

LAMPIRAN

Lampiran 1. Kuantitas bio-oil

Temperatur	400°C	425°C	450°C	475°C	500°C
Cairan (g)	252,67	316,33	364,67	402,67	482,67
Arang (g)	299	283	280	277	267
Gas	448,33	400,67	355,33	320,33	250,33
Presentase (%)					
Cairan	25	32	36	40	48
Arang	30	28	28	28	27
Gas	45	40	36	32	25

Lampiran 2. Nilai densitas bio-oil

Densitas Total					
Temperatur	400°C	425°C	450°C	475°C	500°C
Massa (g)	257	323	370	407	488
	251	314	363	402	480
	250	312	361	399	480
Rata-rata massa (g)	252,67	316,33	364,67	402,67	482,67
Volume (ml)	355	375	420	460	550
Berat (kg)	0,252667	0,316333	0,364667	0,402667	0,482667
Volume (m ³)	0,000355	0,000375	0,000420	0,000460	0,000550
Nilai densitas (kg/m ³)	711,74	843,56	868,25	875,36	877,58

Densitas Minyak					
Temperatur	400°C	425°C	450°C	475°C	500°C
Berat (g)	53	76	142	160	202
Volume (ml)	73	98	174	198	252
Berat (kg)	0,053	0,076	0,142	0,16	0,202
Volume (m ³)	0,000073	0,000098	0,00017	0,000198	0,000252
Densitas (kg/m ³)	726,03	775,51	816,09	808,08	801,59

Lampiran 3. Nilai pH

Temperatur	400°C	425°C	450°C	475°C	500°C
Nilai pH	3,9	4,1	4,4	4,2	4,0
	4,3	4,4	4,3	4,1	4,1
	4,1	4,2	4,2	4,2	4,1
Rata-rata nilai pH	4,10	4,23	4,30	4,17	4,07

Lampiran 4. Nilai kalor bio-oil

Temperatur	400°C	425°C	450°C	475°C	500°C
Nilai kalor (Cal/g)	10588,684	8994,7511	10223,338	10330,747	10496,665
	10472,647	9398,6761	9820,5321	8756,2231	10277,247
Nilai kalor (MJ/kg)	44,33270217	37,65922391	42,80307154	43,25277154	43,94743702
	43,84687846	39,3503771	41,1166038	36,66055488	43,02877774
Rata-rata (MJ/kg)	44,08979032	38,5048005	41,95983767	39,95666321	43,48810738
Min	43,84687846	37,65922391	41,1166038	36,66055488	43,02877774
Max	44,33270217	39,3503771	42,80307154	43,25277154	43,94743702
Negatif	0,242911856	0,845576595	0,843233871	3,296108332	0,459329641
Positif	0,242911856	0,845576595	0,843233871	3,296108332	0,459329641

Lampiran 5. Penggolongan Unsur Carbon Bio-oil

Golongan	400°C	450°C	500°C
Gas oline (C4-C12)	58,50 %	56,82 %	43,88 %
Solar/diesel (C13-C24)	22,63 %	27,49 %	30,17 %
Minyak berat (>C24)	0,19 %	0,23 %	0,73 %

Lampiran 6. Penyusunan GC-MS temperatur 400°C

No	Area %	Nama	Formula	Golongan
1	0,19	METHYLCYCLOPRUPANE	C ₄ H ₈	Cyclo Alkana
2	1,95	1-Hexene	C ₆ H ₁₂	Alkena
3	2,40	1,3-Hexadien-5-yne	C ₆ H ₆	Aromatik
4	2,09	1-hepten	C ₇ H ₁₄	Alkena
5	1,35	heptane	C ₇ H ₁₆	Alkana
6	0,42	Cyclohexane, Methyl-	C ₇ H ₁₄	Cyclo Alkana
7	0,20	Cyclohexene, 4-Methyl	C ₇ H ₁₂	Cyclo Alkena
8	0,37	4-Penten-1-ol,3-Methyl	C ₆ H ₁₂ O	Other O
9	3,93	Toluene	C ₇ H ₈	Touluene
10	0,19	Cyclooctene,4-ethenyl-	C ₁₀ H ₁₆	Other H
11	2,69	1-octene	C ₈ H ₁₆	Alkena
12	1,61	Octane	C ₈ H ₁₈	Alkana
13	0,40	2-Octene	C ₈ H ₁₆	Alkena
14	0,22	2-Octene	C ₈ H ₁₆	Alkena
15	0,29	Cyclooctene	C ₈ H ₁₄	Cyclo Alkena
16	0,60	2-Furancarboxaldehyde	C ₅ H ₄ O ₂	Other O
17	3,00	2,4-Dimethyl-1-heptene	C ₉ H ₁₈	Alkena
18	0,53	2,4-Octadiene	C ₈ H ₁₄	Alkena
19	0,86	Ethylbenzene	C ₈ H ₁₀	Other H
20	1,14	Benzene, 1,2-dimethyl- (CAS) o-Xylene	C ₈ H ₁₀	Other H
21	0,32	Cyclohexanemethanol	C ₇ H ₁₄ O	Other O

22	0,29	1,8-Nonadiene	C ₉ H ₁₆	Alkena
23	0,33	1-Heptene, 3-methyl-	C ₈ H ₁₆	Alkena
24	4,22	1-Nonene	C ₉ H ₁₈	Alkena
25	1,99	Nonane	C ₉ H ₂₀	Alkana
26	0,29	4-Nonene	C ₉ H ₁₈	Alkena
27	0,52	Cyclohexane, 2-propenyl- 1,8-Nonadiene	C ₉ H ₁₆	Other H
28	0,20	1,8-Nonadiene	C ₉ H ₁₆	Alkena
29	0,24	Benzene, propyl-	C ₉ H ₁₂	Other H
30	0,49	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene	C ₉ H ₁₂	Other H
31	0,28	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene	C ₉ H ₁₂	Other H
32	4,28	Phenol (CAS) Izal	C ₆ H ₆ O	Phenol
33	4,88	1-Decene (CAS) Dec-1-ene	C ₁₀ H ₂₀	Alkena
34	1,79	Decane	C ₁₀ H ₂₂	Alkana
35	0,75	5-Decene, (E)-	C ₁₀ H ₂₀	Alkena
36	0,42	Nonane, 2,6-dimethyl-	C ₁₁ H ₂₄	Alkana
37	0,28	Benzene, 1-propenyl- (CAS) Propenylbenzene	C ₉ H ₁₀	Aromatik
38	0,57	INDENE	C ₉ H ₈	Cyclo aromatik
39	1,01	Phenol, 2-methyl- (CAS) o-Cresol	C ₇ H ₈ O	Phenol
40	0,21	Benzeneacetaldehyde, .alpha.-methyl-	C ₉ H ₁₀ O	Other O
41	0,81	Hexadecane, 1-chloro-	C ₁₆ H ₃₃ CL	Other H
42	1,50	Mequinol	C ₇ H ₈ O ₂	Alkohol
43	3,53	1-Undecene (CAS) n-1-Undecene	C ₁₁ H ₂₂	Alkena
44	0,44	1,6-Heptadiene, 3-methyl-	C ₈ H ₁₄	Alkena
45	1,92	Undecane	C ₁₁ H ₂₄	Alkana
46	0,48	5-Undecene, (E)-	C ₁₁ H ₂₂	Alkena
47	0,23	Benzofuran, 2-methyl-	C ₉ H ₈ O	Other O
48	0,24	2-Undecene, (E)-	C ₁₁ H ₂₂	Alkena
49	0,23	Octadecane, 1-(ethenyloxy)-	C ₂₀ H ₄₀ O	Eter
50	0,27	Benzene, (1-cyclopropyl-1-methylethyl)-	C ₁₂ H ₁₆	Other H
51	0,69	Benzene, (1-methyl-2-cyclopropen-1-yl)-	C ₁₀ H ₁₀	Other H
52	0,51	Benzene, (1-methylene-2-propenyl)-	C ₁₀ H ₁₀	Other H
53	0,64	1,9-Decadiene	C ₁₀ H ₁₈	Alkena
54	4,61	1-Dodecene (CAS) Adacene 12	C ₁₂ H ₂₄	Alkena
55	1,82	Dodecane	C ₁₂ H ₂₆	Alkana
56	0,31	5-Dodecene, (E)- (CAS)	C ₁₂ H ₂₄	Alkena

