

Ca-based catalysts for the production of high-quality bio-oils from the catalytic co-pyrolysis of grape seeds and waste tyres

O. Sanahuja-Parejo¹, A. Veses¹, J.M. López¹, R. Murillo¹, M. S. Callén¹ and T. García¹, *

¹ Instituto de Carboquímica (ICB-CSIC), C/ Miguel Luesma Castán, 50018 Zaragoza, Spain

* Correspondence: tomas@icb.csic.es

Supplementary Materials

S.1 Pilot plant operation

A typical pyrolysis experiment comprises the following steps:

1. The selected feedstock/mixtures and catalysts + heat carrier is put inside each hoppers.
2. General services switch-on: the cooling water and natural gas valves of the flare are open. At this point, the condenser, screw feeders and flare are able to work in a safety way.
3. N₂ valve is open and the flows that will be used during the experiment are set in the mass flow controllers.
4. The screw conveyor inside the reactor is connected and the final rotating speed that will be used along the experiment is set in the frequency converter.
5. The power supply for the electrical resistances around the reactor is switched on and the system starts to be heated with a constant heating rate of 5 °C/min.
6. Once the desired temperature in the reactor is achieved, the feeding system of feedstock and catalyst starts.
7. The steady state conditions are achieved after 30 minutes (constant temperature and pressure profiles and stable flame in the flare). After this period, the liquids in the vessels are purged and weighed.
8. The experiment proceeds until the material that was introduced in the hopper is finished. In the meantime, 3 gas samples are collected and analysed in the gas chromatographs.
9. After all the material is fed, the heating continues during 15 extra minutes to be sure that all the material inside the reactor is converted. After that, the electrical resistances are switch off maintaining the rest of the systems on (cooling water, N₂ flow and flare).
10. When the system reaches room temperature, all the systems are switched off and the liquid and solid are purged and weighed to calculate yields and mass balance.
11. Solid and liquid samples are taken and stored for further analyses.
12. Some sections of the pilot plant are dismantled for cleaning and maintenance. After all this sequence, the pilot plant is ready for another experiment.

Table S1. Yields after Catalytic experiments of GS and WT using Ca-based-1 catalyst.

	Liquid (wt%)		Solid (wt%)			Gas (wt%)	Balance	Phase Distribution (wt%)	
	Org.	Aq.	Char	Coke	CO ₂			Org.	Aq.
GS : CaO	15.2 ± 0.8	28.1 ± 1.4	33.1 ± 1.6	0.27	0.9	17.6 ± 1.0	95.2	37.7	62.3
WT : CaO	36.6 ± 1.8	0.0 ± 0.0	38.7 ± 1.8	0.15	0.3	23.1 ± 2.1	98.7	100.0	0.0

Table S2. Liquid properties after the catalytic experiments of GS and WT using Ca-based-1 catalyst.

	Properties				Elemental analysis (wt.%)					
	H ₂ O (wt%)	pH	ν(mPa.s)	ρ(g/mL)	C	H	N	S	O	HHV (MJ/kg)
GSs	4.1 ± 0.6	8.3	85.3 ± 2.3	1.30 ± 0.10	76.8 ± 1.1	8.1 ± 0.3	2.8 ± 0.1	0.4 ± 0.01	11.8 ±	34.5 ± 1.6
WTs	<0.3 ± 0.0	8.4	3.3 ± 0.2	0.87 ± 0.02	89.4 ± 1.3	7.9 ± 0.2	1.2 ± 0.1	0.5 ± 0.02	1.0 ± 0.1	42.3 ± 1.8

Table S3. Ultimate composition of the aqueous fraction after catalytic co-pyrolysis experiments

