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REPORT

TITLE

Analysis of headspace and occluded gas (C1-C9) in nine canned cuttings

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SUMMARY

This report contains tables and figures with data from gas chromatographic analysis of headspace and occluded gas from nine canned cutting samples from an undisclosed location. The yields (in µl/kg dry rock) and relative proportions (in volume %) of 23 hydrocarbon compounds ranging from C1 to C9 are tabulated. Some geochemically relevant peak ratios are also listed and plotted.

KEYWORDS ENGLISH	KEYWORDS NORWEGIAN
Gas analysis	Gassanalyse
Organic geochemistry	Organisk geokjemi

1. Introduction

Ten canned cutting samples were received from Hydro Oil & Energy (Contract No.: 5313623) for gas chromatographic analysis of the C1 to C9 hydrocarbons contained in the headspace and occluded gas.

One of the samples could not be analyzed due to an open lid by arrival, and the report will therefore contain results from nine samples. The hydrocarbon concentrations are expressed as µl gas per kg of dried cuttings. The hydrocarbon composition is expressed in volume percent of all recorded hydrocarbons.

2. Experimental

2.1 Headspace gas

A septum was attached to the can and a sample of headspace gas was taken and injected into a gas chromatograph for analysis of C1 to C9 hydrocarbons.

The can was opened and the volume of the headspace was determined. The cuttings were washed with water (ca. 30 °C) on 4.0, 1.0 and 0.125 mm sieves in order to remove the drilling mud, and were then weighed and dried.

2.2 Occluded gas

Prior to drying, an aliquot of the 1-4 mm fraction was crushed in water for 10 minutes using a gas-tight ball mill. An aliquot of the evolved gas was injected into a gas chromatograph for analysis of C1 to C9 hydrocarbons.

2.3 Gas chromatographic analysis

The gas was analysed on a gas chromatograph fitted with a gas injector. The GC temperature program started at 35 °C, since separation of alkenes from alkanes was of no interest in this project. The instrument was fitted with a capillary column connected to an FID for hydrocarbon detection. Details of the instrumentation are listed in Table 2.1.

Table 2.1 Analytical equipment

Gas chromatograph	Agilent 6890
Injector	Gas injector connected to a 1.0 ml loop
Columns	HP-PONA column: 50 m x 0.20 mm i.d, 0.5 µm film thickness.
Carrier gas	Helium
Detector	FID (250 °C)
Temperature program	35 °C (5 min.) - 8 °C/min. - 180 °C (10 min.)
Chromatographic data system	HP ChemStation Rev. A.10.01

2.4 Identification

Peaks were identified based on three Supelco Reference Standards, guidelines in "The Norwegian Industry Guide to Organic Geochemical Analyses" (Edition 4.0) and internal procedures. Figure 2.1 shows an example of a gas chromatogram with annotation from the method used in this project. Identified compounds, retention indices and comments are listed in Table 2.2.

Table 2.2 Identified compounds with retention indices (RI) and comments. For peak labels see explanation below the table.

Peak label	RI (Kováts)	Comments
C1	100	
C2	158 + 200	Includes ethane and ethene
C3	300	Includes propane and propene
iC4	354	
C4ene	385	
nC4	400	
2,2-DMC3	410	
RI=431	431	Unknown
iC5	467	
RI=485	485	Unknown
RI=493	493	Unknown
nC5	500	
RI=529	529	Unknown
2,2-DMC4	531	Not found in these samples
CyC5 + 2,3-DMC4	561	Not found in these samples
2-MC5	565	Not found in these samples
3-MC5	581	
nC6	600	
2,2-DMC5	624	Not found in these samples
MCyC5	627	Not found in these samples
2,4-DMC5	630	Not found in these samples
2,2,3-TMC4	637	Not found in these samples
Benzene	651	Not found in these samples
3,3-DMC5	656	
CyC6	661	Not found in these samples
2-MC6	668	Not found in these samples
2,3-DMC5	670	Not found in these samples
1,1-DMCyC5	674	Not found in these samples
3-MC6	676	Not found in these samples
c-1,3-DMCyC5	684	Not found in these samples
t-1,3-DMCyC5	687	Not found in these samples
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	690	
nC7	700	
MCyC6 + c-1,2-DMCyC5	725	Not found in these samples
2,2-DMC6 + 1,1,3-TMCyC5	727	Not found in these samples
2,5-DMC6 + 2,2,3-TMC5	734	Not found in these samples
2,4-DMC6	736	Not found in these samples
3,3-DMC6 + t-1,c-2,4-TMCyC5	744	Not found in these samples
t-1,c-2,3-TMCyC5	751	Not found in these samples
2,3,4-TMC5	754	Not found in these samples
Toluene + 2,3,3-TMC5	759	Not found in these samples
2,3-DMC6	763	Not found in these samples
2-M,3-EC5	765	Not found in these samples
2-MC7	768	Not found in these samples
4-MC7 + 3-M,3-EC5	769	Not found in these samples
3,4-DMC6	773	Not found in these samples
3-MC7 + c-1,t-2,3-TMCyC5	775	Not found in these samples