57	0,19	4-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena
58	0,23	Dodecane, 2,6,11-trimethyl-	C ₁₅ H ₃₂	Alkana
59	0,22	DIHYDRO-CARVEOL	C ₁₀ H ₁₈ O	Other O
60	0,28	Benzene, 1,4-dimethoxy-2-methyl-	C ₉ H ₁₂ O ₂	Other O
61	0,61	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
62	2,90	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
63	2,91	DECANE	C ₁₀ H ₂₂	Alkana
64	0,88	1-Heptadecene (CAS) Hexahydroaplotaxene	C ₁₇ H ₃₄	Eter
65	0,42	1-Hexacosanol (CAS) HEXACOSANOL-1	C ₂₆ H ₅₄ O	Alkohol
66	0,21	Nonane, 3-bromo-1,1-dichloro-	C ₉ H ₁₇ BRCL ₂	Other H
67	0,36	Hexadecane, 1-chloro-	C ₁₆ H ₃₃ CL	Other H
68	0,70	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
69	2,81	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
70	1,86	DODECANE	C ₁₂ H ₂₆	Alkana
71	0,30	Undecane, 1,2-dibromo-2-methyl-	C ₁₂ H ₂₄ BR ₂	Other H
72	0,22	4(1H)-Isobenzofuranone, hexahydro-3a,7a-dimethyl	C ₁₀ H ₁₆ O ₂	Other O
73	0,51	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
74	2,24	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
75	1,45	DODECANE	C ₁₂ H ₂₆	Alkana
76	0,22	1-Decanol, 2-hexyl-	C ₁₆ H ₃₄ O	alkohol
77	0,43	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	alkohol
78	1,56	1-Hexadecene	C ₁₆ H ₃₂	Alkena
79	1,16	pentadecane	C ₁₅ H ₃₂	Alkana
80	0,26	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	alkohol
81	1,05	1-Hexadecene	C ₁₆ H ₃₂	Alkena
82	0,95	Pentadecane	C ₁₅ H ₃₂	Alkana
83	0,23	9-Octadecenoic acid (Z)- (CAS) Oleic acid	C ₁₈ H ₃₄ O ₂	Acid
84	0,22	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
85	0,88	1-Octadecene	C ₁₈ H ₃₆	Alkena
86	0,77	Eicosane (CAS) n-Eicosane	C ₂₀ H ₄₂	Alkana
87	0,63	1-Docosene	C ₂₂ H ₄₄	Alkena
88	1,18	2-Heptadecanone	C ₁₇ H ₃₄ O	ketone
89	0,24	1-Hexadecanol	C ₁₆ H ₃₂ O ₂	Acid
90	0,67	Hexadecanoic acid (CAS) Palmitic acid	C ₁₅ H ₃₂ O ₂	Acid

91	0,22	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
92	0,54	1-Docosene	C ₂₂ H ₄₄	Alkena
93	0,48	pentadecane	C ₁₅ H ₃₂	Alkana
94	0,40	1-Docosene	C ₂₂ H ₄₄	Alkena
95	0,51	PENTADECANE, 2,6,10-TRIMETHYL-	C ₁₈ H ₃₈	Alkana
96	0,26	1-Docosene	C ₂₂ H ₄₄	Alkena
97	0,25	Heptadecane	C ₁₇ H ₃₆	Alkana
98	0,53	1-Docosene	C ₂₂ H ₄₄	Alkena
99	0,33	1-Docosene	C ₂₂ H ₄₄	Alkena
100	0,28	1-Docosene	C ₂₂ H ₄₄	Alkena
101	0,24	Nonacosanol	C ₂₉ H ₆₀ O	Alkohol
102	0,19	Tetratetracontane	C ₄₄ H ₉₀	Alkana

Lampiran 7. Penyusunan GC-MS temperatur 450°C

No	Area %	Nama	Formula	Golongan
1	1,67	1-Hexene	C ₆ H ₁₂	Alkena
2	2,00	1,3-Hexadien-5-yne	C ₆ H ₆	Aromatik
3	1,86	1-Heptene	C ₇ H ₁₄	Alkena
4	1,13	Heptane	C ₇ H ₁₆	Alkana
5	0,40	Cyclohexane, methyl-	C ₇ H ₁₄	Cyclo Alkana
6	0,23	Cyclohexene, 4-methyl-	C ₇ H ₁₂	Cyclo Alkena
7	0,38	1-Decyne	C ₁₀ H ₁₈	Alkana
8	3,51	Toluene	C ₇ H ₈	Toueluene
9	0,18	1,4-Octadiene,c&t	C ₈ H ₁₄	Alkena
10	2,51	1-Octene (CAS) Caprylene	C ₈ H ₁₆	Alkena
11	1,52	Octane	C ₈ H ₁₈	Alkana
12	0,30	2-Octene, (E)-	C ₈ H ₁₆	Alkena
13	0,20	2-Octene	C ₈ H ₁₆	Alkena
14	0,38	Spiropentane, butyl-	C ₉ H ₁₆	Other H
15	0,56	2-Furancarboxaldehyde (CAS) Furfural	C ₉ H ₄ O ₂	Other O
16	2,80	2,4-Dimethyl-1-heptene	C ₉ H ₁₈	Alkena
17	0,47	4-(2-BROMETHYL)-CYCLOHEXENE	C ₈ H ₁₃	Cyclo Alkena
18	0,81	Ethylbenzene	C ₈ H ₁₀	Other H
19	1,08	Benzene, 1,2-dimethyl- (CAS) o-Xylene	C ₈ H ₁₀	Other H
20	0,29	Cyclohexanemethanol (CAS) Cyclohexylmethanol	C ₇ H ₁₄ O	Other O
21	0,28	Cyclopropane, 1,1'-(1,2-ethanediyl)bis-	C ₈ H ₁₄	Alkena

22	0,21	1-Heptene, 3-methyl- (CAS) 3-Methyl-1-heptene	C ₈ H ₁₆	Alkena
23	3,39	1-Nonene	C ₉ H ₁₈	Alkena
24	2,00	Dodecane (CAS) n-Dodecane	C ₁₂ H ₂₆	Alkana
25	0,25	4-Nonene	C ₉ H ₁₈	Alkena
26	0,46	Cyclohexane, 2-propenyl-	C ₉ H ₁₆	Other H
27	0,20	1,8-Nonadiene	C ₉ H ₁₆	Alkena
28	0,25	Benzene, propyl-	C ₉ H ₁₂	Other H
29	0,48	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene	C ₉ H ₁₂	Other H
30	4,29	Phenol (CAS) Izal	C ₆ H ₆ O	Phenol
31	4,51	1-Decene (CAS) Dec-1-ene	C ₁₀ H ₂₀	Alkena
32	1,65	Decane (CAS) n-Decane	C ₁₀ H ₂₂	Alkana
33	0,62	5-Decene, (E)-	C ₁₀ H ₂₀	Alkena
34	0,30	Nonane, 2,6-dimethyl-	C ₁₁ H ₂₄	Alkana
35	0,29	Benzene, 1-propenyl- (CAS) Propenylbenzene	C ₉ H ₁₀	Other H
36	0,53	INDENE	C ₉ H ₈	Cyclo Aromatik
37	0,85	3-Octen-1-yne, (E)-	C ₈ H ₁₂	Other H
38	0,18	Benzeneacetaldehyde, .alpha.- methyl-	C ₉ H ₁₀ O	Other O
39	0,83	1-Octanol, 3,7-dimethyl-	C ₁₀ H ₂₂ O	Other O
40	1,46	Mequinol	C ₇ H ₈ O ₂	Phenol
41	3,42	1-Undecene (CAS) n-1- Undecene	C ₁₁ H ₂₂	Alkena
42	0,34	1,9-Decadiene	C ₁₀ H ₁₈	Alkena
43	1,89	Undecane	C ₁₁ H ₂₄	Alkana
44	0,43	Undecane, (E)-	C ₁₁ H ₂₂	Alkena
45	0,20	Benzofuran, 2-methyl- (CAS) 2-Methylbenzofuran	C ₉ H ₈ O	Other O
46	0,22	2-Undecene, (E)-	C ₁₁ H ₂₂	Alkena
47	0,25	1-Undecene, 7-methyl- (CAS)	C ₁₂ H ₂₄	Alkena
48	0,29	Benzene, (1-cyclopropyl-1- methylethyl)-	C ₁₂ H ₁₆	Other H
49	0,72	Benzene, (1-methyl-2- cyclopropen-1-yl)-	C ₁₀ H ₁₀	Other H
50	0,50	Benzene, (1-methylene-2- propenyl)-	C ₁₀ H ₁₀	Other H
51	0,52	1,9-Decadiene	C ₁₀ H ₁₈	Alkena
52	4,40	1-Dodecene (CAS) Adacene 12	C ₁₂ H ₂₄	Alkena
53	1,78	Dodecane (CAS) n-Dodecane	C ₁₂ H ₂₆	Alkana
54	0,29	5-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena
55	0,18	4-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena

56	0,19	1-Octanol, 2-butyl- (CAS) 2-Butyl-1-octanol	C ₁₂ H ₂₆ O	Alkohol
57	0,25	DECANE, 2,3,5,8-TETRAMETHYL-	C ₁₄ H ₃₀	Alkana
58	0,18	Phenethyl alcohol, .alpha.-butyl-.beta.-methyl- (CAS)	C ₁₃ H ₂₀ O	Alkohol
59	0,32	2-Hexen-1-ol, 2-ethyl- (CAS)	C ₈ H ₁₆ O	Other O
60	0,34	Benzene, 1,4-dimethoxy-2-methyl-	C ₉ H ₁₂ O ₂	Other O
61	0,70	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
62	2,93	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
63	2,87	Tridecane, 4,8-dimethyl-	C ₁₅ H ₃₂	Alkana
64	0,19	1-Undecene, 7-methyl- (CAS)	C ₁₂ H ₂₄	Alkena
65	0,94	1-Heptadecene (CAS) Hexahydroaplotaxene	C ₁₇ H ₃₄	Eter
66	0,19	1-Undecene, 7-methyl- (CAS)	C ₁₂ H ₂₄	Alkena
67	0,22	Phenol, 2,6-dimethoxy- (CAS) 2,6-Dimethoxyphenol	C ₈ H ₁₀ O ₃	Other O
68	0,21	Cetylpyridinium Chloride	C ₁₇ H ₃₃ CL	Other H
69	0,37	Hexadecane, 1-chloro-	C ₁₆ H ₃₃ CL	Other H
70	0,18	GERMACRANE-B	C ₁₅ H ₃₀	Other O
71	0,73	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
72	2,91	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
73	1,92	DODECANE	C ₁₂ H ₂₆	Alkana
74	0,57	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
75	2,40	1-Hexadecene	C ₁₆ H ₃₂	Alkena
76	1,59	DODECANE	C ₁₂ H ₂₆	Alkana
77	0,25	2-Hexyl-1-octanol	C ₁₄ H ₃₀ O	Alkohol
78	0,21	1-Heptadecanol (CAS) n-Heptadecanol	C ₁₇ H ₃₆ O	Alkohol
79	0,73	Bicyclo 3.1.0 hexan-3-ol, 4-methylene-1-	C ₁₀ H ₁₆ O	Other O
80	0,53	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
81	1,75	1-Hexadecene	C ₁₆ H ₃₂	Alkena
82	1,36	Heptadecane (CAS) n-Heptadecane	C ₁₇ H ₃₆	Alkana
83	0,35	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
84	1,28	1-Octadecene	C ₁₈ H ₃₆	Alkena
85	1,16	Heptadecane (CAS) n-Heptadecane	C ₁₇ H ₃₆	Alkana
86	0,20	1-Decanol, 2-hexyl-	C ₁₆ H ₃₄ O	Alkohol

87	0,20	9-Octadecenoic acid (Z)- (CAS) Oleic acid	C ₁₈ H ₃₄ O ₂	Acid
88	0,28	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
89	1,03	1-Octadecene	C ₁₈ H ₃₆	Alkena
90	0,93	Eicosane	C ₂₀ H ₄₂	Alkana
91	0,18	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
92	0,76	1-Docosene	C ₂₂ H ₄₄	Alkena
93	1,39	2-Heptadecanone	C ₁₇ H ₃₄ O	Keton
94	0,41	Hexadecanoic acid (CAS) Palmitic acid	C ₁₆ H ₃₂ O ₂	Acid
95	0,21	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
96	0,64	1-Docosene	C ₂₂ H ₄₄	Alkena
97	0,53	Heptadecane	C ₁₇ H ₃₆	Alkana
98	0,21	2-Butanone, 4-cyclohexyl- (CAS) 4-Cyclohexyl-2- butanone	C ₁₀ H ₁₈ O	Keton
99	0,46	1-Docosene	C ₂₂ H ₄₄	Alkena
100	0,57	Eicosane (CAS) n-Eicosane	C ₂₀ H ₄₂	Alkana
101	0,41	1-Docosene	C ₂₂ H ₄₄	Alkena
102	0,33	Hexadecane	C ₁₆ H ₃₄	Alkana
103	0,56	1-Docosene	C ₂₂ H ₄₄	Alkena
104	0,46	1-Docosene	C ₂₂ H ₄₄	Alkena
105	0,38	1-Docosene	C ₂₂ H ₄₄	Alkena
106	0,32	Nonacosanol	C ₂₉ H ₆₀ O	Alkohol
107	0,28	Nonacosanol	C ₂₉ H ₆₀ O	Alkohol
108	0,25	2-Hexyl-1-decanol	C ₁₆ H ₃₄ O	Alkohol
109	0,23	Tetratetracontane (CAS) n- Tetratetracontane	C ₄₄ H ₉₀	Alkana
110	0,22	1-Pentacontanol	C ₅₀ H ₁₀₂ O	Alkohol

Lampiran 8. Penyusunan GC-MS 500°C

No	Area %	Nama	Formula	Nama
1	0,03	2,5-Dimethoxy-4- (methylsulfonyl)amphetamine	C ₁₂ H ₁₉ NO ₄ S	Other O
2	0,15	2-Butene, (Z)- (CAS) cis-2- Butene	C ₄ H ₈	Alkena
3	1,14	Butane, 1-chloro-3-methyl- (CAS) 1-Chloro-3- methylbutane	C ₅ H ₁₁ CL	Other O
4	0,07	Cyclopropane, methylmethylene	C ₅ H ₈	Cyclo Alkena
5	2,02	1-Hexene	C ₆ H ₁₂	Alkena
6	0,03	1,3-Butadiene, 2-ethyl-	C ₆ H ₁₀	Alkena
7	0,11	1,3-Pentadiene, 2-methyl-, (E)-	C ₆ H ₁₀	Alkena

8	0,38	Benzene (CAS) Phene	C ₆ H ₆	Aromatik
9	0,07	1,3,5-Hexatriene, (Z)-	C ₆ H ₈	Cyclo Alkena
10	0,17	Cyclohexene (CAS) Cyclohex-1-ene	C ₆ H ₁₀	Cyclo Alkena
11	1,45	1-Heptene	C ₇ H ₁₄	Alkena
12	1,16	Heptane	C ₇ H ₁₆	Alkana
13	0,22	2-Heptene, (E)- (CAS) trans-2-Heptene	C ₇ H ₁₄	Alkena
14	0,10	2-Heptene	C ₇ H ₁₄	Alkena
15	0,07	Cycloheptene	C ₇ H ₁₂	Cyclo Alkena
16	0,07	Cyclohexane, methyl-	C ₇ H ₁₄	Other H
17	0,08	4-Penten-1-ol, 3-methyl-	C ₆ H ₁₂ O	Other O
18	0,45	Benzene, methyl- (CAS) Toluene	C ₇ H ₈	Touluene
19	0,07	Cyclohexene, 1-methyl-	C ₇ H ₁₂	Cyclo Alkena
20	0,10	1,7-Octadiene (CAS) Octa-1,7-diene	C ₈ H ₁₄	Alkena
21	1,81	1-Octene (CAS) Caprylene	C ₈ H ₁₆	Alkena
22	0,99	Octane	C ₈ H ₁₈	Alkana
23	0,06	2-Octene, (E)- (CAS) E-2-Octene	C ₈ H ₁₆	Alkena
24	0,84	2,4-Dimethyl-1-heptene	C ₉ H ₁₈	Alkena
25	0,15	Benzene, ethyl- (CAS) EB	C ₈ H ₁₀	Other H
26	0,19	Benzene, 1,2-dimethyl- (CAS) o-Xylene	C ₈ H ₁₀	Other H
27	0,09	1,8-Nonadiene	C ₉ H ₁₉	Alkena
28	2,28	1-Nonene	C ₉ H ₁₈	Alkena
29	1,76	Nonane	C ₉ H ₂₀	Alkana
30	0,10	4-Nonene	C ₉ H ₁₈	Alkena
31	0,73	Phenol (CAS) Izal	C ₆ H ₆ O	Phenol
32	3,87	1-Decene	C ₁₀ H ₂₀	Alkena
33	1,87	Decane	C ₁₀ H ₂₂	Alkana
34	0,28	2-Decene, (E)-	C ₁₀ H ₂₀	Alkena
35	0,06	2-Decene, (Z)-	C ₁₀ H ₂₀	Alkena
36	0,13	1-Octanol, 3,7-dimethyl- (CAS) 3,7-Dimethyl-1-octanol	C ₁₀ H ₂₂ O	Alkohol
37	0,12	1-Decene, 2,4-dimethyl- (CAS)	C ₁₂ H ₂₄	alkena
38	0,57	1,6-Octadiene (CAS) 2,7-Octadiene	C ₈ H ₁₄	Alkena
39	3,84	1-Undecene	C ₁₁ H ₂₂	Alkena
40	5,54	Undecane	C ₁₁ H ₂₄	Alkana
41	0,54	5-Undecene, (E)-	C ₁₁ H ₂₂	Alkena
42	0,05	1-METHYL-PYRROLO(1,2-A)PYRAZINE	C ₈ H ₈ N ₂	Other O

