 \text{ mol}$$

$$= 0,018 \text{ mol}$$

- Jumlah TEOS (4:1) = 4 x Jumlah NaHCO_3

$$= 4 \times 0,0022 \text{ mol}$$

$$= 0,009 \text{ mol}$$

- Jumlah TEOS (2:1) = 2 x Jumlah NaHCO_3

$$= 2 \times 0,0022 \text{ mol}$$

$$= 0,004 \text{ mol}$$

$$\begin{aligned}
 \circ \text{ Massa TEOS (8:1)} &= \text{Jumlah TEOS} \times \text{Massa molar TEOS} \\
 &= 0,018 \text{ mol} \times 208,33 \text{ g/mol} \\
 &= 3,7499 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \circ \text{ Massa TEOS (4:1)} &= \text{Jumlah TEOS} \times \text{Massa molar TEOS} \\
 &= 0,009 \text{ mol} \times 208,33 \text{ g/mol} \\
 &= 1,87497 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \circ \text{ Massa TEOS (2:1)} &= \text{Jumlah TEOS} \times \text{Massa molar TEOS} \\
 &= 0,004 \text{ mol} \times 208,33 \text{ g/mol} \\
 &= 0,83332 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{a. Volume TEOS (8:1)} &= \frac{\text{massa TEOS}}{\rho \text{ TEOS}} \\
 &= \frac{3,7499 \text{ gram}}{0,933 \text{ g/mol}} \\
 &= 4,019 \text{ mL} \\
 &= \sim 4 \text{ mL}
 \end{aligned}$$

$$\begin{aligned}
 \text{b. Volume TEOS (4:1)} &= \frac{\text{massa TEOS}}{\rho \text{ TEOS}} \\
 &= \frac{1,87497 \text{ gram}}{0,933 \text{ g/mol}} \\
 &= 2,01 \text{ mL} \\
 &= \sim 2 \text{ mL}
 \end{aligned}$$

$$\begin{aligned}
 \text{c. Volume TEOS (2:1)} &= \frac{\text{massa TEOS}}{\rho \text{ TEOS}} \\
 &= \frac{0,83332 \text{ gram}}{0,933 \text{ g/mol}} \\
 &= 0,893 \text{ mL} \\
 &= \sim 1 \text{ mL}
 \end{aligned}$$

2.2. Perhitungan Massa Ni dan Cu

$$\text{Rasio Ni:Cu} = 3:1$$

$$\text{Massa molar Ni} = 58,6934 \text{ g/mol}$$

$$\text{Massa molar Cu} = 63,546 \text{ g/mol}$$

$$\text{Massa molar Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} = 290,79 \text{ g/mol}$$

$$\text{Massa molar Cu(NO}_3)_2 \cdot 3\text{H}_2\text{O} = 241,60 \text{ g/mol}$$

$$5\% \times 2,4 \text{ g} = 0,12 \text{ g}$$

- $\text{Massa Ni} = \frac{3}{4} \times 0,12 = 0,09 \text{ g}$
- $\text{Massa Cu} = \frac{1}{4} \times 0,12 = 0,03 \text{ g}$

Jadi, massa Ni = 0,09 g, dan massa Cu = 0,03 g

Jumlah Ni(NO₃)₂·6H₂O yang diperlukan:

$$\text{Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O} = \frac{\text{Berat Ni} \times \text{BM Ni(NO}_3)_2 \cdot 6\text{H}_2\text{O}}{\text{BA Ni}} = \frac{0,09 \times 290,79}{58,6934} = 0,446 \text{ g}$$

Jumlah Cu(NO₃)₂·3H₂O yang diperlukan:

$$\text{Cu(NO}_3)_2 \cdot 3\text{H}_2\text{O} = \frac{\text{Berat Cu} \times \text{BM Cu(NO}_3)_2 \cdot 3\text{H}_2\text{O}}{\text{BA Cu}} = \frac{0,03 \times 241,60}{63,546} = 0,114 \text{ g}$$

2.3. Perhitungan Keasaman Katalis secara Gravimetri

Katalis	W1 (g)	W2 (g)	W3 (g)	Keasaman (mmol/g)
K Ni-Cu 8	10,6999	10,7499	10,7506	0,8220
K Ni-Cu 4	10,4623	10,5123	10,5131	0,9394
K Ni-Cu 2	13,2296	13,2796	13,2806	1,1743

$$\text{Keasaman} = \frac{W_3 - W_2}{W_1 - W_2} \times 1000 \text{ mmol/g}$$

$$= \frac{B - A}{A \times \text{BM NH}_3}$$

Contoh perhitungan keasaman pada katalis Ni-Cu 2

$$A = 13,2796 - 13,2296$$

$$B = 13,2806 - 13,2296$$

$$\begin{aligned} \text{Keasaman} &:= \frac{0,0510 - 0,05}{0,05 \times 17,031 \text{ g/mol}} \times 1000 \text{ mmol/g} \\ &= 1,1743 \text{ mmol/g} \end{aligned}$$

2.4. Perhitungan Konversi Minyak Jelantah Setelah Reaksi Hidrorengkah

Berat	K Ni-Cu 8(g)	K Ni-Cu 4 (g)	K Ni-Cu 2 (g)
Katalis Awal	0,15	0,15	0,15
Katalis Akhir	0,2904	0,1525	0,1927
Umpan Awal	15	15	15
Minyak Hasil Reaksi Perengkahan	0,1812	1,0011	0,9845
Sisa Reaksi Perengkahan	8,4505	8,3177	3,7054
Air	3,9081	1,5095	0,9063
Karbon	0,8247	0,5637	0,3827

Contoh Perhitungan Katalis Ni-Cu 8 :