	Elemental analysis (wt.%)				
	C	H	N	S	O
GSs/WTs(80/20)	5.3 ± 0.3	11.0 ± 0.5	2.0 ± 0.1	0.0 ± 0.0	81.7 ± 1.5
Ca-based-1	4.6 ± 0.2	11.1 ± 0.5	2.1 ± 0.1	0.0 ± 0.0	82.2 ± 1.6
Ca-based-2	6.5 ± 0.4	11.0 ± 0.5	2.7 ± 0.2	0.0 ± 0.0	79.8 ± 1.4
Ca-based-3	4.6 ± 0.2	10.8 ± 0.4	2.1 ± 0.1	0.0 ± 0.0	82.5 ± 1.6
Ca-based-4	4.1 ± 0.2	11.1 ± 0.5	1.9 ± 0.1	0.0 ± 0.0	82.9 ± 1.7

Table S4. Identified compounds (sorted by increasing retention time) in the liquid by GC/MS obtained after grape seeds pyrolysis.

Time	Compound Name
8.13	Benzene
8.353	1,4-Cyclohexadiene
11.633	Toluene
12.426	4-Nonene
15.604	Ethylbenzene
16.016	p-Xylene
16.738	3-Undecene, (E)-



17.017	Styrene
18.36	Benzene,1-ethyl-2-methyl-
19.396	Benzene,2-propenyl-
19.704	Benzene, propyl-
20.026	Benzene,1-ethyl-3-methyl-
20.191	Benzene, 1-ethyl-2-methyl-
20.398	2,4-Nonadiyne
20.704	Phenol
20.804	Benzene, 1-ethyl-2-methyl-
20.947	.alpha.-Methylstyrene
21.07	4-Chloro-3-n-hexyltetrahydropyran
21.402	Benzene, 2-propenyl-
21.496	Benzene,1-ethyl-3-methyl-
21.57	Benzene,1-ethenyl-2-methyl-
21.804	Benzene,1-ethenyl-2-methyl-
22.12	Benzeneacetaldehyde, .alpha.-methyl-
22.756	o-Cymene
22.918	D-Limonene
23.346	Indane
23.781	Benzene,1-propynyl-
23.854	Phenol, 2-methyl-
24.111	Benzene, (1-methylenepropyl)-
24.74	p-Cresol
25.207	Isopinocarveol
27.676	Phenol,2,4-dimethyl-
28.02	Naphthalene, 1,2-dihydro-
28.363	Benzene, (1-methylene-2-propenyl)-
28.725	Naphthalene, 1,2-dihydro-
28.837	Benzenemethanol, 4-methyl-
29.394	Cathecol
29.599	Napthalene
30.007	Phenol, 2,4,6-trimethyl-
30.628	Phenol, 2-ethyl-5-methyl-
31.031	Phenol, 2-ethyl-6-methyl-
32.706	E-9-Tetradecenoic acid
33.022	2-Allylphenol
33.661	1H-Indene, 1-ethylidene-
34.24	Bicyclo(4.4.1)undeca,1,3,5,7,9-pentaene
36.109	9-Hexadecenoic acid
36.472	Biphenyl
38.088	Diphenylmethane
39.027	Acenaphthylene
39.315	9-Hexadecenoic acid
39.57	HC lineal
39.832	1,1'-Biphenyl-4-methyl-
40.935	Bibenzyl

41.781	Benzene,1,1'-(1-methyl-1-2-ethanediyl)bis-
42.339	9-Hexadecenoic acid
42.578	HC lineal
43.174	Fluorene
44.801	Benzene,1,1'-(1,3-propanediyl)bis-
45.404	HC lineal
45.542	Benzene, 1,1'-(1-methyl-1,3-propanediyl)
46.284	Anthracene, 9,10-dihydro-
46.562	Estilbene
46.61	Napthalene,1,2,3,4-tetrahydro-1-phenyl-
47.147	1,2-Diphenylcyclopropane
48.161	1H-Indene, 2-phenyl-
48.803	Benzene, 1,1'-(3-methyl-1-propene-1,3-di
48.914	Phenanthrene
50.194	Napthalene,(1-phenyl-methyl)-
50.603	Anthracene, 9-ethenyl-
50.897	2-Heptadecanone
51.58	Naphthalene, 1,2-dihydro-4-phenyl-
52.448	Anthracene, 1-methyl-
55.682	2-Nonadecanone
57.583	p-terphenyl
58.505	m-terphenyl
61.572	Dasycarpidan-1-one
68.299	Tribenzo(a,e,i)cyclododecene
70.829	9,12,15-Octadecatrienoic aci, 2,3-bis(trimethylsilyl)oxy)propyl) ester (Z,Z,Z)-
73.215	1,1',3',1'' -Terphenyl,5'-phenyl-

Table S5. Identified compounds (sorted by increasing retention time) in the liquid by GC/MS obtained after PS pyrolysis.