43	0,15	2-Undecene, (E)-	C ₁₁ H ₂₂	Alkena
44	0,43	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
45	0,46	Naphthalene	C ₁₀ H ₈	PAH
46	2,95	1-Dodecene (CAS) Adacene 12	C ₁₂ H ₂₄	Alkena
47	2,89	Dodecane (CAS) n-Dodecane	C ₁₂ H ₂₆	Alkana
48	1,46	4-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena
49	3,11	Octanoic Acid	C ₈ H ₁₆ O ₂	Acid
50	0,26	Benzene, hexyl- (CAS) 1- Phenylhexane	C ₁₂ H ₁₈	Alkohol
51	0,17	2-Hexen-1-ol, 2-ethyl- (CAS)	C ₈ H ₁₆ O	Acid
52	0,59	Nonanoic acid (CAS) Nonoic acid	C ₉ H ₁₈ O ₂	Acid
53	0,34	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
54	2,45	1-Dodecene (CAS) Adacene 12	C ₁₂ H ₂₄	Alkena
55	3,66	Tridecane (CAS) n-Tridecane	C ₁₃ H ₂₈	Alkana
56	0,21	5-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena
57	0,08	1-Octanol, 2-butyl-	C ₁₂ H ₂₆ O	Alkohol
58	0,10	Cyclopropane, octyl-	C ₁₁ H ₂₂	Alkena
59	0,24	1-Hexanol, 2-ethyl-2-propyl-	C ₁₁ H ₂₄ O	Alkohol
60	0,21	Benzene, heptyl-	C ₁₃ H ₂₀	Other H
61	0,39	.ALPHA.-CITRONELLOL	C ₁₀ H ₂₀ O	Alkohol
62	2,91	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
63	3,83	1-Pentadecene (CAS) Pentadec-1-ene	C ₁₅ H ₃₀	Alkena
64	0,99	Dodecane (CAS) n-Dodecane	C ₁₂ H ₂₆	Alkana
65	0,12	5-Tetradecene, (E)-	C ₁₄ H ₂₈	Alkena
66	0,27	Dodecanal	C ₁₂ H ₂₄ O	Aldehit
67	0,06	1-Tetradecene (CAS) n- Tetradec-1-ene	C ₁₄ H ₂₈	Alkena
68	0,06	2-Nonen-1-ol, (E)- (CAS) trans-2-Nonenol	C ₉ H ₁₈ O	Other O
69	0,09	Cyclotetradecane	C ₁₄ H ₂₈	Cyclo Alkana
70	0,07	9,12-Octadecadienoic acid (Z,Z)-, phenylmethyl ester	C ₂₅ H ₃₈ O ₂	Other O
71	0,32	1,13-Tetradecadiene	C ₁₄ H ₂₆	Alkena
72	1,51	1-Tetradecene	C ₁₄ H ₂₈	Alkena
73	1,31	2-Undecanone	C ₁₁ H ₂₂ O	Ketone
74	2,71	Heptadecane (CAS) n- Heptadecane	C ₁₇ H ₃₆	Alkana
75	0,11	5-Dodecene, (E)-	C ₁₂ H ₂₄	Alkena
76	0,13	1-Hexadecene (CAS) Cetene	C ₁₆ H ₃₂	Alkena

77	0,04	Tetradecanoic acid, 12-methyl-, methyl ester	C ₁₆ H ₃₂ O ₂	Asam
78	0,06	Octadecane, 1-chloro-	C ₁₈ H ₃₇ CL	Other O
79	0,13	Dodecylcyclohexane	C ₁₈ H ₃₆	Other H
80	8,07	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
81	5,36	1-Hexadecene (CAS) Cetene	C ₁₆ H ₃₂	Alkena
82	1,95	Dodecanoic acid (CAS) Lauric acid	C ₁₂ H ₂₄ O ₂	Acid
83	0,80	Pentadecane (CAS) n-Pentadecane	C ₁₅ H ₃₂ O ₂	Alkana
84	0,20	Cyclopentane, 1-methyl-3-(2-methylpropyl)-	C ₁₀ H ₂₀	Other H
85	0,31	Undecanal	C ₁₁ H ₂₂ O	Aldehyd
86	0,55	Allyl nonanoate	C ₁₂ H ₂₂ O ₂	Other O
87	0,30	1-Undecanol (CAS) n-Undecanol	C ₁₁ H ₂₄ O	Alkena
88	0,68	9-Octadecen-1-ol, (Z)- (CAS) cis-9-Octadecen-1-ol	C ₁₈ H ₃₆ O	Alkohol
89	0,88	1-Hexadecene	C ₁₆ H ₃₂	Alkena
90	1,65	Heptadecane (CAS) n-Heptadecane	C ₁₇ H ₃₆	Alkana
91	0,07	2-Tridecen-1-ol, (E)-	C ₁₃ H ₂₆ O	Alkohol
92	0,05	1-Hexadecene	C ₁₆ H ₃₂	Alkena
93	0,05	1-Heptacosanol	C ₂₇ H ₅₆ O	Alkohol
94	1,61	Tetradecanoic acid	C ₁₄ H ₂₈ O ₂	Acid
95	0,33	1-Octadecene	C ₁₈ H ₃₆	Alkena
96	0,43	1,12-Tridecadiene	C ₁₃ H ₂₄	Alkena
97	0,72	1-Hexadecene	C ₁₆ H ₃₂	Alkena
98	0,54	Heptadecane (CAS) n-Heptadecane	C ₁₇ H ₃₆	Alkana
99	0,05	1-Tridecanol	C ₁₃ H ₂₈ O	Alkohol
100	0,09	Dodecanoic acid, ethenyl ester	C ₁₄ H ₂₆ O ₂	Other O
101	0,34	9-Octadecanone	C ₁₈ H ₃₆ O	Ketone
102	0,24	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
103	0,50	1-Hexadecene	C ₁₆ H ₃₂	Alkena
104	0,73	Pentacosane	C ₂₅ H ₅₂	Alkana
105	0,43	1-Docosene	C ₂₂ H ₄₄	Alkena
106	0,21	10-Heneicosene (c,t)	C ₂₁ H ₄₂	Alkena
107	0,08	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol
108	0,41	1-Eicosene	C ₂₀ H ₄₀	Alkena
109	0,36	Heptadecane (CAS) n-Heptadecane	C ₁₇ H ₃₆	Alkana
110	0,68	8-Pentadecanone	C ₁₅ H ₃₀ O	Ketone
111	0,11	1,15-Pentadecanediol	C ₁₅ H ₃₂ O ₂	Alkohol

112	0,26	1-Nonadecene	C ₁₉ H ₃₈	Alkena
113	0,19	Heptadecane (CAS) n- Heptadecane	C ₁₇ H ₃₆	Alkana
114	0,20	1-Docosene	C ₂₂ H ₄₄	Alkena
115	0,12	10-Heneicosene (c,t)	C ₂₁ H ₄₂	Alkena
116	0,33	1-Nonadecene	C ₁₉ H ₃₈	alkena
117	0,23	Hexadecane (CAS) n- Hexadecane	C ₁₆ H ₃₄	Alkana
118	0,35	9-Octadecanone	C ₁₈ H ₃₆ O	Ketone
119	0,21	10-Heneicosene (c,t)	C ₂₁ H ₄₂	Alkena
120	0,14	Hexadecane	C ₁₆ H ₃₄	Alkana
121	0,17	1-Docosene	C ₂₂ H ₄₄	Alkena
122	0,34	12-Tricosanone	C ₂₃ H ₄₆ O	Ketone

Lampiran 9. GC-MS temperatur 400°C

C:\GCMSsolution\Data\Project1\hp5 14 juni 2017\Andrea temp 400 .qgd

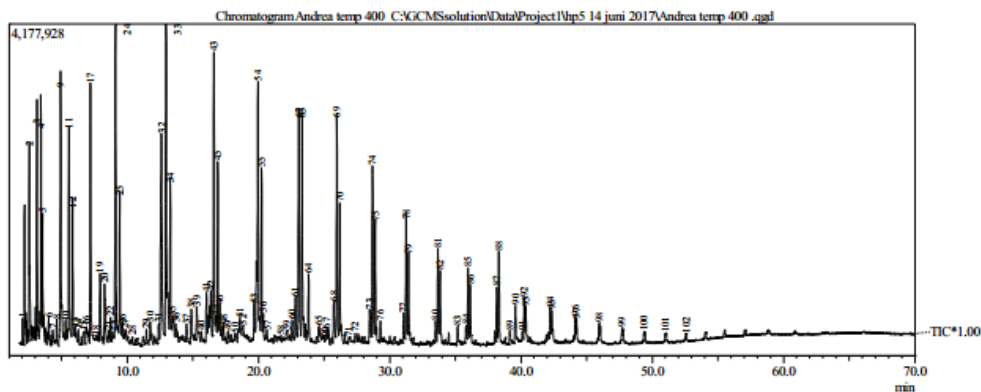
8/2



Lab. Kimia Organik FMIPA - UGM

Sample Information

Analyzed by : Admin
 Sample Name : Andrea temp 400
 Sample ID : 08.17.04.03
 Data File : C:\GCMSsolution\Data\Project1\hp5 14 juni 2017\Andrea temp 400 .qgd
 Method File : C:\GCMSsolution\Data\Project1\hp5 14 juni 2017\pyrolysis.qm
 Tuning File : C:\GCMSsolution\System1\Tune1\juni 21 2017.qgt



