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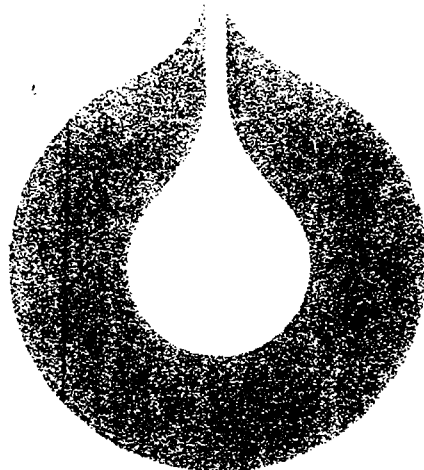
 **STATOIL**

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statoil

TBP distillation of condensate
from 30/2-1 DST 2

**STATOIL
EXPLORATION & PRODUCTION
LABORATORY**

Oddbjørn Kopperstad

April-83

LAB 83

Report number 92058070



Classification

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Subtitle

[Empty box for subtitle]

Co-workers

Kjell Øygaard
Reidun Kleven

Title

TBP distillation of condensate
from 30/2-1 DST 2
STATOIL
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Oddbjørn Kopperstad
April-83 LAB 83.17

Prepared

Oddbjørn Kopperstad

Approved

F. R. Rasmussen

SUMMARY.

This report presents the results from a true boiling point distillation, performed on a 179 ml sample from a single flash of separator condensate, bottle no. 8207608 from 30/2-1 DST 2.

The sample was fractionated by distillation from room temperature to 331°C, the densities were measured at 15°C.

Table 1.

Summary of representative data for condensate from 30/2-1 DST 2.

	Density at 15°C (g/cm ³)	Molecular Weight	Weight % of the condensate
Condensate	0.8083		100
C ₁₀ ⁺	0.8426	233	70.08
C ₂₀ ⁺	0.8670	396	29.32

2. METHODS AND EQUIPMENT.

2.1 Distillation.

TBP distillation was performed according to ASTM D-2892, with a Fisher HMS 500.

The fractions were collected according to the boiling point range of the various hydrocarbon groups (D.L.Katz and Firoozabadi, Journ. Petr. Tech., Nov. 1978, s. 1650).

From room temperature to 151.3°C the sample was fractionated at atmospheric pressure, the heavier fraction were separated at reduced pressure (25.4 mbar).

2.2 Compositional analysis.

Component analysis of the gas and the liquid fractions were performed using a Hewlet Packard 5880 gas chromatographic system.

Chromatographic conditions:

Column for the liquid: Chrompack 25m x 0.22mm WCOT,
Cp sil 5 on fused silica,
filmthickness 0.14 μ m.

Column for the gas: Chrompack 50m x 0.23mm WCOT,
Cp sil 5 on fused silica,
filmthickness 0.3 μ m

- Carrier gas: Helium 22 cm/sek. linear velocity at 10°C.
- Detector: Flame ionisation, Nitrogen make up gas, temp. 320°C.
- Injection: All glass splitter, with a packed "Jennings tube". Split ratio 1:80, temp. 310°C for the liquid. Temp. 200°C for the gas.
- Temp. program: For the first fractions the injection temp was 10°C, isothermal for 4 min., then 4°C/min. The injection temp. was 100°C for the C₁₂-C₁₉ fractions For the gas -30°C isothermal 4 min., then 8°C/min. to 160°C isothermal.

Gas Chromatograms of the different carbon to carbon cut are enclosed in the appendix.

The molecular weights was determined by freezing point depression using a Knauer molecular weight instrument, with benzene as a reference substance.

The density was determined by Paar DMA 602 frequency densiometer.

Since the residue of C_{20}^+ - fraction was very viscous, the density could not be measured directly. However, dilution of a C_{20}^+ sample with toluene in a known ratio C_{20}^+ fraction/toluene and measuring the density of this solution, the density of C_{20}^+ could be calculated after the following equation:

$$\rho_{20^+} = \frac{gC_{20^+}}{\frac{gs}{\rho_s} - \frac{gt}{\rho_t}}$$

gC_{20^+} - the weight of C_{20}^+

gt - the weight of toluene

ρ_t - the density of toluene

gs - the weight of the solution

ρ_s - the density of the solution

In a series of measurements of C_{20}^+ distillation fractions in this manner, we have found that to the measured values of the densities it should be added empirically 0.009 g/cm^3 to obtain a correct value of the density.

3. RESULTS.

The composition of the whole condensate from the TBP distillation is given in table 2.

The calculated density of the distillate

$$S = \frac{\text{Cum. weight}}{\text{Cum. volum}}$$

and % by volum distilled are given in table 3 whereas the calculated molecular weight and densities are given in table 4.