Time	Compound Name
7.55	1,3-Cyclopentadiene,5-methyl-
7.661	1,4-Cyclohexadiene
7.82	Cyclopentene,3-methyl-
8.13	Benzene
8.345	1,4-Cyclohexadiene
10.889	Cyclopentadiene, 5,5-dimethyl-
11.213	1,4-Cyclohexadiene, 1-methyl-
11.64	Toluene
13.948	1,3-Dimethyl-1-cyclohexene
14.057	Cyclopentene,1-(1-methylethyl)-
15.604	Ethylbenzene
16.016	p-Xylene

17.017	Styrene
18.378	Benzene,1-ethyl-2-methyl-
19.396	Benzene,2-propenyl-
19.704	Benzene, propyl-
20.026	Benzene,1-ethyl-3-methyl-
20.191	Benzene, 1-ethyl-2-methyl-
20.398	Benzene,1,2,3-trimethyl-
20.704	Phenol
20.804	Benzene, 1-ethyl-2-methyl-
20.947	.alpha.-Methylstyrene
21.402	Benzene, 2-propenyl-
21.496	Benzene,1-ethyl-3-methyl-
21.57	Benzene,1-ethenyl-2-methyl-
21.804	Benzene,1-ethenyl-2-methyl-
22.528	Benzene,1-methyl-3-(1-methylethyl)-
22.694	Benzene,1-ethyl-3-methyl-
22.756	o-Cymene
22.947	1-(2-Methylphenyl)ethanol
23.346	Indane
23.781	Benzene,1-propynyl-
23.875	Benzyl alcohol
24.079	Benzene,2-ethyl,1,4-dimethyl-
24.765	p-Cresol
24.868	1,4-Cyclohexadiene,3-ethenyl,1,4-dimethyl-
24.997	o-Cymene
25.126	o-Isopropenyltoluene
25.245	p-Cymene
25.515	o-Isopropenyltoluene
25.724	Benzene,1-methyl-4-(2-propenyl)-
26.717	Benzene,1,2,4,5-tetramethyl-
26.976	Benzene,(2-methyl-1-propenyl)-
27.19	2,4-Dimethylstyrene
27.344	3a,6-Methano-3aH-indene,2,3,6,7-tetrahydro-
27.497	Benzene, (1-methylenebutyl)-
27.607	Benzene,1-methyl-4-(2-propenyl)-
27.709	Phenol,2,3-dimethyl-
28.024	Naphthalene, 1,2-dihydro-
28.246	Benzene,1-butyryl-
28.708	Tetracyclo(5.3.0.0.<2.6>0<3.10>)deca-4,8-diene
29.109	(1-Methylenebut-2-enyl)benzene
29.599	Napthalene
30.626	Benzene, (3-methyl-2-butenyl)-
31.173	Benzothiazole
32.002	1H-Indene,1,3-dimethyl-
32.21	Benzene, (2-cyclopropylethenyl)-
32.363	1H-Indene,1,1-dimethyl-