Peak#	R.Time	L.Time	F.Time	Area	Area%	Height	Name
1	2.043	1.992	2.142	845394	0.19	331551	METHYLCYCLOPROPANE
2	2.550	2.508	2.758	8690737	1.95	2060814	1-Hexene
3	3.130	2.925	3.308	10715358	2.40	2833993	1,3-Hexadiene-5-yne
4	3.439	3.308	3.508	9301358	2.09	2925156	1-Heptene
5	3.558	3.508	3.758	5995206	1.35	1649059	Heptane
6	4.030	3.875	4.158	1856493	0.42	345381	Cyclohexene, methyl-
7	4.336	4.275	4.425	899827	0.20	175887	Cyclohexene, 4-methyl-
8	4.640	4.425	4.758	1631247	0.37	325432	4-Penten-1-ol, 3-methyl- (CAS) 1-PENTEN-5-OL, 3-METHYL-
9	4.938	4.758	5.392	17500267	3.93	3347198	Toluene
10	5.325	5.258	5.392	836840	0.19	243521	Cyclooctene, 4-ethenyl-
11	5.574	5.392	5.775	11977426	2.69	2744328	1-Octene (CAS) Caprylene
12	5.846	5.775	5.975	7185488	1.61	1765216	Octane
13	6.042	5.975	6.208	1785599	0.40	230940	2-Octene, (E)-
14	6.287	6.208	6.392	974031	0.22	197426	2-Octene, (Z)-
15	6.694	6.575	6.792	1313740	0.29	174231	Cyclooctene
16	6.882	6.792	7.125	2672106	0.60	232646	2-Furancarboxaldehyde (CAS) Furfural
17	7.207	7.125	7.442	13367741	3.00	3302176	2,4-Dimethyl-1-heptene
18	7.642	7.442	7.875	2370740	0.53	122224	2,4-Octadiene
19	7.945	7.875	8.058	3821417	0.86	884819	Ethylbenzene
20	8.282	8.192	8.458	5103267	1.14	746809	Benzene, 1,2-dimethyl- (CAS) o-Xylene
21	8.599	8.458	8.692	1435465	0.32	177059	Cyclohexanemethanol (CAS) Cyclohexylmethanol
22	8.742	8.692	8.808	1271923	0.29	353775	1,8-Nonadiene
23	8.892	8.808	9.025	1490150	0.33	166646	1-Heptene, 3-methyl- (CAS) 3-Methyl-1-heptene
24	9.116	9.025	9.292	18831823	4.22	3858360	1-Nonene
25	9.440	9.292	9.575	8848724	1.99	1905677	Nonane
26	9.642	9.575	9.692	1282297	0.29	278500	4-Nonene
27	9.846	9.692	9.992	2321770	0.52	196195	Cyclohexane, 2-propenyl-
28	10.410	10.192	10.525	891608	0.20	108764	1,8-Nonadiene
29	11.466	11.358	11.625	1071887	0.24	188500	Benzene, propyl-
30	11.764	11.625	11.975	2180731	0.49	275389	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene
31	12.412	12.292	12.475	1249319	0.28	256723	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene
32	12.617	12.475	12.858	19096317	4.28	2601662	Phenol (CAS) Iral
33	12.969	12.858	13.208	21770523	4.88	3911765	1-Decene (CAS) Deco-1-ene
34	13.289	13.208	13.375	7970305	1.79	2043463	Decane
35	13.472	13.375	13.642	3336249	0.75	329941	5-Decene, (E)-
36	13.692	13.642	13.942	1867831	0.42	233740	Nonane, 2,6-dimethyl-
37	14.529	14.442	14.775	1265229	0.28	232250	Benzene, 1-propenyl- (CAS) Propenylbenzene
38	14.894	14.775	15.075	2556445	0.57	435887	INDENE
39	15.312	15.075	15.592	4502586	1.01	461628	Phenol, 2-methyl- (CAS) o-Cresol
40	15.660	15.592	15.792	922921	0.21	152754	Benzeneacetaldehyde, alpha-methyl-
41	16.047	15.792	16.142	3613568	0.81	627651	Hexadecane, 1-chloro-
42	16.382	16.142	16.475	6694500	1.50	644028	Mesquinal
43	16.617	16.475	16.708	15749464	3.53	3443527	1-Undecene (CAS) n-1-Undecene
44	16.758	16.708	16.842	1963651	0.44	333576	1,6-Heptadiene, 3-methyl- (CAS)
45	16.910	16.842	16.992	8543063	1.92	2251617	Undecane
46	17.055	16.992	17.125	2132911	0.48	483244	5-Undecene, (E)-
47	17.192	17.125	17.275	1020467	0.23	196505	Benzofuran, 2-methyl-
48	17.348	17.275	17.442	1086804	0.24	232105	2-Undecene, (E)-
49	17.688	17.558	17.842	1040628	0.23	144288	Octadecane, 1-(ethenyl-)
50	18.253	18.008	18.375	1194807	0.27	104192	Benzene, (1-cyclopropyl-1-methyl)ethyl-
51	18.589	18.375	18.708	3091142	0.69	298761	Benzene, (1-methyl-2-cyclopropen-1-yl)- (CAS) CYCLOPROPENE, 3-METHYL-3-PHENYL
52	18.834	18.708	19.008	2262646	0.51	206592	Benzene, (1-methyleno-2-propenyl)-
53	19.680	19.358	19.775	2861928	0.64	500242	1,9-Decadiene
54	19.973	19.775	20.158	20539237	4.61	3269917	1-Dodecene (CAS) Adacene 12
55	20.242	20.158	20.325	8281893	1.86	2165146	Dodecane
56	20.376	20.325	20.458	1372206	0.31	346012	5-Dodecene, (E)- (CAS)
57	20.658	20.458	20.742	831096	0.19	130117	4-Dodecene, (E)-
58	21.692	21.392	21.758	1042489	0.23	76889	Dodecane, 2,6,11-trimethyl-
59	22.178	22.008	22.342	973106	0.22	116054	DIBYDRO-CARVEOL, MAIN PEAK

Peak#	R.Time	L.Time	F.Time	Area	Area%	Height	Name
60	22.576	22.508	22.708	1233353	0.28	255352	Benzene, 1,4-dimethoxy-2-methyl-
61	22.821	22.708	22.925	2715357	0.61	541012	1,13-Tetradecadiene
62	23.080	22.925	23.242	12921609	2.90	2796703	1-Pentadecene (CAS) Pentadec-1-ene
63	23.331	23.242	23.658	12966720	2.91	2757485	DECANE
64	23.824	23.658	23.975	3942258	0.88	844550	1-Heptadecene (CAS) Hexahydroptolaxene
65	24.600	24.525	24.792	1854444	0.42	200897	1-Hexacosanol (CAS) HEXACOSANOL-1
66	24.958	24.792	25.025	932521	0.21	82291	Nonane, 3-bromo-1,1-dichloro-
67	25.224	25.025	25.292	1600576	0.36	189990	Hexadecane, 1-chloro-
68	25.744	25.642	25.875	3098810	0.70	537974	1,13-Tetradecadiene
69	25.980	25.875	26.125	12538098	2.81	2814077	1-Pentadecene (CAS) Pentadec-1-ene
70	26.200	26.125	26.492	8282436	1.86	1682502	DODECANE
71	26.875	26.658	27.308	1328457	0.30	80050	Undecane, 1,2-dibromo-2-methyl-
72	27.378	27.308	27.525	991634	0.22	129525	4(1H)-isobenzofuranone, hexahydro-3a,7a-dimethyl-, cis(-,*)-(CAS) 2.ALPHA.,3.ALPHA.4
73	28.481	28.258	28.592	2266059	0.51	406304	1,13-Tetradecadiene
74	28.695	28.592	28.825	9974780	2.24	2165801	1-Pentadecene (CAS) Pentadec-1-ene
75	28.897	28.825	29.175	6466170	1.45	1501389	DODECANE
76	29.303	29.225	29.375	977324	0.22	254524	1-Decanol, 2-hexyl-
77	31.063	30.975	31.158	1896301	0.43	372856	1,15-Pentadecanediol
78	31.254	31.158	31.375	6932355	1.56	1594952	1-Hexadecene
79	31.438	31.375	31.725	5181898	1.16	1139813	pentadecane
80	33.502	33.392	33.592	1137902	0.26	257330	1,15-Pentadecanediol
81	33.678	33.592	33.742	4666486	1.05	1177075	1-Hexadecene
82	33.844	33.742	33.992	4234392	0.95	896634	Pentadecane
83	35.184	35.075	35.258	1007210	0.23	210392	9-Octadecenoic acid (Z)- (CAS) Oleic acid
84	35.819	35.692	35.875	986885	0.22	213859	1,15-Pentadecanediol
85	35.976	35.875	36.058	3920387	0.88	943497	1-Octadecene
86	36.130	36.058	36.308	3431804	0.77	733234	Eicosane (CAS) n-Eicosane
87	38.166	38.092	38.242	2807118	0.63	669302	1-Docosene
88	38.318	38.242	38.508	5246655	1.18	1114350	2-Heptadecanone
89	39.155	39.025	39.325	1059598	0.24	168722	1-Hexadecanol
90	39.583	39.325	39.825	3006865	0.67	465388	Hexadecanoic acid (CAS) Palmitic acid
91	40.108	39.825	40.175	971019	0.22	136632	1,15-Pentadecanediol
92	40.249	40.175	40.308	2424249	0.54	542014	1-Docosene
93	40.373	40.308	40.575	2123959	0.48	442089	pentadecane
94	42.235	42.175	42.292	1768650	0.40	430505	1-Docosene
95	42.351	42.292	42.558	2269917	0.51	381276	PENTADECANE, 2,6,10-TRIMETHYL-
96	44.138	44.075	44.192	1165893	0.26	303255	1-Docosene
97	44.242	44.192	44.458	1099514	0.25	268726	Heptadecane
98	45.955	45.792	46.258	2362436	0.53	253485	1-Docosene
99	47.700	47.575	47.975	1461810	0.33	172681	1-Docosene
100	49.378	49.225	49.592	1260424	0.28	140480	1-Docosene
101	50.992	50.825	51.208	1058864	0.24	116649	Nonacosanol
102	52.594	52.392	52.758	854628	0.19	95385	Tetraetracontane
				445731816	100.00	88858955	