- Fraksi cair (%b/b)

$$= \frac{\text{berat produk cair}}{\text{berat umpan}} \times 100\%$$

$$= \frac{\text{berat minyak} + \text{berat air}}{\text{berat umpan}} \times 100\%$$

$$= \frac{4,0893 \text{ g}}{15 \text{ g}} \times 100\%$$

$$= 27,262 \%$$
- Fraksi karbon (%b/b)

$$= \frac{\text{berat karbon}}{\text{berat umpan}} \times 100\%$$

$$= \frac{0,8247 \text{ g}}{15 \text{ g}} \times 100\%$$

$$= 5,497\%$$
- Residu (%b/b)

$$= \frac{\text{berat sisa reaksi hidrorengkah}}{\text{berat umpan}} \times 100\%$$

$$= \frac{8,4505 \text{ g}}{15 \text{ g}} \times 100\%$$

$$= 56,34 \%$$
- Fraksi gas (%b/b)

$$= 100\% - (\text{Fraksi cair} + \text{Fraksi karbon} + \text{Residu})$$

$$= 100\% - (27,26\% + 5,49\% + 56,34\%)$$

$$= 11,72 \%$$
- Konversi total

$$= \text{Fraksi cair} + \text{Fraksi gas} + \text{karbon}$$

$$= 27,262\% + 11,72\% + 5,49\% = 44,47\%$$

Produk (%)	K Ni-Cu 8 (%)	K Ni-Cu 4 (%)	K Ni-Cu 2 (%)
Fraksi Cair	27,262	16,209	12,605
Fraksi Karbon	5,497	3,758	2,551
Residu	56,34	55,451	24,703
Fraksi gas	11,72	25,08	59,585
Konversi total	44,47	45,03	74,73

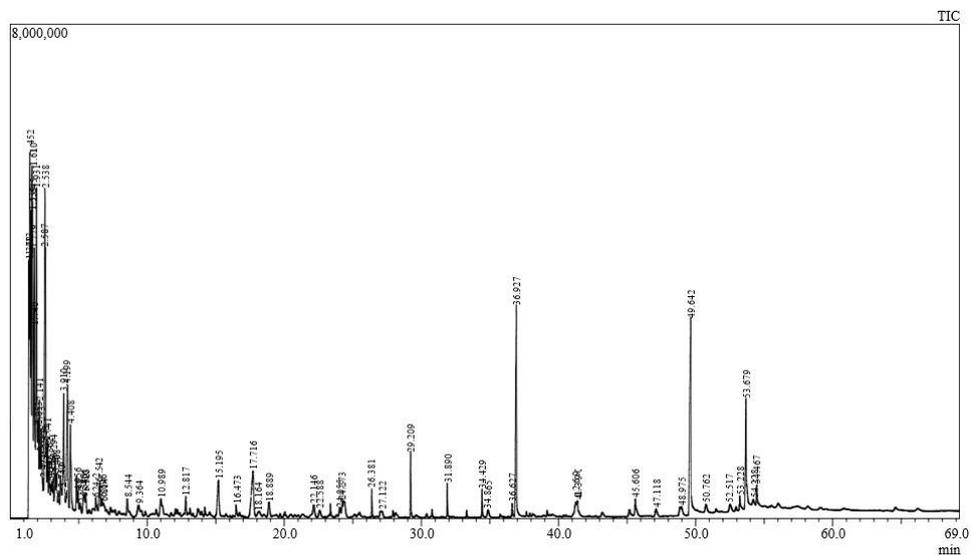
2.5. Selektivitas Produk Cair Katalis

Sampel	Luas Area GC			Konversi Total	Total Luas AreaGC
	Gasoline (C₅-C₁₂)	Kerosene (C₁₃-C₁₅)	Diesel (C₁₆-C₁₈)		
K Ni-Cu 8	28,11%	7,12%	3,75%	44,47 %	100%
K Ni-Cu 4	29,39 %	9,74 %	1,13 %	45,03 %	
K Ni-Cu 2	62,37%	6,59%	4,25%	74,73 %	

	K Ni-Cu 8	K Ni-Cu 4	K Ni-Cu 2
Parafin	2,96%	5,53%	5,53%
Olefin	45,4%	47,68%	15,53%
Siklik	11,16%	15,63%	5,4%