32.441	Napthalene,1,2-dihydro,3-methyl-
32.528	Napthalene,1,2-dihydro,6-methyl-
32.822	(1-Methylpenta-1,3-dienyl)benzene
33.657	Bicyclo(4.4.1)undeca,1,3,5,7,9-pentaene
34.24	Benzocycloheptatriene
35.738	(1-Methylenepent-2-enyl)benzene
35.898	(1-Methylpenta-2,4-dienyl)benzene
36.151	1,2,3-Trimethylindene
36.477	Biphenyl
36.873	Benzo(b)thiophene,2,7-dimethyl-
36.988	Napthalene,1-ethyl-
37.376	Napthalene,2,6-dimethyl-
37.429	Napthalene,1,3-dimethyl-
37.831	Napthalene,1,7-dimethyl-
37.984	Napthalene,1,8-dimethyl-
38.503	Quinoline,2,7-dimethyl-
39.028	Napthalene,1,8-dimethyl-
39.851	1,1'-Biphenyl-4-methyl-
40.066	Acenaphthene
40.18	1,1'-Biphenyl-2-methyl-
40.531	Napthalene,1-(1-methylethyl)-
41.07	3-(2-Methylpropenyl)-1H-Indene
41.349	Napthalene,1,4,5-trimethyl-
41.792	Napthalene,1,4,6-trimethyl-
41.961	Napthalene,2,3,6-trimethyl-
42.293	1-Isopropenylnapthalene
42.366	Napthalene,1,6,7-trimethyl-
42.44	4,6,8-Trimethylazulene
42.59	Fluorene
42.984	Fluorene,2,4a-dihydro-
43.162	1H-Phenylene
43.339	Bi,1,3,5-Cycloheptatrien-1-yl
43.561	1-Isopropenylnapthalene
44.509	Napthalene, 1-(2-nitro-2-propenyl)-
45.855	Benzene, (4,5,5-trimethyl,1,3-cyclopentadien-1-yl)-
46.408	9H-Fluorene,2-methyl-
46.461	9H-Fluorene,1-methyl-
46.929	9H-Fluorene,9-methyl-
48.911	Phenanthrene
49.202	9,10-Ethanoanthracene,9,10-dihydro,11,12-diacetyl-
49.502	Anthracene, 9,10-dihydro-2-methyl-
49.651	.alpha. Methylstilbene
50.91	5H-Dibenzo(a,d)cyclohepten-5-ol, 10,11-dihydro-
51.807	1H-Indene, 2-phenyl-
51.975	1H-Cyclopropa(l)phenanthrene,1a,9b-dihydro-
52.249	Cyclobuta(a)dibenzo(c,f)cycloheptadiene, 1-methyl-

52.412	Anthracene, 1-methyl-
52.94	1,4-Benzenediamine, N-phenyl-
53.15	2,3-Diazabicyclo(2.2.1)hept-2-ene,1,4-diphenyl
53.616	Napthalene,2-phenyl-
55.099	1,3-Diphenyl-3-methylcyclopropene
55.309	9,10-Dimethylantracene
57.367	Pyrene
57.793	1,3-Pentadiene, 1,1-diphenyl-, (Z)-
73.272	Tribenzo(a,e,i)cyclododecene

Table S6. Identified compounds (sorted by increasing retention time) in the liquid by GC/MS obtained after co-pyrolysis of GS and WT experiments.

Time	Compound Name
8.219	Benzene
11.713	1,3,5-Cycloheptatriene
12.502	1-Octene
15.664	Ethylbenzene
16.064	p-Xylene
16.797	2-Nonenal, (E)-
17.064	Styrene
18.447	Benzene,1-ethyl-2-methyl-
19.908	Cyclohexene,1-methyl-4-(1-methylethenyl)-,(S)-
20.074	Benzene,1-ethyl-3-methyl-
20.233	Benzene, 1-ethyl-2-methyl-
20.454	Benzene,1,2,4-trimethyl-
20.772	Phenol
20.872	Benzene, 1-ethyl-2-methyl-
21.01	.alpha.-Methylstyrene
21.137	4-Undecene,5-methyl-, (E)-
21.478	1,5,5-Trimethyl-6-methylene-cyclohexene
21.54	Benzene,1,2,4-trimethyl-
21.62	Benzene,1-ethenyl-2-methyl-
22.585	trans-3-Caren-2-ol
22.751	Benzene,1-ethyl-3-methyl-
22.796	2,6-Dimethyl-1,3,5,7-octatetraene,E,E-
22.987	D-Limonene
23.403	1,3-Methanopentalene,1,2,3,5-tetrahydro-
23.846	1-Propyne-3-phenyl-
23.937	Benzyl alcohol
24.126	2,6-Dimethyl-1,3,5,7-octatetraene,E,E-
24.798	Phenol,3-methyl-
25.058	1,4-Cyclohexadiene,3-ethenyl,1,2-dimethyl-
25.275	7-Tetradecene