Lampiran 10. GC-MS temperatur 450°C

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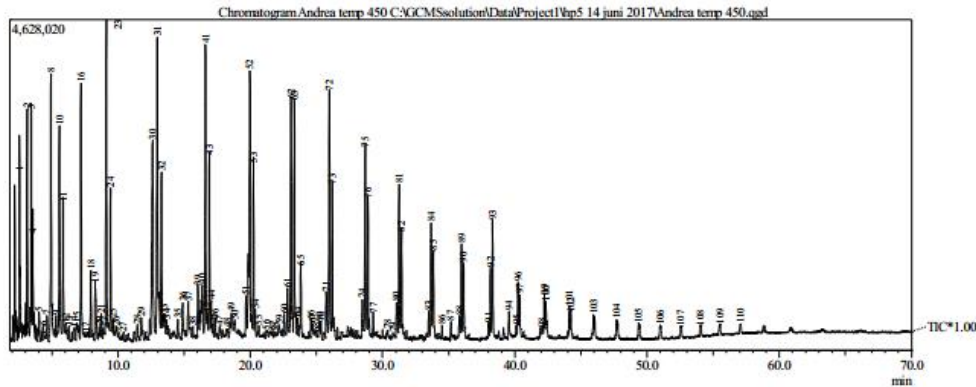
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Lab. Kimia Organik FMIPA - UGM

Sample Information

Analyzed by : Admin
 Sample Name : Andrea temp 450
 Sample ID : 08.17.04.04-04
 Data File : C:\GCMSSolution\Data\Project1\hp5 14 juni 2017\Andrea temp 450.qgd
 Method File : C:\GCMSSolution\Data\Project1\hp5 14 juni 2017\pyrolysis.qgm
 Tuning File : C:\GCMSSolution\System1\Tune1\juni 21 2017.qgt



Peak#	R.Time	I.Time	F.Time	Area	Area%	Height	Name
1	2.546	2.508	2.758	8677248	1.67	2452984	1-Hexene
2	3.126	2.992	3.308	10419096	2.00	3209120	1,3-Hexadiene-5-yne
3	3.433	3.308	3.508	9679589	1.86	2819394	1-Heptene
4	3.554	3.508	3.742	5874860	1.13	1641491	Heptane
5	4.025	3.875	4.158	2070584	0.40	408536	Cyclohexane, methyl-
6	4.328	4.258	4.425	1221230	0.23	218055	Cyclohexene, 4-methyl-
7	4.632	4.425	4.742	1999188	0.38	348472	1-Decyne
8	4.929	4.758	5.375	18296552	3.51	3643267	Toluene
9	5.309	5.242	5.375	954974	0.18	287359	1,4-Octadiene, c&t
10	5.566	5.375	5.775	13069208	2.51	2809635	1-Octene (CAS) Caprylene
11	5.840	5.775	5.992	7912137	1.52	1985995	Octane
12	6.025	5.992	6.192	1585782	0.30	249280	2-Octene, (E)-
13	6.276	6.192	6.375	1026293	0.20	211211	2-Octene
14	6.697	6.375	6.792	1956028	0.38	183455	Spiropentane, butyl- (CAS) 2-BUTYLSPIROPENTANE
15	6.873	6.792	7.108	2911988	0.56	256262	2-Furancarboxaldehyde (CAS) Furfural
16	7.200	7.108	7.442	14585041	2.80	3390001	2,4-Dimethyl-1-heptene
17	7.608	7.442	7.875	2455684	0.47	111043	4-(2-BROMETHYL)-CYCLOHEXENE
18	7.936	7.875	8.058	4192161	0.81	985119	Ethylbenzene
19	8.274	8.192	8.458	5603692	1.08	839444	Benzene, 1,2-dimethyl- (CAS) o-Xylene
20	8.591	8.458	8.675	1501340	0.29	205711	Cyclohexanemethanol (CAS) Cyclohexylmethanol
21	8.733	8.675	8.808	1448489	0.28	365392	Cyclopropane, 1,1'-(1,2-ethanediyldi)- (CAS) Ethane, 1,2-dicyclopropyl-
22	8.884	8.808	8.942	1082792	0.21	182937	1-Heptene, 3-methyl- (CAS) 3-Methyl-1-heptene
23	9.109	8.942	9.225	20445199	3.93	4429250	1-Nonene
24	9.433	9.225	9.575	10404509	2.00	1984787	Dodecane (CAS) n-Dodecane
25	9.625	9.575	9.692	1311366	0.25	310005	4-Nonene
26	9.838	9.692	9.975	2406870	0.46	214653	Cyclohexane, 2-propenyl-
27	10.399	10.175	10.542	1058982	0.20	121768	1,8-Nomadiene
28	11.459	11.342	11.608	1279638	0.25	226471	Benzene, propyl-
29	11.757	11.608	11.958	2504732	0.48	316735	Benzene, 1-ethyl-2-methyl- (CAS) o-Ethyltoluene
30	12.615	12.275	12.842	22349920	4.29	2737381	Phenol (CAS) lral
31	12.966	12.842	13.208	23501308	4.51	4081301	1-Decene (CAS) Dec-1-ene
32	13.285	13.208	13.375	8613471	1.65	2200935	Decane (CAS) n-Decane
33	13.466	13.375	13.625	3233911	0.62	332062	5-Decene, (E)-
34	13.687	13.625	13.808	1561424	0.30	251217	Nonane, 2,6-dimethyl-
35	14.520	14.425	14.775	1490885	0.29	271706	Benzene, 1-propenyl- (CAS) Propenylbenzene
36	14.887	14.775	15.042	2768979	0.53	500167	INDENE
37	15.306	15.192	15.575	4425514	0.85	529814	3-Octen-1-yne, (E)-
38	15.650	15.575	15.742	956825	0.18	170179	Benzeneacetaldehyde, alpha-methyl-
39	16.041	15.742	16.142	4309949	0.83	758523	1-Octanol, 3,7-dimethyl- (CAS) 3,7-Dimethyl-1-octanol
40	16.376	16.142	16.475	7605897	1.46	758507	Mequinol
41	16.612	16.475	16.708	17777055	3.42	3981240	1-Undecene (CAS) n-1-Undecene
42	16.758	16.708	16.825	1789869	0.34	355071	1,9-Decadiene
43	16.906	16.825	16.992	9837318	1.89	2590991	Undecane
44	17.049	16.992	17.125	2224961	0.43	506992	5-Undecene, (E)-
45	17.187	17.125	17.275	1015685	0.20	211156	Benzofuran, 2-methyl- (CAS) 2-Methylbenzofuran
46	17.342	17.275	17.425	1163801	0.22	271352	2-Undecene, (E)-
47	17.680	17.558	17.825	1277094	0.25	169236	1-Undecene, 7-methyl- (CAS)
48	18.242	18.008	18.375	1522684	0.29	129884	Benzene, (1-cyclopropyl-1-methylethyl)- (CAS) 2-CYCLOPROPYL-2-PHENYLPROPANE
49	18.579	18.375	18.708	3723888	0.72	344609	Benzene, (1-methyl-2-cyclopropen-1-yl)- (CAS) CYCLOPROPENE, 3-METHYL-3-PHENYL-
50	18.823	18.708	19.008	2593602	0.50	249741	Benzene, (1-methylene-2-propenyl)-
51	19.675	19.575	19.758	2706401	0.52	568161	1,9-Decadiene
52	19.970	19.758	20.158	22911906	4.40	3606355	1-Dodecane (CAS) Adiacene 12
53	20.239	20.158	20.308	9258640	1.78	2470387	Dodecane (CAS) n-Dodecane
54	20.371	20.308	20.458	1490984	0.29	384016	5-Dodecene, (E)-
55	20.646	20.458	20.725	913920	0.18	156200	4-Dodecene, (E)-
56	21.210	21.108	21.392	974531	0.19	105789	1-Octanol, 2-butyl- (CAS) 2-Butyl-1-octanol
57	21.686	21.392	21.742	1304983	0.25	92759	DECANE, 2,3,5,8-TETRAMETHYL-
58	21.858	21.742	22.075	935405	0.18	74786	Phenethyl alcohol, alpha-butyl-beta-methyl- (CAS)
59	22.174	22.075	22.342	1664516	0.32	179641	2-Hexen-1-ol, 2-ethyl- (CAS)