Lampiran 3 Data Kromatogram

Kromatogram K Ni Cu 8

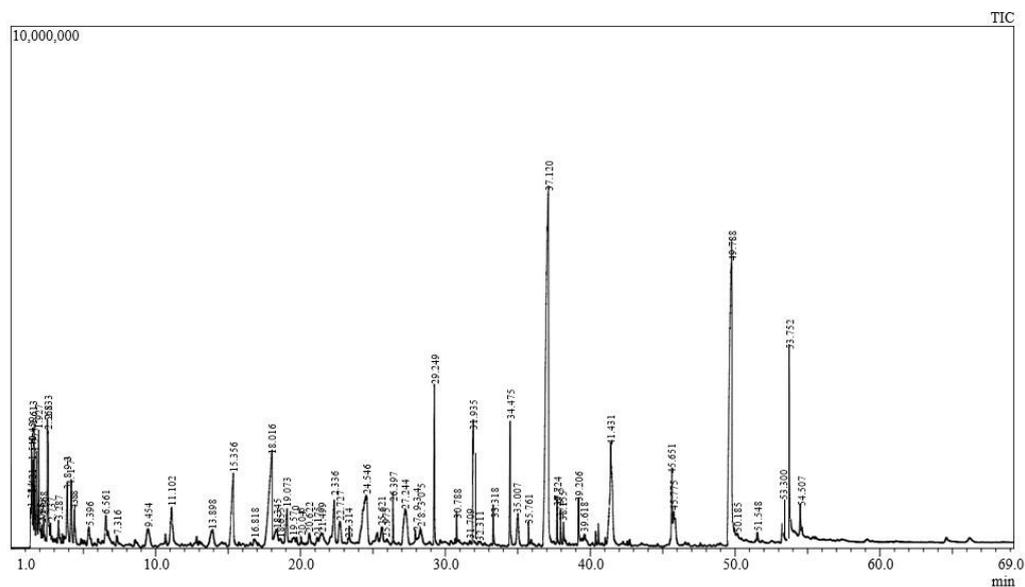


Peak report TIC

Peak#	R.Time	I.Time	F.Time	Area	Area %	Height	Height %	A/H	Mark	Name
1	1.378	1.285	1.400	13851917	3.84	4169125	4.57	3.32		1-Hexanol (CAS) n-Hexanol
2	1.413	1.400	1.430	6794014	1.88	4237611	4.64	1.60	V	Heptane (CAS) n-Heptane
3	1.452	1.430	1.510	18548397	5.14	5899878	6.46	3.14	V	1-Heptene (CAS) 1-n-Heptene
4	1.539	1.510	1.575	13359266	3.71	4957328	5.43	2.69	V	Heptane, 2,4-dimethyl- (CAS) 2,4-Dimet
5	1.610	1.575	1.630	14240470	3.95	5676597	6.22	2.51	V	1-Octene (CAS) Caprylene
6	1.645	1.630	1.700	13427860	3.72	5097580	5.59	2.63	V	2,4,5-TRIVINYL-1,3-DIOXOLANE
7	1.740	1.700	1.750	6785631	1.88	3091542	3.39	2.19	V	Cyclohexene, 1-methyl- (CAS) 1-Methyl
8	1.779	1.750	1.860	15245663	4.23	4343430	4.76	3.51	V	Nonane (CAS) n-Nonane
9	1.931	1.860	2.010	23104097	6.41	5309704	5.82	4.35	V	Cyclopropane, 1-methyl-2-pentyl- (CAS)
10	2.053	2.010	2.105	7424664	2.06	1554985	1.70	4.77	V	2-Hepten-1-ol, (Z)- (CAS) cis-HEPT-2-E
11	2.141	2.105	2.185	6196570	1.72	1873641	2.05	3.31	V	1-Dodecyne (CAS) 1-C12H22
12	2.208	2.185	2.240	2913163	0.81	1021645	1.12	2.85	V	1,4-Heptadiene, 3-methyl- (CAS) 3-Met
13	2.273	2.240	2.305	4231124	1.17	1405252	1.54	3.01	V	Decane (CAS) n-Decane
14	2.325	2.305	2.390	3181393	0.88	839271	0.92	3.79	V	Cyclopentene, 1-methyl- (CAS) 1-Methy
15	2.424	2.390	2.450	1823713	0.51	607415	0.67	3.00	V	Cyclopentane, 1-methyl-2-(2-propenyl)-, Cyclooctene (CAS)
16	2.538	2.450	2.560	19641750	5.45	5280103	5.79	3.72	V	
17	2.587	2.560	2.625	11108186	3.08	4318744	4.73	2.57	V	1-Octanol, 3,7-dimethyl- (CAS) 3,7-Dim
18	2.643	2.625	2.680	2779121	0.77	1074124	1.18	2.59	V	1,3-Nonadiene, (E)- (CAS) 1,TRANS-3-
19	2.741	2.680	2.785	5087561	1.41	1197152	1.31	4.25	V	Bicyclo[3.3.1]nonane (CAS)
20	2.862	2.840	2.900	2368866	0.66	863371	0.95	2.74	V	Hexanal (CAS) n-Hexanal
21	2.974	2.935	3.005	1746976	0.48	485646	0.53	3.60	V	Cyclohexane, (1-methylpropyl)- (CAS) s
22	3.049	3.005	3.080	2029109	0.56	525781	0.58	3.86	V	Cyclohexanol, 1-ethynyl- (CAS) 1-Ethyn
23	3.150	3.115	3.200	1943366	0.54	568029	0.62	3.42	V	3-Nonen-2-ol, (E)- (CAS) TRANS-NON
24	3.294	3.200	3.375	5671224	1.57	901144	0.99	6.29	V	Undecane (CAS) n-Undecane
25	3.408	3.375	3.485	2495155	0.69	643893	0.71	3.88	V	Benzene, ethyl- (CAS) EB
26	3.670	3.615	3.720	2672694	0.74	594810	0.65	4.49	V	Benzene, 1,2-dimethyl- (CAS) o-Xylene
27	3.740	3.720	3.785	1303486	0.36	383345	0.42	3.40	V	Cyclopentene, 4-methyl- (CAS) 4-Methy