25.581	Benzene,1-methyl-4-(1-methylethenyl)-
26.297	10,12-Octadecadiynoic acid
26.777	6,7-Dimethyl,3,5,8,8a-tetrahydro-1H-2-benzopyran
27.273	5,7-Dodecadiyn,1,12-diol
27.653	3a.6-Methano,3aH-indene,2,3,6,7-tetrahydro-
27.768	Phenol,2,3-dimethyl-
28.071	1,2-Butadiene,3-phenyl-
28.488	Bicyclo(3.1.1)hept-2-ene-2-ethanol, 6,6-dimethyl-
29.142	7-Tetradecene
29.437	Hydrocinnamic acid,o-(1,2,3,4-tetrahydro-2-naphthyl-methyl)-
29.652	Napthalene
29.786	Benzene,(3-methyl-2-butenyl)-
30.924	Bicyclo(3.1.1)hept-3-ene-spiro-2-4'-(1',3'-dioxane), 7,7-dimethyl-
31.159	1,2,4-Metheno-1H-cyclobuta(cd)pentalene,3,5-diol, octahydro-
31.941	Oxacyclotetradeca-4,11-diyne
32.064	(1-Methylenebut-2-enyl)benzene
32.272	Napthalene,1,2-dihydro-3-methyl-
32.769	7-Tetradecene
33.038	4-Hydroxy-4-methylhex-5-enoic acid, tert-butyl-ester
33.718	Benzocycloheptatriene
34.3	Bicyclo(4.4.1)undeca,1,3,5,7,9-pentaene
35.556	4,7,10,13,16,19-Docosahexaenoic acid, methyl ester, (all-Z)-
36.174	7-Tetradecene
36.407	9-Octadecen-12-ynoic acid, methyl ester
36.539	Biphenyl
39.376	9-Hexadecenoic acid
39.589	Geranyl isovalerate
40.97	Benzaldehyde-4-benzyloxy-3-fluoro-5-methoxy-
41.402	3-(2-Methyl-propenyl)-1H-indene
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44.845	Benzene,1,1'-(1,3-propanediyl)bis-
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45.426	Geranyl isovalerate
46.62	5,8,11,14-Eicosatetraynoic acid
46.663	Napthalene,1,2,3,4-tetrahydro-1-phenyl-
47.178	1,2-Diphenylcyclopropane
47.961	Erucid acid
48.201	Cyclobuta(a)dibenzo(8c,f)cycloheptadiene, 1-methyl-
48.953	9,10-Ethanoanthracene,9,10-dihydro,11,12-diacetyl-
50.66	Olean-12-ene-3,28-diol, (3. beta)-
50.837	2-Heptadecanone
53.632	Napthalene,2-phenyl-
57.279	Isoquinoline,(1-phenylmethyl)-
63.795	Lineal HC
65.688	Lineal HC
67.491	Lineal HC

69.255	Lineal HC
71.109	Lineal HC
73.27	1,1',3',1'' -Terphenyl,5'-phenyl-

Table S7. Identified compounds (sorted by increasing retention time) in the liquid by GC/MS obtained after Catalytic co-pyrolysis of GS and WT experiments.