Peak label	RI (Kováts)	Comments
RI=781 (DMCyC6)	780 + 781	Not found in these samples
nC8	800	
2,3,5-TMC6 + c,1,2-EMCyC5	819	Not found in these samples
E-Benzene	855	
m+p-Xylene	863	
4-MC8 + 2-MC8	874	Not found in these samples
o-Xylene	886	
nC9	900	

Explanations:

Structural groups	Parent structures	Numbers of functional groups	Names of functional groups	Steric configurations
n = normal	C1 = methane	D = di	M = methyl	c = cis
i = iso	C2 = ethane	T = tri	E = ethyl	t = trans
Cy = cyclo	etc.		P = propyl	o = ortho
				m = meta
				p = para

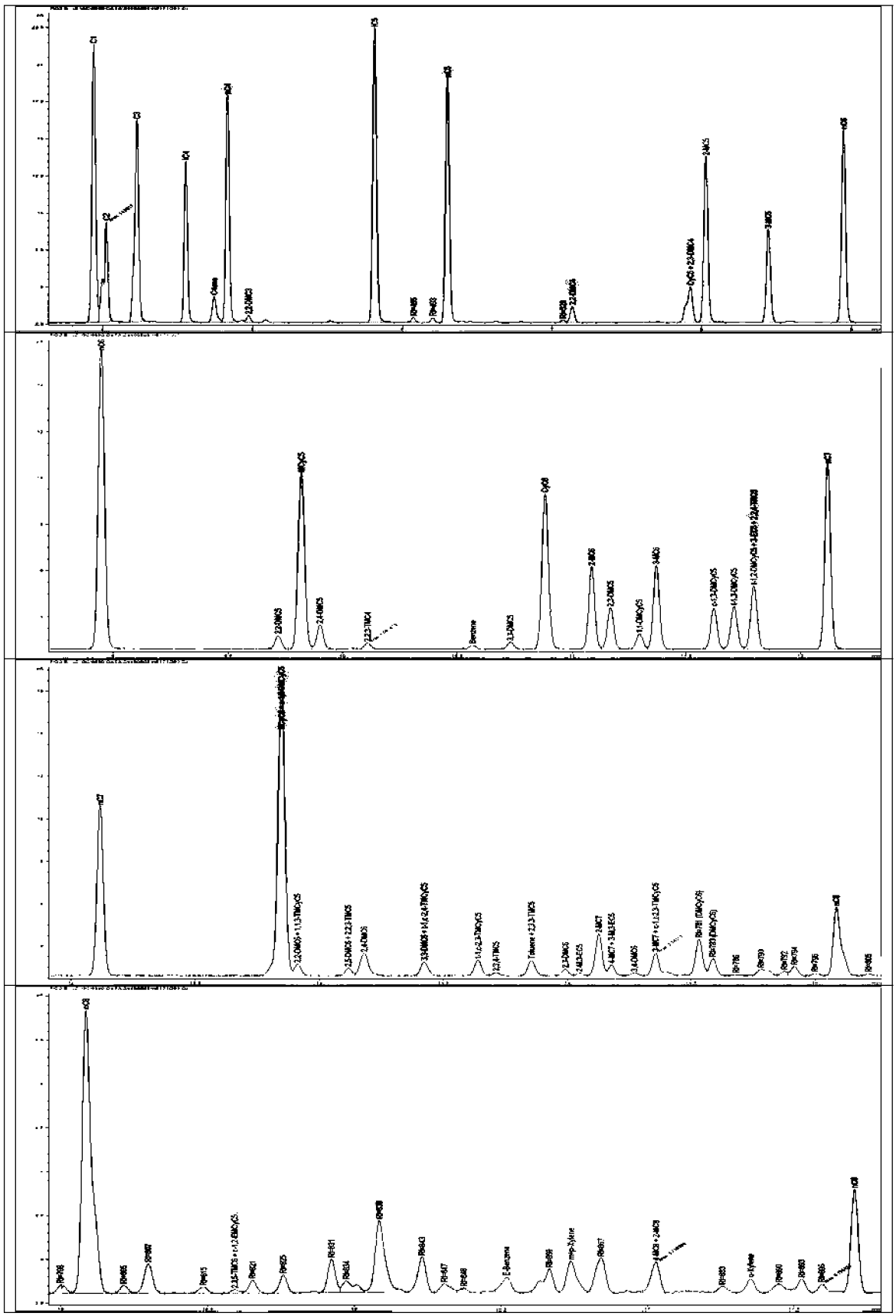

Figure 2.1 An example of a gas chromatogram with annotation. Expanded views of C1 to n-C6, n-C6 to n-C7, n-C7 to n-C8 and n-C8 to n-C9 ranges.

2.5 Quantification

A 1000 ppm (µl/l) standard gas sample containing methane, ethane, propane, i-butane, n-butane, n-pentane and n-hexane was used for quantification. The variation between the standards analysed was small (Table 2.3), and the average response factors were used for quantification of all samples. The response factor for n-C5 was used for all compounds eluting between n-C4 and n-C5 and so on. Response factors for the C6-C7, C7-C8 and C8-C9 component groups were extrapolated based on molecular mass.

A 100 ppm (µl/l) standard gas sample containing methane, ethane, propane, n-butane, n-pentane and n-hexane was used for control of linearity.

Rock-related concentrations (in µl/kg) for compounds having a concentration of less than 0.2 ppm (µl/l) in the analysed gas are not reported, as this corresponds to an area of about 0.08, which is the lowest reliable area in the gas chromatograms.

Table 2.3 Results from analyses of 1000 ppm standard (based on peak area)