Peak #	R.Time	I.Time	F.Time	Area	Area %	Height	Height %	A/H	Mark	Name
28	3.910	3.785	4.035	12098292	3.36	1922703	2.11	6.29	V	1-Dodecene (CAS) Adacene 12
29	4.199	4.035	4.305	12053931	3.34	2044301	2.24	5.90	V	2-Undecene, (Z)- (CAS) (Z)-2-Undecene
30	4.408	4.305	4.630	7603308	2.11	1389699	1.52	5.47	V	2-Undecene, (Z)- (CAS) (Z)-2-Undecene
31	4.956	4.915	5.040	1365615	0.38	329861	0.36	4.14	V	Benzene, propyl- (CAS) n-Propylbenzen
32	5.098	5.040	5.230	925726	0.26	151056	0.17	6.13	V	o-Menth-8-ene (CAS) CIS-ISOPROPEN
33	5.340	5.230	5.380	1323695	0.37	251564	0.28	5.26		Dodecane (CAS) n-Dodecane
34	5.416	5.380	5.470	1426584	0.40	307836	0.34	4.63	V	Cyclopentene, 3-propyl- (CAS) 3-N-PRO
35	5.523	5.470	5.650	1607666	0.45	328960	0.36	4.89	V	CYCLOUNDECENE, (Z)-
36	6.242	6.195	6.410	1079455	0.30	210331	0.23	5.13		Styrene
37	6.542	6.410	6.630	3052399	0.85	447641	0.49	6.82	V	1-Dodecene (CAS) Adacene 12
38	6.696	6.630	6.765	1103461	0.31	198597	0.22	5.56	V	1,7-Octadiene (CAS) Octa-1,7-diene
39	6.814	6.765	6.985	966192	0.27	127857	0.14	7.56	V	2-ENDO-4-ENDO-DIMETHYL-8-OXA
40	8.544	8.455	8.660	1354355	0.38	249327	0.27	5.43		Benzene, butyl- (CAS) n-Butylbenzene
41	9.364	9.200	9.490	1236190	0.34	137083	0.15	9.02		Tridecane (CAS) n-Tridecane
42	10.989	10.845	11.095	2352001	0.65	274500	0.30	8.57		1-Tridecene (CAS) n-Tridec-1-ene
43	12.817	12.715	12.925	1445929	0.40	296633	0.33	4.87		Benzene, pentyl- (CAS) Pentylbenzene
44	15.195	15.005	15.390	4734622	1.31	577951	0.63	8.19		1-Tetradecene (CAS) n-Tetradec-1-ene
45	16.473	16.430	16.650	1071819	0.30	203000	0.22	5.28	V	Benzaldehyde (CAS) Phenylmethanal
46	17.716	17.400	17.930	8508573	2.36	726643	0.80	11.71		Pentadecane (CAS) n-Pentadecane
47	18.164	17.930	18.410	1138770	0.32	82397	0.09	13.82	V	Cyclododecane (CAS) CYCLODODEC
48	18.889	18.730	19.080	1910504	0.53	238324	0.26	8.02		1-Hexadecene (CAS) Cetene
49	22.146	22.020	22.380	1361183	0.38	167576	0.18	8.12		1-Hexadecene (CAS) Cetene
50	22.588	22.420	22.830	1137939	0.32	115326	0.13	9.87		5-Eicosyne (CAS)
51	24.055	23.950	24.140	1130931	0.31	152577	0.17	7.41	V	Decane, 2-methyl- (CAS) 2-Methyldecane
52	24.273	24.140	24.650	4393638	1.22	273127	0.30	16.09	V	Heptadec-8-ene
53	26.381	26.330	26.520	1427157	0.40	454658	0.50	3.14		Hexanoic acid (CAS) n-Hexanoic acid
54	27.122	26.890	27.350	1534784	0.43	104543	0.11	14.68		9-Eicosene, (E)- (CAS)
55	29.209	29.110	29.410	3425837	0.95	1048561	1.15	3.27		Heptanoic acid (CAS) Heptoic acid
56	31.890	31.790	32.030	1641985	0.46	539554	0.59	3.04		Octanoic acid (CAS) Caprylic acid
57	34.429	34.320	34.570	1525310	0.42	449847	0.49	3.39		Nonanoic acid (CAS) Nonoic acid
58	34.865	34.740	35.110	941283	0.26	112149	0.12	8.39		9-Tricosene, (Z)- (CAS) Muscalure
59	36.627	36.520	36.770	1094761	0.30	220564	0.24	4.96		2-Heptadecanone (CAS) 2-HEPTADEC
60	36.927	36.770	37.170	15995256	4.44	3361739	3.68	4.76		Decanoic acid (CAS) Capric acid
61	41.269	40.970	41.340	2480445	0.69	228069	0.25	10.88		9-Tricosene, (Z)- (CAS) Muscalure
62	41.390	41.340	41.670	1626252	0.45	247028	0.27	6.58	V	Dodecanamide, N,N-bis(2-hydroxyethyl)
63	45.606	45.460	45.950	2055939	0.57	272519	0.30	7.54		9-Octadecenoic acid (Z)- (CAS) Oleic ac
64	47.118	46.950	47.380	1210524	0.34	125190	0.14	9.67		Nonacosane (CAS) n-Nonacosane
65	48.975	48.700	49.200	2096648	0.58	139986	0.15	14.98		Tetratetracontane (CAS) n-Tetratetracont
66	49.642	49.440	49.980	19421970	5.39	3118849	3.42	6.23		Hexadecanoic acid (CAS) Palmitic acid
67	50.762	50.600	51.000	1234052	0.34	128703	0.14	9.59		TETRACONTANE
68	52.517	52.350	52.780	1276344	0.35	119835	0.13	10.65		Tetratetracontane (CAS) n-Tetratetracont
69	53.228	53.140	53.490	1373363	0.38	226176	0.25	6.07		Octadecanoic acid (CAS) Stearic acid
70	53.679	53.490	53.980	10571585	2.93	1772272	1.94	5.96	V	OCTADEC-9-ENOIC ACID
71	54.228	53.980	54.380	1590754	0.44	125142	0.14	12.71	V	TETRACONTANE
72	54.467	54.380	54.590	1665780	0.46	343414	0.38	4.85	V	9,12-Octadecadienoic acid (Z,Z)- (CAS)