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46.62	5,8,11,14-Eicosatetraynoic acid
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48.953	9,10-Ethanoanthracene,9,10-dihydro,11,12-diacetyl-
50.66	Olean-12-ene-3,28-diol, (3. beta)-
50.837	2-Heptadecanone
51.624	Carnegine
53.632	Napthalene,2-phenyl-
55.13	13-Heptadecyn-1-ol
55.267	Ethanol,2-(9,12-octadecadienyloxy)- (Z,Z)-
55.682	2-Nonadecanone
57.279	Isoquinoline,(1-phenylmethyl)-
61.572	Dasycarpidan-1-one
61.837	Lineal HC
63.795	Lineal HC

65.688	Lineal HC
67.491	Lineal HC
69.255	Lineal HC
71.109	Lineal HC
73.27	1,1',3',1''-Terphenyl,5'-phenyl-

Table S8. Families and compounds identified after GC/MS

AROMATICS
Benzene
Toluene
Ethylbenzene
p-Xylene
Styrene
Benzene,1-ethyl-2-methyl-
Benzene,2-propenyl-
Benzene, propyl-
Benzene,1-ethyl-3-methyl-
Benzene, 1-ethyl-2-methyl-
Benzene,1,2,3-trimethyl-
Benzene, 1-ethyl-2-methyl-
.alpha.-Methylstyrene
Benzene, 2-propenyl-
Benzene,1-ethyl-3-methyl-
Benzene,1-ethenyl-2-methyl-
Benzene,1-ethenyl-2-methyl-
Benzene,1-methyl-3-(1-methylethyl)-
Benzene,1-ethyl-3-methyl-
o-Cymene
1-(2-Methylphenyl)ethanol
Benzene,1-propynyl-
Benzene,2-ethyl,1,4-dimethyl-
o-Cymene
o-Isopropenyltoluene
p-Cymene
o-Isopropenyltoluene
Benzene,1-methyl-4-(2-propenyl)-
Benzene,1,2,4,5-tetramethyl-
Benzene,(2-methyl-1-propenyl)-
2,4-Dimethylstyrene
Benzene, (1-methylenebutyl)-
Benzene,1-methyl-4-(2-propenyl)-
Naphthalene, 1,2-dihydro-
Benzene,1-butyryl-



(1-Methylenebut-2-enyl)benzene
Naphthalene
Benzene, (3-methyl-2-butenyl)-
Benzothiazole
1H-Indene,1,3-dimethyl-
Benzene, (2-cyclopropylethenyl)-
1H-Indene,1,1-dimethyl-
Naphthalene,1,2-dihydro,3-methyl-
Naphthalene,1,2-dihydro, 6-methyl-
(1-Methylpenta-1,3-dienyl)benzene
(1-Methylenepent-2-enyl)benzene
(1-Methylpenta-2,4-dienyl)benzene
1,2,3-Trimethylindene
Biphenyl
Benzo(b)thiophene,2,7-dimethyl-
Naphthalene,1-ethyl-
Naphthalene,2,6-dimethyl-
Naphthalene,1,3-dimethyl-
Naphthalene,1,7-dimethyl-
Naphthalene,1,8-dimethyl-
Quinoline,2,7-dimethyl-
Naphthalene,1,8-dimethyl-
1,1'-Biphenyl-4-methyl-
Acenaphthene
1,1'-Biphenyl-2-methyl-
Naphthalene,1-(1-methylethyl)-
3-(2-Methylpropenyl)-1H-Indene
Naphthalene,1,4,5-trimethyl-
Naphthalene,1,4,6-trimethyl-
Naphthalene,2,3,6-trimethyl-
1-Isopropenylnaphthalene
Naphthalene,1,6,7-trimethyl-
4,6,8-Trimethylazulene
Fluorene
Fluorene,2,4a-dihydro-
1H-Phenylene
1-Isopropenylnaphthalene
Naphthalene, 1-(2-nitro-2-propenyl)-
Benzene, (4,5,5-trimethyl,1,3-cyclopentadien-1-yl)-
9H-Fluorene,2-methyl-
9H-Fluorene,1-methyl-
9H-Fluorene,9-methyl-
Phenanthrene
9,10-Ethanoanthracene,9,10-dihydro,11,12-diacetyl-



Anthracene, 9,10-dihydro-2-methyl-
 .alpha. Methylstilbene
 1H-Indene, 2-phenyl-
 Anthracene, 1-methyl-
 1,4-Benzenediamine, N-phenyl-
 Napthalene,2-phenyl-
 1,3-Diphenyl-3-methylcyclopropene
 9,10-Dimethylantracene
 Pyrene
 1,3-Pentadiene, 1,1-diphenyl-, (Z)-
 Retene