	C1	C2	C3	iC4	nC4	nC5	nC6
Average ppm	994	991	991	992	993	996	1003
Stdev.	17	16	16	16	15	16	20
Stdev. (% of average)	1.7	1.6	1.6	1.6	1.5	1.6	2.0
n	6	6	6	6	6	6	6

2.6 Concentrations and ratios

The yields of hydrocarbons (µl/kg dry rock) in headspace (H) and occluded (O) gas and the sum of H + O are given in Table 4.3, and the hydrocarbon composition (volume %) is given in Table 4.4. Selected summary data and peak ratios are calculated and given in Table 4.5. Abbreviations used in Table 4.5 are explained in Table 2.4.

Table 2.4 Explanations of the variables listed in Table 4.5.

Abbreviation	Explanation
Hydrocarbon yields for selected C-number ranges	
CncC1	Concentration of C1 (µl/kg dry rock)
CncC2C4	Concentration of C2 through n-C4 (µl/kg dry rock)
CncC5C9	Concentration of C5 through n-C9, i.e. all peaks eluting after n-C4 (µl/kg dry rock)
CncC1C9	Sum of these concentrations
Hydrocarbon composition for selected C-number ranges	
PctC1	Fraction of C1 (% volume of all C1-C9 HC)
PctC2C4	Fraction of C2 through n-C4 (% volume of all C1-C9 HC)
PctC5C9	Fraction of C5 through n-C9, i.e. all peaks eluting after n-C4 (% volume of all C1-C9 HC).
PctC1C9	Sum of these fractions (= 100 vol %)
Wetness	
Wetness	100* (Sum C2 to n-C4 / (Sum C1 to n-C4) (volume %)

2.7 Water content

The water content of the cuttings was determined by weighing the fractions before and after drying at 35 °C for at least 24 hours. The dry weight of the rock used for occluded gas analysis was determined using the wet weight of this rock and the water content of the remaining 1-4 mm fraction. Water contents for the three individual grain size fractions are listed in Table 4.2.