Kromatogram K Ni Cu 4



Peak#	R.Time	I.Time	F.Time	Area	Area %	Height	Height %	A/H	Mark	Name
1	1.384	1.300	1.400	1765835	0.33	757034	1.14	2.33		1-Hexene (CAS) Hexene-1
2	1.421	1.400	1.440	1855379	0.34	1025098	1.54	1.81	V	Heptane (CAS) n-Heptane
3	1.459	1.440	1.510	4361918	0.81	2033559	3.06	2.14	V	1-Heptene (CAS) 1-n-Heptene
4	1.540	1.510	1.580	3873324	0.72	1656732	2.49	2.34	V	Octane (CAS) n-Octane
5	1.613	1.580	1.710	7620408	1.41	2339664	3.52	3.26	V	1-Octene (CAS) Caprylene
6	1.777	1.710	1.870	6054823	1.12	1794623	2.70	3.37	V	Nonane (CAS) n-Nonane
7	1.927	1.870	2.015	6789853	1.25	2186319	3.29	3.11	V	1-Nonene (CAS) n-Non-1-ene
8	2.045	2.015	2.105	1160327	0.21	284521	0.43	4.08	V	Cyclohexane, cyclopropyl- (CAS) Cyclo
9	2.143	2.105	2.190	1085461	0.20	349851	0.53	3.10	V	CYCLOHEXYLETHANOL
10	2.268	2.190	2.310	1722902	0.32	489580	0.74	3.52	V	Decane (CAS) n-Decane
11	2.533	2.455	2.550	6072889	1.12	2311401	3.47	2.63		Cyclooctene (CAS)
12	2.568	2.550	2.675	6180569	1.14	2102702	3.16	2.94	V	1-Decene (CAS) Dec-1-ene
13	2.737	2.675	2.785	1189467	0.22	317096	0.48	3.75	V	1-Undecyne (CAS) 1-C11H20
14	3.287	3.200	3.390	2349919	0.43	435722	0.65	5.39		Undecane (CAS) n-Undecane
15	3.893	3.780	4.045	5753912	1.06	1107609	1.66	5.19		1-Undecene (CAS) n-1-Undecene
16	4.173	4.065	4.300	5951290	1.10	1188276	1.79	5.01		2-Undecene, (Z)- (CAS) (Z)-2-Undecene
17	4.388	4.300	4.595	3569778	0.66	641310	0.96	5.57		2-Undecene, (Z)- (CAS) (Z)-2-Undecene
18	5.396	5.245	5.490	3011437	0.56	352227	0.53	8.55		Benzene, 1,3,5-trimethyl- (CAS) 1,3,5-T
19	6.561	6.425	6.655	3384058	0.63	491011	0.74	6.89		1-Dodecene (CAS) Adacene 12
20	7.316	7.235	7.450	1104191	0.20	178142	0.27	6.20		Benzene, 1,2,4-trimethyl- (CAS) 1,2,4-T
21	9.454	9.260	9.755	4771351	0.88	323478	0.49	14.75		Tridecane (CAS) n-Tridecane
22	11.102	10.9	11.5	7146882	1.32	702841	1.06	10.17		1-Tridecene (CAS) n-Tridec-1-ene

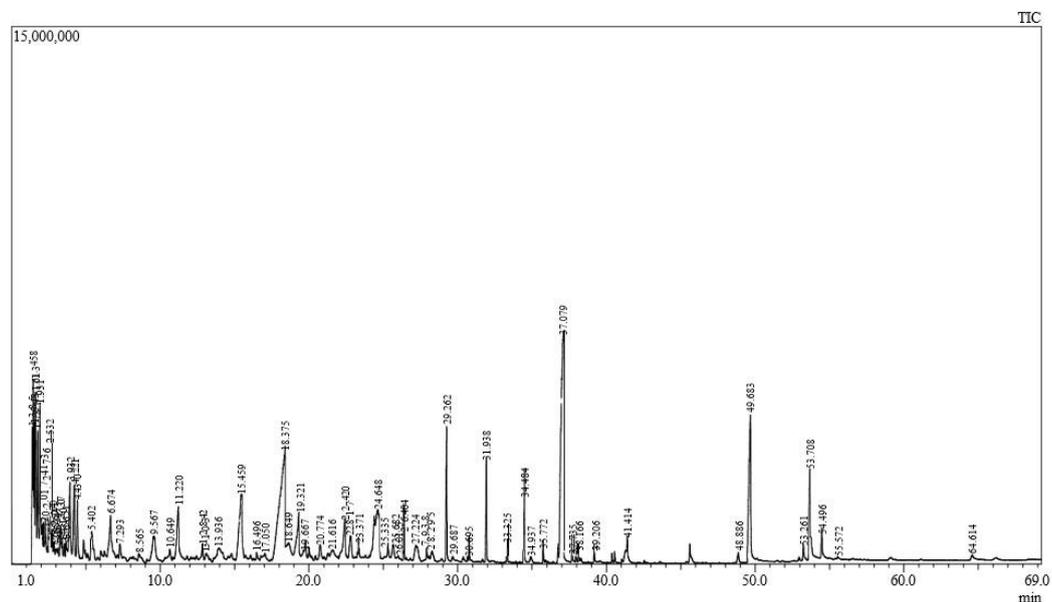
23	13.898	13.5 85	14.2 45	4948850	0.91	289177	0.43	17.11	Tetradecane (CAS) n-Tetradecane
24	15.356	14.9 95	15.5 65	14233609	2.63	1374726	2.07	10.35	1-Tetradecene (CAS) n-Tetradec-1-ene
25	16.818	16.6 90	17.0 50	1609379	0.30	126431	0.19	12.73	Cyclopentane, undecyl- (CAS) 1-Undecyl
26	18.016	17.4 70	18.1 15	27558338	5.09	1743650	2.62	15.80	Pentadecane (CAS) n-Pentadecane
27	18.345	18.1 15	18.5 35	5155175	0.95	301160	0.45	17.12	V 7-Tetradecene (CAS) 7-Tetradecene,cdant