CYCLIC HYDROCARBONS

1,3-Cyclopentadiene,5-methyl-
 1,4-Cyclohexadiene
 Cyclopentene,3-methyl-
 1,4-Cyclohexadiene
 Cyclopentadiene, 5,5-dimethyl-
 1,4-Cyclohexadiene, 1-methyl-
 1,3-Dimethyl-1-cyclohexene
 Cyclopentene,1-(1-methylethyl)-
 Indane
 1,4-Cyclohexadiene,3-ethenyl,1,4-dimethyl-
 3a,6-Methano-3aH-indene,2,3,6,7-tetrahydro-
 Tetracyclo(5.3.0.0.<2.6>0<3.10>)deca-4,8-diene
 Bicyclo(4.4.1)undeca,1,3,5,7,9-pentaene
 Benzocycloheptatriene
 Bi,1,3,5-Cycloheptatrien-1-yl
 5H-Dibenzo(a,d)cyclohepten-5-ol, 10,11-
 dihydro-
 1H-Cyclopropa(l)phenanthrene,1a,9b-dihydro-
 Cyclobuta(a)dibenzo(c,f)cycloheptadiene, 1-
 methyl-
 2,3-Diazabicyclo(2.2.1)hept-2-ene,1,4-diphenyl
 Tribenzo(a,e,i)cyclododecene

ESTERS

2,5-Octadecadiynoic acid, methyl ester
 4-Hydroxy-4-methylhex-5-enoic acid, tert-butyl-ester
 4,7,10,13,16,19-Docosahexaenoic acid, methyl ester, (all-Z)-
 9-Octadecen-12-ynoic acid, methyl ester
 Geranyl isovalerate
 10,13-Octadecadiynoic acid, methyl ester
 9,12,15-Octadecatrienoic aci, 2,3-bis(trimethylsilyl)oxy)propyl) ester
 (Z,Z,Z)-

FATTY ACIDS

10,12-Octadecadiynoic acid
 Hydrocinnamic acid, o-(1,2,3,4-tetrahydro-2-naphthyl-
 methyl)-
 9-Hexadecenoic acid
 5,8,11,14-Eicosatetraynoic acid
 Erucid acid
 5,8,11,14-Eicosatetraynoic acid
 Oleic acid

KETONES

2-Heptadecanone
 2-Nonadecanone
 Dasycarpidan-1-
 one

PHENOLS

Phenol
 Phenol, 2-methyl-
 p-Cresol
 Phenol, 2,4-dimethyl-
 Cathecol
 Phenol, 2,4,6-trimethyl-
 Phenol, 2-ethyl-5-methyl-
 Phenol, 2-ethyl-6-methyl-
 1,2-Benzenediol, 4-
 methyl-
 2-Allylphenol

OTHERS OXYGENATED

2-Nonenal, (E)-
 6,7-Dimethyl, 3,5,8,8a-tetrahydro-1H-2-benzopyran
 5,7-Dodecadiyn, 1,12-diol
 Bicyclo(3.1.1)hept-2-ene-2-ethanol, 6,6-dimethyl-
 Bicyclo(3.1.1)hept-3-ene-spiro-2-4'-(1',3'-dioxane), 7,7-
 dimethyl-
 1,2,4-Metheno-1H-cyclobuta(cd)pentalene, 3,5-diol,
 octahydro-
 5,7-Dodecadiyn, 1,12-diol
 Benzaldehyde-4-benzyloxy-3-fluoro-5-methoxy-
 Olean-12-ene-3,28-diol, (3. beta)-
 Carnegine
 13-Heptadecyn-1-ol
 Ethanol, 2-(9,12-octadecadienyloxy)- (Z,Z)-



OLEFINS

1-Octene

4-Undecene,5-methyl-, (E)-

2,6-Dimethyl-1,3,5,7-

octatetraene,E,E-

7-Tetradecene