Peak#	R.Time	L.Time	F.Time	Area	Area%	Height	Name
60	22.570	22.492	22.692	1747820	0.34	326298	Benzene, 1,4-dimethoxy-2-methyl-
61	22.817	22.692	22.942	3662422	0.70	665349	1,13-Tetradecadiene
62	23.081	22.942	23.242	15242130	2.93	3244750	1-Pentadecene (CAS) Pentadec-1-ene
63	23.332	23.242	23.525	14935342	2.87	3204716	Tridecane, 4,8-dimethyl-
64	23.575	23.525	23.642	971004	0.19	268821	1-Undecene, 7-methyl- (CAS)
65	23.821	23.642	23.942	4906451	0.94	1031566	1-Heptadecene (CAS) Hexahydroplotaxene
66	24.596	24.525	24.642	1013435	0.19	254971	1-Undecene, 7-methyl- (CAS)
67	24.692	24.642	24.792	1157108	0.22	202344	Phenol, 2,6-dimethoxy- (CAS) 2,6-Dimethoxyphenol
68	24.958	24.792	25.025	1070424	0.21	92758	Cetylpyridinium Chloride
69	25.223	25.025	25.292	1927712	0.37	228641	Hexadecane, 1-chloro-
70	25.342	25.292	25.442	928421	0.18	236093	GERMACRANE-B
71	25.739	25.642	25.875	3792699	0.73	670579	1,13-Tetradecadiene
72	25.982	25.875	26.125	15160956	2.91	3351831	1-Pentadecene (CAS) Pentadec-1-ene
73	26.198	26.125	26.492	9974674	1.92	2118604	DODECANE
74	28.477	28.242	28.592	2971058	0.57	537356	1,13-Tetradecadiene
75	28.696	28.592	28.825	12481705	2.40	2646362	1-Hexadecene
76	28.897	28.825	29.158	8278051	1.59	1918674	DODECANE
77	29.297	29.208	29.392	1277638	0.25	332216	2-Hexyl-1-octanol
78	30.373	30.208	30.475	1098787	0.21	122619	1-Heptadecanol (CAS) n-1heptadecanol
79	30.792	30.475	30.975	992185	0.19	86713	Bicyclo 3.1.0 hexan-3-ol, 4-methylene-1-(1-methylethyl)-, (1.alpha.,3.alpha.,5.alpha.)-
80	31.061	30.975	31.158	2745969	0.53	510234	1,15-Pentadecanediol
81	31.254	31.158	31.358	9123108	1.75	2102836	1-Hexadecene
82	31.438	31.358	31.708	7091961	1.36	1528409	Heptadecane (CAS) n-Heptadecane
83	33.497	33.392	33.575	1832196	0.35	391313	1,15-Pentadecanediol
84	33.676	33.575	33.742	6667295	1.28	1618397	1-Octadecene
85	33.843	33.742	33.992	6037980	1.16	1239255	Heptadecane (CAS) n-Heptadecane
86	34.499	34.275	34.658	1054636	0.20	198038	1-Decanol, 2-hexyl-
87	35.174	35.058	35.242	1051215	0.20	236728	9-Octadecenoic acid (Z)- (CAS) Oleic acid
88	35.814	35.692	35.875	1466224	0.28	308403	1,15-Pentadecanediol
89	35.974	35.875	36.042	5384766	1.03	1315747	1-Octadecene
90	36.127	36.042	36.308	4853870	0.93	1042688	Eicosane
91	38.013	37.858	38.075	913717	0.18	210709	1,15-Pentadecanediol
92	38.161	38.075	38.242	3953045	0.76	954131	1-Docosene
93	38.316	38.242	38.492	7239065	1.39	1574071	2-Heptadecanone
94	39.564	39.275	39.658	2115756	0.41	373143	Hexadecanoic acid (CAS) Palmitic acid
95	40.111	39.808	40.158	1103468	0.21	181210	1,15-Pentadecanediol
96	40.244	40.158	40.308	3308064	0.64	765060	1-Docosene
97	40.371	40.308	40.542	2746505	0.53	581761	Heptadecane
98	42.058	41.992	42.158	1113008	0.21	125109	2-Butanone, 4-cyclohexyl- (CAS) 4-Cyclohexyl-2-butanone
99	42.232	42.158	42.292	2403339	0.46	553585	1-Docosene
100	42.345	42.292	42.542	2979896	0.57	504873	Eicosane (CAS) n-Eicosane
101	44.129	43.892	44.175	2157486	0.41	440514	1-Docosene
102	44.242	44.175	44.392	1740877	0.33	364281	Hexadecane
103	45.951	45.775	46.225	2909702	0.56	325453	1-Docosene
104	47.695	47.508	47.975	2375045	0.46	263807	1-Docosene
105	49.366	49.175	49.608	1979019	0.38	213500	1-Docosene
106	50.984	50.825	51.192	1661361	0.32	181263	Nonacosanol
107	52.539	52.358	52.758	1481346	0.28	161239	Nonacosanol
108	54.031	53.892	54.242	1301034	0.25	155184	2-Hexyl-1-decanol
109	55.520	55.358	55.675	1193563	0.23	149583	Tetratetracontane (CAS) n-Tetratetracontane
110	57.061	56.892	57.242	1124547	0.22	132835	1-Pentacontanol
				520539663	100.00	103672610	

Lampiran 11. GC-MS temperatur 500°C

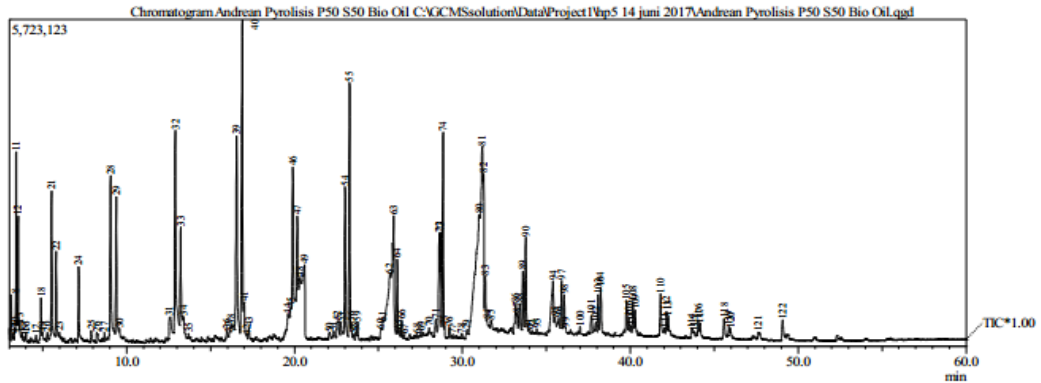
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Lab. Kimia Organik FMIPA - UGM

Sample Information

Analyzed by : Admin
 Sample Name : Andrean Pyrolysis P50 S50 Bio Oil
 Sample ID :
 Data File : C:\GCMSsolution\Data\Project1\hp5 14 juni 2017\Andrean Pyrolysis P50 S50 Bio Oil.qgd
 Method File : C:\GCMSsolution\Data\Project1\hp5 14 juni 2017\pyrolysis.qgm
 Tuning File : C:\GCMSsolution\System1\Tune1\juni 21 2017.qgt



Peak#	R.Time	L.Time	F.Time	Area	Area%	Height	Name
1	1.942	1.900	2.000	171392	0.03	29360	2,5-Dimethoxy-4-(methylsulfonyl)amphetamine
2	2.033	2.000	2.125	799531	0.15	424198	2-Butene, (Z)- (CAS) cis-2-Butene
3	2.175	2.125	2.358	5932634	1.14	2293858	Butane, 1-chloro-3-methyl- (CAS) 1-Chloro-3-methylbutane
4	2.392	2.358	2.408	341289	0.07	209208	Cyclopropane, methylmethylene-
5	2.535	2.408	2.750	10486126	2.02	3590487	1-Hexene
6	2.683	2.658	2.717	167090	0.03	124256	1,3-Butadiene, 2-ethyl-
7	3.006	2.967	3.075	561732	0.11	218177	1,3-Pentadiene, 2-methyl-, (E)-
8	3.111	3.075	3.175	1951286	0.38	811754	Benzene (CAS) Phenol
9	3.208	3.175	3.275	356574	0.07	124180	1,3,5-Hexatriene, (Z)-
10	3.333	3.275	3.375	856763	0.17	243578	Cyclohexene (CAS) Cyclohex-1-ene
11	3.413	3.375	3.467	7549887	1.45	3311799	1-Heptene
12	3.531	3.467	3.600	6006569	1.16	2187971	Heptane
13	3.633	3.600	3.717	1164483	0.22	311342	2-Heptene, (E)- (CAS) trans-2-Heptene
14	3.762	3.717	3.842	506306	0.10	145685	2-Heptene
15	3.922	3.842	3.958	350435	0.07	87376	Cycloheptene
16	3.998	3.958	4.042	384734	0.07	158443	Cyclohexane, methyl-
17	4.599	4.542	4.683	412581	0.08	123823	4-Penten-1-ol, 3-methyl-
18	4.895	4.783	4.950	2360512	0.45	726137	Benzene, methyl- (CAS) Toluene
19	4.983	4.950	5.050	373933	0.07	132375	Cyclohexene, 1-methyl-
20	5.273	5.200	5.333	540122	0.10	154758	1,7-Octadiene (CAS) Octa-1,7-diene
21	5.526	5.333	5.733	9391930	1.81	2616129	1-Octene (CAS) Caprylene
22	5.795	5.733	5.933	5153004	0.99	1537729	Octane
23	5.983	5.933	6.025	311554	0.06	108659	2-Octene, (E)- (CAS) E-2-Octene
24	7.140	7.067	7.292	4350958	0.84	1311449	2,4-Dimethyl-1-heptene
25	7.888	7.825	8.000	797251	0.15	208698	Benzene, ethyl- (CAS) EB
26	8.217	8.142	8.358	1004159	0.19	167068	Benzene, 1,2-dimethyl- (CAS) o-Xylene
27	8.678	8.625	8.742	451539	0.09	147988	1,8-Nonadiene
28	9.041	8.933	9.292	11847055	2.28	2812841	1-Nonene
29	9.376	9.292	9.525	9136322	1.76	2454785	Nonane
30	9.575	9.525	9.642	526630	0.10	143331	4-Nonene
31	12.559	12.475	12.775	3812691	0.73	385982	Phenol (CAS) Izal
32	12.897	12.775	13.142	20097766	3.87	3656171	1-Decene
33	13.216	13.142	13.367	9706362	1.87	1958716	Decane
34	13.392	13.367	13.567	1443413	0.28	382673	2-Decene, (E)-
35	13.692	13.567	13.750	303121	0.06	89346	2-Decene, (Z)-
36	15.967	15.900	16.067	698840	0.13	162252	1-Octanol, 3,7-dimethyl- (CAS) 3,7-Dimethyl-1-octanol
37	16.108	16.067	16.167	598686	0.12	112334	1-Decene, 2,4-dimethyl- (CAS)
38	16.212	16.167	16.408	2944787	0.57	243964	1,6-Octadiene (CAS) 2,7-Octadiene
39	16.548	16.408	16.758	19925246	3.84	3561779	1-Undecene
40	16.890	16.758	16.958	28784982	5.54	5593452	Undecane
41	16.997	16.958	17.117	2817943	0.54	648092	5-Undecene, (E)-
42	17.158	17.117	17.217	257173	0.05	64421	1-METHYL-PYRROLO(1,2-A)PYRAZINE
43	17.278	17.217	17.375	754327	0.15	212745	2-Undecene, (E)-
44	19.600	19.500	19.700	2248708	0.43	289048	1,13-Tetradecadiene
45	19.767	19.700	19.808	2387089	0.46	429866	Naphthalene
46	19.896	19.808	20.000	15312270	2.95	2905577	1-Dodecene (CAS) Adacene 12
47	20.164	20.000	20.250	15011154	2.89	2084830	Dodecane (CAS) n-Dodecane
48	20.314	20.250	20.383	7578716	1.46	1021573	4-Dodecene, (E)-
49	20.598	20.383	20.733	16121133	3.11	1290587	Octanoic Acid
50	22.042	21.967	22.275	1109075	0.21	113746	Benzene, hexyl- (CAS) 1-Phenylhexane
51	22.319	22.275	22.425	901952	0.17	143855	2-Hexen-1-ol, 2-ethyl- (CAS)
52	22.565	22.425	22.683	3088866	0.59	322256	Nonanoic acid (CAS) Nonoic acid
53	22.751	22.683	22.833	1771293	0.34	303155	1,13-Tetradecadiene
54	23.009	22.833	23.167	12725756	2.45	2681665	1-Dodecene (CAS) Adacene 12
55	23.278	23.167	23.342	18999863	3.66	4504960	Tridecane (CAS) n-Tridecane
56	23.375	23.342	23.450	1070223	0.21	311895	5-Dodecene, (E)-
57	23.508	23.450	23.592	426318	0.08	97569	1-Octanol, 2-butyl-
58	23.658	23.592	23.700	536481	0.10	150768	Cyclopropane, octyl-
59	23.750	23.700	23.858	1222883	0.24	313521	1-Hexanol, 2-ethyl-2-propyl- (CAS) 2 ETHYL-2-PROPYL-HEXANOL