Peak#	R.Time	Time	F.Time	Area	Area %	Height	Height %	A/H	Mark	Name
28	18.655	18.5 35	18.835	1497484	0.28	123962	0.19	12.08	V	3,4-Nonadiene (CAS)
29	19.073	18.8 35	19.195	5997718	1.11	680171	1.02	8.82	V	1-Hexadecene (CAS) Cetene
30	19.570	19.1 95	19.885	3809476	0.70	149535	0.22	25.48	V	E8-DODECENYLACETATE
31	20.046	19.8 85	20.335	1275716	0.24	147139	0.22	8.67	V	Butanoic acid (CAS) n-Butyric acid
32	20.622	20.3 35	20.995	2885719	0.53	228875	0.34	12.61	V	Cyclohexane, undecyl- (CAS) Undecylcy
33	21.175	20.9 95	21.265	1451564	0.27	150323	0.23	9.66		Heptadecane, 2,6,10,15-
34	21.499	21.2 65	21.865	4806521	0.89	229304	0.34	20.96	V	tetramethyl- (CA 3-Hexadecene, (Z)- (CAS)
35	22.336	21.8 65	22.525	9716748	1.80	841502	1.26	11.55	V	1-Hexadecene (CAS) Cetene
36	22.727	22.5 25	22.945	5369702	0.99	452152	0.68	11.88	V	5-Eicosyne (CAS)
37	23.314	22.9 45	23.695	3614002	0.67	132887	0.20	27.20	V	BENZENE, 1,2-DIFLUORO-4-[2-(4'-PE
38	24.546	23.6 95	24.835	23631626	4.37	940332	1.41	25.13	V	9-Eicosene, (E)- (CAS)
39	25.621	25.4 35	25.885	4415188	0.82	340566	0.51	12.96	V	9-Octadecen-1-ol, (Z)- (CAS) cis-9-Octa
40	25.975	25.8 85	26.245	1313177	0.24	118889	0.18	11.05	V	1-Heptadecene (CAS) Hexahydroplotax
41	26.397	26.2 45	26.665	3769452	0.70	922550	1.39	4.09	V	Hexanoic acid (CAS) n-Hexanoic acid
42	27.244	26.9 35	27.595	12036518	2.22	675198	1.01	17.83	V	9-Eicosene, (E)- (CAS)
43	27.934	27.5 95	28.015	1893555	0.35	266351	0.40	7.11	V	5-Hexenoic acid (CAS) Hex-5-enoic acid
44	28.305	28.0 15	28.645	5130890	0.95	292748	0.44	17.53	V	Cyclododecene, (E)- (CAS) (E)-Cyclodo
45	29.249	29.1 25	29.545	12007793	2.22	2694876	4.05	4.46	V	Heptanoic acid (CAS) Heptoic acid
46	30.788	30.5 35	31.225	3960952	0.73	479298	0.72	8.26	V	5-Hexenoic acid, 5-methyl- (CAS)
47	31.709	31.2 25	31.825	1518725	0.28	89447	0.13	16.98	V	(R)-(-)-14-Methyl-8-hexadecyn-1-ol
48	31.935	31.8 25	32.215	9075616	1.68	2053471	3.09	4.42	V	Octanoic acid (CAS) Caprylic acid
49	32.311	32.2 15	32.635	1097314	0.20	75724	0.11	14.49	V	9-Tricosene, (Z)- (CAS) Muscalure
50	33.318	33.2 35	33.565	2700925	0.50	624538	0.94	4.32		7-Octenoic acid (CAS)
51	34.475	34.2 85	34.675	9737068	1.80	1966490	2.96	4.95		Nonanoic acid (CAS) Nonoic acid
52	35.007	34.6 75	35.305	5818600	1.07	594649	0.89	9.78	V	9-Tricosene, (Z)- (CAS) Muscalure

53	35.761	35.6	35.845	1462003	0.27	395308	0.59	3.70	8-Nonenoic acid (CAS)
		95							

54	37.120	36.6 55	37.405	88763726	16.40	6661276	10.01	13.33		Decanoic acid (CAS) Capric acid
55	37.724	37.6 15	37.915	3574170	0.66	739968	1.11	4.83	V	9 DECENOIC ACID
56	37.975	37.9 15	38.095	2355962	0.44	622870	0.94	3.78	V	9 DECENOIC ACID
57	38.155	38.0 95	38.455	2322614	0.43	368223	0.55	6.31	V	9 DECENOIC ACID
58	39.206	39.1 15	39.355	3980115	0.74	853333	1.28	4.66		Undecanoic acid (CAS) Undecylic acid
59	39.618	39.3 55	40.015	3713694	0.69	209307	0.31	17.74	V	9-Octadecen-1-ol, (Z)- (CAS) cis-9-Octa
60	41.431	41.1 55	41.965	24129627	4.46	1846617	2.78	13.07		9-Octadecenoic acid (Z)- (CAS) Oleic ac
61	45.651	45.4 45	45.715	7020644	1.30	1357871	2.04	5.17		Tetradecanoic acid (CAS) Myristic acid
62	45.775	45.7 15	46.225	7021433	1.30	621993	0.93	11.29	V	Ethanol, 2-(9-octadecenyloxy)-, (E)- (CA)
63	49.788	49.4 05	50.065	71547485	13.22	5358487	8.05	13.35		Hexadecanoic acid (CAS) Palmitic acid
64	50.185	50.0 65	50.665	2757657	0.51	172206	0.26	16.01	V	9-Hexadecenoic acid (CAS)
65	51.548	51.3 25	51.775	1397970	0.26	177211	0.27	7.89		12-Tricosanone (CAS) Lauron
66	53.300	53.1 55	53.545	4928237	0.91	819930	1.23	6.01		Octadecanoic acid (CAS) Stearic acid
67	53.752	53.5 45	54.355	32985570	6.09	3542867	5.32	9.31	V	OCTADEC-9-ENOIC ACID
68	54.507	54.3 55	54.835	4521144	0.84	619455	0.93	7.30	V	9,12-Octadecadienoic acid (Z,Z)- (CAS)
				54129542 4	100.0 0	66541839	100.00			