3. Comments on samples and analytical data

The wet cutting samples were received in pressure-lid cans of 1 l volume at ambient temperature. Secondary modification of the gas composition by microbial activity cannot be completely ruled out.

The samples were labelled '1A' to '1J'. One of the lids, '1F', was open by arrival and all the sample material had leaked out.

Some of the samples contained soft material and had to be cleaned extremely carefully to prevent loss of sample material. The adhering (and foaming) mud could hence not be removed completely. The mud in the samples '1C', '1D', '1E', '1G', '1H', '1I' and '1J' also contained a black, fine-grained material with almost graphite-like lustre. The material floated on the water and was decanted from the samples. However, a significant part remained in the 0.125 – 1 mm fractions.

Sample descriptions are listed in Table 4.1. Those of samples '1C', '1E', '1G', '1H' and '1I' were done on the 0.125 – 1 mm and the >4 mm fraction as all material from the 1-4 mm fraction was used for the occluded gas analyses.

Only 23 hydrocarbon compounds were identified in these samples. Some of the peak ratios in Table 4.5 and Figure 4.1 show erratic values. This is typically due to low concentrations. Care should, therefore, be taken in the interpretation of these ratios.

4. Results

Table 4.1
Sample description

Table 4.1 Sample description. Lithologies in order of decreasing abundance.

Sample ID	External sample ID	Lithology (description on 1 – 4 mm fraction if not specified otherwise. numbers represent roughly estimated percentages)	Gas volume headspace (ml)	Gas volume occluded (ml)	Rock weight total sample dry (g)	Rock weight occluded sample dry (g)
H6174	1A	100 marl?, ltgy; tr fragments of crystalline rocks (quartz-rich, with euhedral garnets)	40	14.1	235.5	12.1
H6175	1B	90 marl?, ltgy; 10 fragments of crystalline rocks (euhedral garnets etc.); tr metal flakes	20	19.5	168.3	15.3
H6176	1C	>4 mm: 95 rounded "mud lumps" containing numerous spherical inclusions, ltgy; 5 basalt?; tr metal; 0.125 - 1.0 mm: Quartz sand + black additive	174	32.5	268.3	7.5
H6177	1D	50 "mud lumps" containing spherical inclusions, ltgy; 30 marl? and carbonates; 20 crystalline rocks; tr plastic and metal flakes; 0.125 - 1.0 mm: Quartz sand + black additive	194	29	329.2	12.0
H6178	1E	>4 mm: (5 pieces) ltgy "mud lumps", black chert?, metal flake; 0.125 - 1.0 mm: Quartz sand + black additive	396	24.4	449.5	13.2
H6179	1F	- - - - - - No analysis - - - - - - - -	-	-	-	
H6180	1G	>4 mm: (3 pieces) ltgy "mud lump", basalt, metal flake; 0.125 - 1.0 mm: Quartz sand + black additive	170	27.2	802.3	4.7
H6181	1H	0.125 - 1.0 mm: Quartz sand + black additive	120	34.4	260.0	9.9
H6182	1I	>4 mm: "mud lumps" containing spherical inclusions, ltgy; 0.125 - 1.0 mm: Quartz sand + black additive	155	29.5	136.0	11.3
H6183	1J	very small and poorly washed sample: mostly crystalline (metamorphic?) rocks; >4 mm: 95 rounded "mud lumps" containing numerous spherical inclusions, ltgy; 5 various crystalline rock fragments; 0.125 - 1.0 mm: Quartz sand + black additive.	160	20.2	280.2	15.9

Key: SH = shale, SST = sandstone, glauc = glauconitic, ADD = mud additive, tr = trace, v = very, fgr = fine grained, gy = grey, dk = dark, m = medium, lt = light.

Table 4.2
Water contents of different grain size fractions

Table 4.2 Water contents of different grain size fractions.