Pak#	R.Time	L.Time	F.Time	Area	Area%	Height	Name
60	25.142	25.050	25.217	1102323	0.21	155238	Benzene, heptyl-
61	25.267	25.217	25.342	2049748	0.39	283668	.ALPHA.-CITRONELLOL
62	25.675	25.342	25.708	15092870	2.91	1124107	1,13-Tetradecadiene
63	25.903	25.708	26.050	19894386	3.83	2155139	1-Pentadecene (CAS) Pentadec-1-ene
64	26.121	26.050	26.192	5164513	0.99	1397184	Dodecane (CAS) n-Dodecane
65	26.233	26.192	26.292	615787	0.12	155776	5-Tetradecene, (E)-
66	26.382	26.292	26.467	1396346	0.27	336526	Dodecanal
67	26.519	26.467	26.600	326835	0.06	84384	1-Tetradecene (CAS) n-Tetradec-1-ene
68	27.282	27.217	27.358	297574	0.06	77396	2-Nonen-1-ol, (E)- (CAS) trans-2-Nonenol
69	27.521	27.358	27.583	489054	0.09	95698	Cyclotetradecane
70	28.017	27.967	28.108	352551	0.07	102202	9,12-Octadecadienoic acid (Z,Z)-, phenylmethyl ester
71	28.412	28.292	28.492	1644350	0.32	304121	1,13-Tetradecadiene
72	28.624	28.492	28.658	7858790	1.51	1820897	1-Tetradecene
73	28.702	28.658	28.758	6789762	1.31	1844976	2-Undecanone
74	28.847	28.758	28.900	14091715	2.71	3596542	Heptadecane (CAS) n-Heptadecane
75	28.933	28.900	28.983	588356	0.11	209703	5-Dodecene, (E)-
76	29.220	29.150	29.308	695719	0.13	187097	1-Hexadecene (CAS) Cetene
77	29.400	29.308	29.450	203680	0.04	63316	Tetradecanoic acid, 12-methyl-, methyl ester (CAS) Methyl 12-methyltetradecanoate
78	29.941	29.875	30.025	334832	0.06	82955	Octadecane, 1-chloro-
79	30.269	30.175	30.350	676660	0.13	122567	Dodecylcyclohexane
80	30.983	30.350	31.050	41888605	8.07	2084619	1,15-Pentadecanediol
81	31.180	31.050	31.225	27807595	5.36	3265822	1-Hexadecene (CAS) Cetene
82	31.271	31.225	31.308	10114559	1.95	2785126	Dodecanoic acid (CAS) Lauric acid
83	31.362	31.308	31.425	4164826	0.80	976650	Pentadecane (CAS) n-Pentadecane
84	31.467	31.425	31.533	1043464	0.20	211805	Cyclopentane, 1-methyl-3-(2-methylpropyl)- (CAS) CYCLOPENTANE, 3-ISOBUTYL-1-METHYL
85	31.695	31.533	31.842	1618993	0.31	179873	Undecanal
86	33.173	33.008	33.208	2843793	0.55	527548	Allyl nonanoate
87	33.250	33.208	33.308	1548580	0.30	361516	1-Undecanol (CAS) n-Undecanol
88	33.417	33.308	33.508	3527000	0.68	530242	9-Octadecen-1-ol, (Z)- (CAS) cis-9-Octadecen-1-ol
89	33.606	33.508	33.667	4555280	0.88	1099516	1-Hexadecene
90	33.774	33.667	33.908	8591477	1.65	1692018	Heptadecane (CAS) n-Heptadecane
91	33.967	33.908	34.033	380860	0.07	84548	2-Tridecen-1-ol, (E)-
92	34.158	34.033	34.200	251358	0.05	56560	1-Hexadecene
93	34.424	34.367	34.492	284610	0.05	92725	1-Heptacosanol
94	35.396	35.142	35.458	8373813	1.61	908931	Tetradecanoic acid
95	35.514	35.458	35.600	1705779	0.33	281221	1-Octadecene
96	35.736	35.600	35.825	2240683	0.43	270158	1,12-Tridecadiene
97	35.901	35.825	35.975	3730022	0.72	922085	1-Hexadecene
98	36.053	35.975	36.125	2793214	0.54	682099	Heptadecane (CAS) n-Heptadecane
99	36.150	36.125	36.225	282880	0.05	93219	1-Tridecanol
100	37.015	36.933	37.083	472664	0.09	129248	Dodecanoic acid, ethenyl ester (CAS) Vinyl dodecanoate
101	37.682	37.575	37.775	1745605	0.34	324356	9-Octadecanone
102	37.933	37.775	38.008	1234531	0.24	194861	1,15-Pentadecanediol
103	38.083	38.008	38.150	2598892	0.50	679211	1-Hexadecene
104	38.236	38.150	38.358	3814725	0.73	795765	Pentacosane
105	39.774	39.700	39.842	2213635	0.43	565290	1-Docosene
106	39.909	39.842	39.975	1069285	0.21	269985	10-Heneicosene (c,t)
107	40.033	39.975	40.092	435031	0.08	127931	1,15-Pentadecanediol
108	40.165	40.092	40.225	2134884	0.41	556927	1-Eicosene
109	40.291	40.225	40.442	1870705	0.36	424352	Heptadecane (CAS) n-Heptadecane
110	41.806	41.708	41.925	3529568	0.68	725541	8-Pentadecanone
111	42.033	41.925	42.092	582931	0.11	103582	1,15-Pentadecanediol
112	42.151	42.092	42.208	1336627	0.26	381289	1-Nonadecene
113	42.262	42.208	42.333	972537	0.19	284391	Heptadecane (CAS) n-Heptadecane
114	43.668	43.558	43.742	1025194	0.20	158275	1-Docosene
115	43.792	43.742	43.875	625894	0.12	115229	10-Heneicosene (c,t)
116	44.051	43.875	44.108	1695875	0.33	319597	1-Nonadecene
117	44.154	44.108	44.300	1180125	0.23	254051	Hexadecane (CAS) n-Hexadecane
118	45.586	45.483	45.717	1832463	0.35	344055	9-Octadecanone
119	45.869	45.717	45.925	1098268	0.21	205940	10-Heneicosene (c,t)
120	45.967	45.925	46.100	739255	0.14	175934	Hexadecane
121	47.625	47.558	47.842	903951	0.17	108801	1-Docosene
122	49.073	48.958	49.200	1768195	0.34	332646	12-Tricosanone
				519195580	100.00	99837270	

Lampiran 12. Produk Bio-oil



400°C



425°C



450°C



475°C



500°C