ST 9: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by pyrolysis of residual fat at 450 °C, 1.0 atm, 50 min, using a pyrolysis reactor of 2.0 L, in semi pilot scale.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983
∑ ***(Area.%)*** **=**			**2.613**

Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 10: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by pyrolysis of residual fat at 450 °C, 1.0 atm, 60 min, using a pyrolysis reactor of 2.0 L, in semi pilot scale.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983
∑ ***(Area.%)*** **=**			**2.613**
Phenols			

Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 11: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by pyrolysis of residual fat at 450 °C, 1.0 atm, 70 min, using a pyrolysis reactor of 2.0 L, in semi pilot scale.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983
∑ ***(Area.%)*** **=**			**2.613**
Phenols			

Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 12: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by pyrolysis of residual fat at 450 °C, 1.0 atm, 80 min, using a pyrolysis reactor of 2.0 L, in semi pilot scale.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983
∑ ***(Area.%)*** **=**			**2.613**
Phenols			

Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 13: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 5.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 40 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 14: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 5.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 50 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 15: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 5.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 60 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 16: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 5.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 70 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 17: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 7.5% (wt.) Red Mud pellets activated with 1.0 M HCl, 40 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 18: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 7.5% (wt.) Red Mud pellets activated with 1.0 M HCl, 50 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 19: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 7.5% (wt.) Red Mud pellets activated with 1.0 M HCl, 60 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 20: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 7.5% (wt.) Red Mud pellets activated with 1.0 M HCl, 70 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 21: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 10.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 50 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
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Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
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2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 22: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 10.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 60 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 23: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 10.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 70 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
6,7-Dimethyl-3,5,8,8a-tetrahydro-1H-2-benzopyran	10.368	110028-10-9	1.243
2,4-Dimethylstyrene	11.371	2234-20-0	0.703
1H-Indene, 1-methyl-	11.547	767-58-8	1.830
Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
Hexanoic acid, 2-phenylethyl ester	6.917	72934-12-4	0.494
2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
1-Hexadecanol, 2-methyl-	16.583	2490-48-4	0.849
Carveol	10.263	99-48-9	1.259
2-Indanol	9.760	4254-29-9	0.568
2,6,8-Trimethylbicyclo[4.2.0]oct-2-ene-1,8-diol	10.484	-	1.505
1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**

ST 24: Classes of compounds, summation of peak areas, CAS number, and retention times of chemical compounds identified by CG-MS in in bio-oil by catalytic upgrading of residual fat pyrolysis vapors at 450 °C, 1.0 atm, 10.0% (wt.) Red Mud pellets activated with 1.0 M HCl, 80 min, using a catalyst fixed bed reactor, in semi pilot scale two-stage reactor of 2.0 L.

450°C			
Class of Compounds: Chemical Compounds	RT [min]	CAS	ω_i% (Area)
Alkanes			
Undecane	10.548	1120-21-4	3.19
Tridecane	13.794	629-50-5	3.93
Tetradecane	15.276	629-59-4	0.75
Pentadecane	16.744	629-62-9	1.55
∑ ***(Area.%)*** **=**			**9.41**
Alkenes			
p-Mentha-1,5,8-triene	9.861	21195-59-5	2.254
1-Undecene	10.402	821-95-4	2.776
1-Dodecene	12.088	112-41-4	3.034
Bicyclo[6.4.0]dodeca-9,11-diene	13.291	-	0.614
1-Tridecene	13.672	2437-56-1	2.098
Bicyclo[4.4.1]undeca-1,3,5,7,9-pentaene	14.286	2443-46-1	1.380
1-Tetradecene	15.167	1120-36-1	1.111
∑ ***(Area.%)*** **=**			**13.267**
Aromatic Hydrocarbons			
Benzene, 1,3-dimethyl-	6.247	108-38-3	0.578
Benzene, propyl-	7.995	103-65-1	0.516
Benzene, 1-ethyl-3-methyl-	8.128	620-14-4	0.686
Benzene, 1-ethyl-2-methyl-	8.193	611-14-3	0.593
Trimethylbenzene	8.283	108-67-8	0.566
Benzene, (1-methylethyl)-	8.454	98-82-8	1.050
Benzene, 1,2,4-trimethyl-	8.738	95-63-6	2.107
Benzene, 1-ethenyl-2-methyl-	8.770	611-15-4	2.709
Benzene, 1,2,3-trimethyl-	9.255	526-73-8	1.297
Benzene, pentyl-	11.607	538-68-1	2.205
Benzene, (1-methyl-2-propynyl)-	11.646	4544-28-9	0.875
Benzene, (1-methyl-2-cyclopropen-1-yl)-	11.685	65051-83-4	1.441
o-Xylene	6.413	95-47-6	1.136
p-Xylene	6.834	106-42-3	2.080
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2,4-Dimethylstyrene	11.371	2234-20-0	0.703
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Naphthalene	12.217	91-20-3	10.081
1H-Indene, 2,3-dihydro-4,7-dimethyl-	12.533	6682-71-9	0.760
Benzocycloheptatriene	14.038	264-09-5	1.401
Indane	9.516	496-11-7	0.763
Indene	9.699	95-13-6	6.702
∑ ***(Area.%)*** **=**			**41.322**
Esters			
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2-Furancarboxylic acid, 3-phenylpropyl ester	8.536	-	0.645
Carbonic acid, octadecyl phenyl ester	8.616	-	3.193
Acetic acid, 2-methylene-bicyclo[3.2.1]oct-6-en-8-yl ester	9.379	-	0.644
1-hydroxy-1,2,3,4-tetrahydronaphthalene trifluoroacetate ester	11.850	134563-46-5	0.526
∑ ***(Area.%)*** **=**			**5.502**
Ketones			
5H-Inden-5-one, 1,2,3,6,7,7a-hexahydro-	9.975	1489-28-7	1.630
Tricyclo[4.2.1.1(2,5)]deca-3,7-dien-9-one, 10-hydroxy-10-methyl-	11.767	70220-88-1	0.983

∑ ***(Area.%)*** **=**			**2.613**
Phenols			
Phenol	8.704	108-95-2	0.741
2-(2-Hydroxyphenyl)buta-1,3-diene	12.450	90-05-1	0.608
∑ ***(Area.%)*** **=**			**1.349**
Alcohols			
2-heptanol	5.906	543-49-7	0.366
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2-Indanol	9.760	4254-29-9	0.568
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1-Naphthalenol, 1,2,3,4-tetrahydro-3-methyl-	13.388	3344-45-4	0.427
2-Naphthalenol, 1,2-dihydro-, acetate\3-Methoxymethoxy-1,5,5-trimethyl-cyclohexene	12.300	132316-80-4	1.073
∑ ***(Area.%)*** **=**			**6.047**
Furans			
Benzofuran	8.816	271-89-6	3.746
Benzofuran, 2-methyl	10.838	4265-25-2	4.997
Furan, 2-(2 furanylmethyl)-5-methyl	11.922	13678-51-8	1.209
Benzofuran, 4,7-dimethyl	12.739	28715-26-6	3.287
∑ ***(Area.%)*** **=**			**13.239**
Aldehyds			
Myrtenal	10.034	564-94-3	1.724
Cinnamaldehyde	12.654	104-55-2	5.523
∑ ***(Area.%)*** **=**			**7.247**