Sample ID	External sample ID.	Water content >4 mm fraction (wt% of wet fraction)	Water content 4-1 mm fraction (wt% of wet fraction)	Water content 1-0.125 mm fraction (wt% of wet fraction)	Water content >0.125 mm (wt% of wet fraction)
H6174	1A	42.2	36.5	30.6	34.3
H6175	1B	31.5	24.2	21.2	22.2
H6176	1C	50.0	30.0[1]	21.8	23.4
H6177	1D	44.8	30.4	19.3	21.7
H6178	1E	25.0	30.0[1]	19.7	20.0
H6179	1F	- - - - No analysis - -- -			
H6180	1G	28.6	30.0[1]	16.9	17.0
H6181	1H	0.0	30.0[1]	18.3	18.9
H6182	1I	20.8	30.0[1]	18.2	19.3
H6183	1J	20.9	23.7	19.0	19.5

Comment:

1) Estimated value due to a very small sample amount

Table 4.3
Yield of hydrocarbons in headspace and occluded gas
(µl/kg dry rock)

Table 4.3 Yield of hydrocarbons in headspace and occluded gas (µl/kg dry rock).

Sample-ID	H6174	H6174	H6174	H6175	H6175	H6175	H6176	H6176	H6176
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1A	1A	1A	1B	1B	1B	1C	1C	1C
Compound									
C1	549	72	621	1253	216	1469	992	606	1598
C2	3	4	7	6	10	16	4	79	83
C3	2	2	4	1	3	4	2	34	37
iC4	0	0	1	0	0	0	0	0	0
C4ene	0	1	1	0	1	1	1	9	10
nC4	0	1	1	0	1	1	0	7	7
2,2-DMC3	0	0	0	0	0	0	0	0	0
RI=431	0	0	0	0	0	0	0	0	0
iC5	0	0	0	0	0	0	0	0	0
RI=485	0	0	0	0	0	0	0	0	0
RI=493	0	0	0	0	0	0	0	0	0
nC5	0	1	1	0	0	0	0	6	6
RI=529	0	0	0	0	0	0	0	0	0
3-MC5	0	0	0	0	0	0	0	0	0
nC6	0	1	1	0	1	1	0	10	10
3,3-DMC5	0	0	0	0	0	0	0	0	0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0	0	0	0	0	0	0	0	0
nC7	0	0	0	0	0	0	0	0	0
nC8	0	0	0	0	0	0	0	0	0
E-Benzene	0	0	0	0	0	0	0	0	0
m+p-Xylene	0	0	0	0	0	0	0	0	0
o-Xylene	0	0	0	0	0	0	0	0	0
nC9	0	0	0	0	0	0	0	0	0
Sum FID	554	81	636	1260	233	1493	1000	750	1750

Sample-ID	H6177	H6177	H6177	H6178	H6178	H6178	H6180	H6180	H6180
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1D	1D	1D	1E	1E	1E	1G	1G	1G
Compound									
C1	1372	559	1932	942	626	1568	182	1351	1533
C2	8	36	44	4	38	42	2	67	70
C3	2	13	15	5	13	19	2	24	27
iC4	0	2	2	1	2	2	1	4	5
C4ene	1	4	4	2	4	6	1	4	5
nC4	0	4	4	0	3	3	0	6	6
2,2-DMC3	0	0	0	0	0	0	0	0	0
RI=431	0	0	0	1	0	1	0	0	0
iC5	0	1	1	1	1	2	0	3	3
RI=485	0	0	0	0	0	0	0	0	0
RI=493	0	0	0	0	0	0	0	0	0
nC5	0	1	2	1	1	2	0	3	3
RI=529	0	0	0	0	0	0	0	0	0
3-MC5	0	1	1	0	1	1	0	0	0
nC6	0	1	1	1	1	2	0	2	2
3,3-DMC5	0	0	0	0	0	0	0	0	0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0	0	0	0	0	0	0	0	0
nC7	0	1	1	0	1	1	0	0	0
nC8	0	1	1	0	1	1	0	0	0
E-Benzene	0	0	0	0	0	0	0	1	1
m+p-Xylene	1	1	2	0	0	0	0	6	6
o-Xylene	0	1	1	0	0	0	0	3	3
nC9	0	1	1	0	0	0	0	0	0
Sum FID	1384	626	2010	956	692	1649	189	1474	1663