Kromatogram K Ni Cu 2



Peak #	R.Time	I.Time	F.Time	Area	Area%	Height	Height %	A/H Mark	Name
1	1.385	1.290	1.440	18824573	2.65	3821964	4.25	4.93	1-Hexene (CAS) Hexene-1
2	1.458	1.440	1.515	14287483	2.01	5176117	5.75	2.76 V	1-Heptene (CAS) 1-n-Heptene
3	1.543	1.515	1.585	10330030	1.46	3951794	4.39	2.61 V	Heptane, 2,4-dimethyl- (CAS) 2,4-Dimet
4	1.613	1.585	1.705	19343889	2.73	4792358	5.33	4.04 V	1-Octene (CAS) Caprylene
5	1.781	1.705	1.865	15732520	2.22	3701295	4.11	4.25 V	Nonane (CAS) n-Nonane
6	1.931	1.865	2.010	16354261	2.30	4392931	4.88	3.72 V	Cyclopropane, 1-methyl-2-pentyl- (CAS)
7	2.071	2.010	2.110	5086204	0.72	1051404	1.17	4.84 V	Pentanal (CAS) n-Pentanal
8	2.143	2.110	2.190	3698249	0.52	1123915	1.25	3.29 V	CYCLOHEXYL ETHANOL
9	2.210	2.190	2.235	1447614	0.20	588796	0.65	2.46 V	1,4-Heptadiene, 3-methyl- (CAS)
10	2.276	2.235	2.390	6201512	0.87	1231183	1.37	5.04 V	3-Met Decane (CAS) n-Decane
11	2.532	2.450	2.550	10728562	1.51	3297877	3.67	3.25 V	Cyclooctene (CAS) (Z)-Cyclooctene
12	2.740	2.680	2.790	4075320	0.57	896035	1.00	4.55 V	1-Undecyne (CAS) 1-C11H20
13	2.820	2.790	2.845	1410585	0.20	481847	0.54	2.93 V	2-Octyn-1-ol (CAS) Oct-2-yn-1-ol
14	2.864	2.845	2.935	1945082	0.27	552556	0.61	3.52 V	Hexanal (CAS) n-Hexanal
15	2.981	2.935	3.080	2621134	0.37	346333	0.38	7.57 V	Cyclohexane, (1-methylpropyl)- (CAS) s
16	3.154	3.080	3.200	1838135	0.26	378295	0.42	4.86 V	Methylenecyclooctane
17	3.307	3.200	3.380	6106486	0.86	994059	1.10	6.14 V	Undecane (CAS) n-Undecane
18	3.410	3.380	3.490	2042298	0.29	527106	0.59	3.87 V	Benzene, ethyl- (CAS) EB
19	3.555	3.490	3.620	2261413	0.32	463704	0.52	4.88 V	Cyclohexanol, 1-ethynyl-, carbamate (C
20	3.661	3.620	3.720	2260545	0.32	550460	0.61	4.11 V	Benzene, 1,2-dimethyl- (CAS) o-Xylene
21	3.932	3.790	4.070	15042387	2.12	2165869	2.41	6.95 V	1-Dodecene (CAS) Adacene 12
22	4.221	4.070	4.315	12735706	1.79	2069808	2.30	6.15 V	2-Undecene, (Z)- (CAS) (Z)-2-Undecene
23	4.430	4.315	4.615	8109194	1.14	1636918	1.82	4.95 V	3-Undecene, (E)- (CAS) (E)-3-Undecene
24	5.402	5.250	5.515	6757319	0.95	800175	0.89	8.44	Benzene, 1,3,5-trimethyl- (CAS) 1,3,5-T
25	6.674	6.400	7.045	12525183	1.76	1166892	1.30	10.73 V	1-Dodecene (CAS) Adacene 12
26	7.293	7.225	7.465	2356757	0.33	397112	0.44	5.93	Benzene, 1,2,4-trimethyl- (CAS) 1,2,4-T
27	8.565	8.475	8.705	1878591	0.26	209975	0.23	8.95	Benzene, butyl- (CAS) n-Butylbenzene