Table 4.3 Continued

Sample-ID	H6181	H6181	H6181	H6182	H6182	H6182	H6183	H6183	H6183
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1H	1H	1H	1I	1I	1I	1J	1J	1J
Compound									
C1	556	520	1076	2338	463	2801	1634	262	1896
C2	3	40	42	12	43	56	9	26	35
C3	2	18	19	7	20	26	3	13	16
iC4	0	0	0	0	0	0	0	1	1
C4ene	1	7	8	3	7	10	1	5	6
nC4	0	3	3	0	2	2	0	2	2
2,2-DMC3	0	0	0	0	0	0	0	1	1
RI=431	1	0	1	3	0	3	2	0	2
iC5	0	1	1	0	1	1	0	1	1
RI=485	0	1	1	0	1	1	0	1	1
RI=493	0	1	1	0	1	1	0	1	1
nC5	0	1	1	0	0	0	0	1	1
RI=529	0	1	1	0	0	0	0	1	1
3-MC5	0	0	0	0	0	0	0	0	0
nC6	0	1	1	0	0	0	0	1	1
3,3-DMC5	0	0	0	0	0	0	0	0	0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0	0	0	0	0	0	0	0	0
nC7	0	1	1	0	0	0	0	0	0
nC8	0	1	1	0	0	0	0	0	0
E-Benzene	0	1	1	0	0	0	0	0	0
m+p-Xylene	0	6	7	0	0	0	0	0	0
o-Xylene	0	4	4	0	0	0	0	0	0
nC9	0	0	0	0	0	0	0	0	0
Sum FID	563	606	1169	2363	539	2902	1651	312	1963

Table 4.4
Composition of hydrocarbons in headspace and occluded gas (volume %)

Table 4.4 Composition of hydrocarbons in headspace and occluded gas (volume %).

Sample-ID	H6174	H6174	H6174	H6175	H6175	H6175	H6176	H6176	H6176
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External-ID	1A	1A	1A	1B	1B	1B	1C	1C	1C
Compound									
C1	99.0	88.6	97.7	99.5	92.6	98.4	99.2	80.8	91.3
C2	0.5	5.3	1.1	0.5	4.5	1.1	0.4	10.5	4.7
C3	0.3	2.3	0.6	0.0	1.4	0.3	0.2	4.6	2.1
iC4	0.0	0.5	0.1	0.0	0.2	0.0	0.0	0.0	0.0
C4ene	0.0	0.7	0.1	0.0	0.4	0.1	0.1	1.2	0.6
nC4	0.0	0.6	0.1	0.0	0.3	0.1	0.0	0.9	0.4
2,2-DMC3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI=431	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
iC5	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0
RI=485	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI=493	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC5	0.0	0.7	0.1	0.0	0.2	0.0	0.0	0.7	0.3
RI=529	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-MC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC6	0.0	1.3	0.2	0.0	0.2	0.0	0.0	1.3	0.6
3,3-DMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E-Benzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
m+p-Xylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
o-Xylene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum FID	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sample-ID	H6177	H6177	H6177	H6178	H6178	H6178	H6180	H6180	H6180
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External-ID	1D	1D	1D	1E	1E	1E	1G	1G	1G
Compound									
C1	99.1	89.4	96.1	98.5	90.5	95.1	96.4	91.6	92.2
C2	0.6	5.8	2.2	0.4	5.5	2.6	1.2	4.6	4.2
C3	0.1	2.1	0.7	0.6	1.9	1.1	1.2	1.7	1.6
iC4	0.0	0.3	0.1	0.1	0.2	0.1	0.4	0.3	0.3
C4ene	0.0	0.6	0.2	0.2	0.6	0.4	0.5	0.3	0.3
nC4	0.0	0.6	0.2	0.0	0.4	0.2	0.0	0.4	0.3
2,2-DMC3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RI=431	0.0	0.0	0.0	0.1	0.0	0.0	0.3	0.0	0.0
iC5	0.0	0.2	0.1	0.1	0.2	0.1	0.0	0.2	0.2
RI=485	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
RI=493	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC5	0.0	0.2	0.1	0.1	0.2	0.1	0.0	0.2	0.2
RI=529	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-MC5	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0
nC6	0.0	0.2	0.1	0.1	0.2	0.1	0.0	0.1	0.1
3,3-DMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC7	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
nC8	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
E-Benzene	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
m+p-Xylene	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.4	0.4
o-Xylene	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.2
nC9	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum FID	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.4 Continued

Sample-ID	H6181	H6181	H6181	H6182	H6182	H6182	H6183	H6183	H6183
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External-ID	1H	1H	1H	1I	1I	1I	1J	1J	1J
Compound									
C1	98.8	85.7	92.0	98.9	86.0	96.5	99.0	83.9	96.6
C2	0.4	6.6	3.6	0.5	8.0	1.9	0.5	8.3	1.8
C3	0.3	2.9	1.6	0.3	3.7	0.9	0.2	4.2	0.8
iC4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
C4ene	0.2	1.1	0.7	0.1	1.3	0.3	0.1	1.4	0.3
nC4	0.0	0.4	0.2	0.0	0.4	0.1	0.0	0.5	0.1
2,2-DMC3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
RI=431	0.3	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1
iC5	0.0	0.2	0.1	0.0	0.1	0.0	0.0	0.2	0.0
RI=485	0.0	0.2	0.1	0.0	0.2	0.0	0.0	0.2	0.0
RI=493	0.0	0.2	0.1	0.0	0.2	0.0	0.0	0.3	0.0
nC5	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.2	0.0
RI=529	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.2	0.0
3-MC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC6	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.3	0.0
3,3-DMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
t-1,2-DMCyC5 + 3-EC5 + 2,2,4-TMC5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
nC7	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
nC8	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
E-Benzene	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
m+p-Xylene	0.0	1.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0
o-Xylene	0.0	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0
nC9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sum FID	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4.5
Ratios and summary data

(See Table 2.4 for explanations and comments;
-1 = ratio cannot be calculated)

Table 4.5 Ratios and summary data. (See Table 2.4 for explanation and comments; -1 = ratio cannot be calculated

Sample-ID	H6174	H6174	H6174	H6175	H6175	H6175	H6176	H6176	H6176
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1A	1A	1A	1B	1B	1B	1C	1C	1C
Compound									
CncC1	549	72	621	1253	216	1469	992	606	1598
CncC2C4	5	8	13	7	16	23	7	129	136
CncC5C9	0	2	2	0	1	1	1	15	16
CncC1C9	554	81	636	1260	233	1493	1000	750	1750
PctC1	99.0	88.6	97.7	99.5	92.6	98.4	99.2	80.8	91.3
PctC2C4	1.0	9.4	2.0	0.5	6.8	1.5	0.7	17.2	7.8
PctC5C9	0.1	2.0	0.3	0.0	0.6	0.1	0.1	2.0	0.9
PctC1C9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wetness	1.0	9.6	2.0	0.5	6.9	1.5	0.7	17.5	7.8

Sample-ID	H6177	H6177	H6177	H6178	H6178	H6178	H6180	H6180	H6180
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1D	1D	1D	1E	1E	1E	1G	1G	1G
Compound									
CncC1	1372	559	1932	942	626	1568	182	1351	1533
CncC2C4	11	58	69	12	60	72	6	106	112
CncC5C9	1	8	10	2	6	9	0	18	18
CncC1C9	1384	626	2010	956	692	1649	189	1474	1663
PctC1	99.1	89.4	96.1	98.5	90.5	95.1	96.4	91.6	92.2
PctC2C4	0.8	9.3	3.4	1.3	8.6	4.4	3.4	7.2	6.7
PctC5C9	0.1	1.3	0.5	0.2	0.9	0.5	0.3	1.2	1.1
PctC1C9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wetness	0.8	9.5	3.5	1.3	8.7	4.4	3.4	7.3	6.8

Sample-ID	H6181	H6181	H6181	H6182	H6182	H6182	H6183	H6183	H6183
Gas fraction	H	O	H+O	H	O	H+O	H	O	H+O
External ID.	1H	1H	1H	1I	1I	1I	1J	1J	1J
Compound									
CncC1	556	520	1076	2338	463	2801	1634	262	1896
CncC2C4	5	67	72	22	72	94	13	46	59
CncC5C9	2	20	22	4	3	7	3	5	8
CncC1C9	563	606	1169	2363	539	2902	1651	312	1963
PctC1	98.8	85.7	92.0	98.9	86.0	96.5	99.0	83.9	96.6
PctC2C4	0.9	11.0	6.1	0.9	13.4	3.2	0.8	14.6	3.0
PctC5C9	0.4	3.2	1.8	0.2	0.6	0.2	0.2	1.5	0.4
PctC1C9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Wetness	0.9	11.4	6.3	0.9	13.5	3.2	0.8	14.8	3.0