Peak #	R.Time	I.Time	F.Time	Area	Area%	Height	Height %	A/H Mark	Name
28	9.567	9.285	9.845	10285985	1.45	672510	0.75	15.29 V	Tridecane (CAS) n-Tridecane
29	10.649	10.555	10.805	2177479	0.31	308343	0.34	7.06 V	1H-Indene, 2,3-dihydro- (CAS) 2,3-Dihy
30	11.220	10.935	11.505	14106353	1.99	1437250	1.60	9.81 V	1-Dodecanol (CAS) n-Dodecanol
31	12.842	12.715	12.965	2204570	0.31	410976	0.46	5.36	Benzene, pentyl- (CAS) Pentylbenzene
32	13.103	12.965	13.295	2284548	0.32	197826	0.22	11.55	2,3-Nonadiene (CAS)
33	13.936	13.785	14.165	5977300	0.84	338564	0.38	17.65 V	Decane, 2-methyl- (CAS) 2-Methyldecan
34	15.459	15.065	16.395	30847585	4.35	1836429	2.04	16.80 S	1-Tetradecene (CAS) n-Tetradec-1-ene
35	16.496	16.395	16.715	1700095	0.24	229303	0.25	7.41 V	Benzaldehyde (CAS) Phenylmethanal
36	17.050	16.715	17.375	3975958	0.56	208442	0.23	19.07 V	METHYL-7,8-DIDEUTERO-7-NONEN
37	18.375	17.515	18.455	77343005	10.90	2939650	3.27	26.31	Pentadecane (CAS) n-Pentadecane
38	18.649	18.455	18.935	9987846	1.41	480717	0.53	20.78 V	1-Pentadecanol (CAS) Pentadecanol
39	19.321	18.935	19.495	16106320	2.27	1255293	1.40	12.83 V	1-Hexadecene (CAS) Cetene
40	19.667	19.495	20.335	9183162	1.29	274319	0.30	33.48 V	1,10-Decanediol (CAS) Decane-1,10-dio
41	20.774	20.575	21.175	4257581	0.60	411186	0.46	10.35	Cyclohexane, 1,1'-(1,3-propanediyl)bis-
42	21.616	21.175	22.055	7986223	1.13	281813	0.31	28.34 V	9-Octadecene, (E)- (CAS)
43	22.420	22.055	22.615	13241288	1.87	1078239	1.20	12.28 V	1-Hexadecene (CAS) Cetene
44	22.817	22.615	23.015	7348529	1.04	663333	0.74	11.08 V	5-Eicosyne (CAS)
45	23.371	23.015	23.535	5009716	0.71	523516	0.58	9.57 V	Pentanoic acid (CAS) Valeric acid
46	24.648	23.535	24.975	37928626	5.34	1389239	1.54	27.30 V	9-Eicosene, (E)- (CAS)
47	25.335	24.975	25.495	4462795	0.63	365452	0.41	12.21 V	1-Octadecanol (CAS) Stenol
48	25.682	25.495	25.855	4890120	0.69	434496	0.48	11.25 V	(R)-(-)-(Z)-14-Methyl-8-hexadecen-1-ol
49	26.015	25.855	26.295	1658187	0.23	125718	0.14	13.19 V	1-Heptadecene (CAS) Hexahydroplotax
50	26.404	26.295	26.735	5830658	0.82	1097648	1.22	5.31	Hexanoic acid (CAS) n-Hexanoic acid
51	27.224	26.735	27.575	7862701	1.11	431484	0.48	18.22 V	9-Eicosene, (E)- (CAS)
52	27.938	27.615	28.175	3126205	0.44	327493	0.36	9.55	5-Hexenoic acid (CAS) Hex-5-enoic acid
53	28.295	28.175	28.655	3216028	0.45	282163	0.31	11.40 V	9-Octadecen-1-ol, (Z)- (CAS) cis-9-Octa
54	29.262	29.095	29.535	16419041	2.31	3027766	3.37	5.42	Heptanoic acid (CAS) Heptonic acid
55	29.687	29.535	30.295	1841426	0.26	144479	0.16	12.75 V	Benzene, decyl- (CAS) n-Decylbenzene
56	30.695	30.575	31.215	3352972	0.47	140845	0.16	23.81 V	Benzaldehyde, 4-pentyl-
57	31.938	31.815	32.175	11269014	1.59	2348896	2.61	4.80	Octanoic acid (CAS) Caprylic acid
58	33.325	33.015	33.695	4042601	0.57	734252	0.82	5.51	7-Octenoic acid (CAS)
59	34.484	33.695	34.735	10474572	1.48	2020860	2.25	5.18 V	Nonanoic acid (CAS) Nonoic acid
60	34.937	34.735	35.335	1869440	0.26	176850	0.20	10.57 V	9-Tricosene, (Z)- (CAS) Muscalure
61	35.772	35.335	35.855	2114843	0.30	516784	0.57	4.09	8-Nonenoic acid (CAS)
62	37.079	36.655	37.615	74015799	10.43	6349421	7.06	11.66	Decanoic acid (CAS) Capric acid
63	37.735	37.615	37.895	2962717	0.42	481906	0.54	6.15 V	9 DECENOIC ACID
64	38.166	37.895	38.615	4804658	0.68	374782	0.42	12.82 V	9 DECENOIC ACID
65	39.206	39.095	39.495	2030668	0.29	379621	0.42	5.35	Undecanoic acid (CAS) Undecylic acid
66	41.414	40.975	41.935	7900044	1.11	676474	0.75	11.68	9-Octadecenoic acid (Z)- (CAS) Oleic ac
67	48.886	48.615	49.175	2129647	0.30	272173	0.30	7.82	Hexadecanoic acid, 2-hydroxy-1,3-propa
68	49.683	49.415	50.055	33745612	4.75	3949494	4.39	8.54	Hexadecanoic acid (CAS) Palmitic acid
69	53.261	53.135	53.535	2623743	0.37	389115	0.43	6.74	Octadecanoic acid (CAS) Stearic acid
70	53.708	53.535	54.335	19702608	2.78	2197696	2.44	8.97 V	OCTADEC-9-ENOIC ACID
71	54.496	54.335	54.935	6060597	0.85	800830	0.89	7.57 V	9,12-Octadecadienoic acid (Z,Z)- (CAS)
72	55.572	54.935	55.935	1649832	0.23	76406	0.08	21.59 V	9-Hexadecenoic acid (CAS)
73	64.614	64.375	65.095	1827792	0.26	135669	0.15	13.47	2,2,3,3,4,4 HEXADEUTERO OCTADEC
				709837521	100.00	89962499	100.00		