Table 5 gives the weight % of the fraction overlap of each cut. The gas chromatograms of each fractions are enclosed in the appendix.

The composition of the gas and the light end fractions determined by gas chromatography is given in table 6.

Table 2. TBP distillation of single flash oil from separator liquid
30/2-1 DST 2.

Hydrocarbon group	boiling ranges (°C)	% by weight distillation	% by weight distilled	Density at 15°C (g/cm ³)	% by volum of condensate	Mol. weight
gass	<36.5	0.437	0.437	0.3692*	0.946	27.8*
C ₅	<36.5	4.412	4.849	0.6439*	5.480	72.9*
C ₆	69.2	4.217	9.066	0.7034	4.795	84*
C ₇	98.9	4.880	13.946	0.7432	5.251	96*
C ₈	126.1	8.355	22.301	0.7612	8.778	106
C ₉	151.3	8.093	30.394	0.7786	8.312	118
C ₁₀ ⁺	>151.3	70.079		0.8426	66.511	233
C ₁₀	174.6	5.727	36.121	0.7869	5.820	132
C ₁₁	196.4	4.655	40.776	0.7883	4.722	149
C ₁₂	216.8	4.231	45.007	0.7989	4.236	163
C ₁₃	235.9	4.727	49.734	0.8195	4.613	175
C ₁₄	253.9	4.555	54.289	0.8307	4.385	194
C ₁₅	271.1	4.029	58.318	0.8332	3.867	203
C ₁₆	287.3	3.172	61.490	0.8383	3.026	217
C ₁₇	303.0	3.721	65.211	0.8360	3.560	235
C ₁₈	317.0	2.910	68.121	0.8415	2.765	247
C ₁₉	331.0	2.554	70.675	0.8520	2.397	255
C ₂₀ ⁺	>331.0	29.324	100.000	0.8670	27.047	396

* Calculated values from the GC-composition.

Table 3: Cumulativ weight, cumulativ vol. and
calculated

$$S = \frac{\text{cum.weight}}{\text{cum.vol.}} \text{ and } \% \text{ by volume}$$

of distillate from from 30/2-1 DST 2.

Fraction	Cum. weight	Cum vol.	<u>Cum.weight</u> <u>Cum.vol.</u>	% by volume distilled
gas	0.798	2.161	0.369	0.946
C ₅	8.857	14.677	0.603	6.426
C ₆	16.560	25.628	0.646	11.221
C ₇	25.474	37.622	0.677	16.472
C ₈	40.735	57.671	0.701	25.250
C ₉	55.517	76.656	0.724	33.562
C ₁₀	65.977	89.949	0.733	39.382
C ₁₁	74.480	100.786	0.739	44.104
C ₁₂	82.208	110.409	0.745	48.340
C ₁₃	90.842	120.944	0.751	52.953
C ₁₄	99.162	130.960	0.757	57.338
C ₁₅	106.522	139.793	0.762	61.205
C ₁₆	112.316	146.704	0.766	64.231
C ₁₇	119.112	154.834	0.769	67.791
C ₁₈	124.426	161.149	0.772	70.556
C ₁₉	129.091	166.624	0.775	72.953

Table 4:

Measured and calculated molecular weights and densities from distillation of 30/2-1-DST 2

	Condensate	C ₁₀ ⁺	C ₂₀ ⁺
Measured mol. weights		233	396
Calculated mol. weight using C ₁₀ ⁺ mol.weight	159,8		
Calculated mol. weight using C ₂₀ ⁺ mol.weight	160,7	234	
Measured densities (g/cm ³)	0.808	0.843	0.8670
Calculated density (g/cm ³) using C ₁₀ ⁺ density	0.803		
calculated density (g/cm ³) using C ₂₀ ⁺ density	0.800	0.838	

Table 5.

Distribution and % overlap of each carbon to carbon cut from distillation of 30/2-1 DST 4.

Component	Weight % of the condensate	Weight % of fraction overlap
gas	0.437	82 -18
C ₅	4.412	63 -37
C ₆	4.217	7-57-36
C ₇	4.880	3-58-39
C ₈	8.355	11-81-8
C ₉	8.093	14-74-12
C ₁₀	5.727	12-80-8
C ₁₁	4.655	11-77-12
C ₁₂	4.231	13-72-15
C ₁₃	4.727	12-76-12
C ₁₄	4.555	12-75-13
C ₁₅	4.029	10-80-10
C ₁₆	3.172	12-78-10
C ₁₇	3.721	11-67-22
C ₁₈	2.910	7-72-21
C ₁₉	2.554	11-73-16

Table 6

Total composition of the gas and the light-end fractions
determined by G.C.

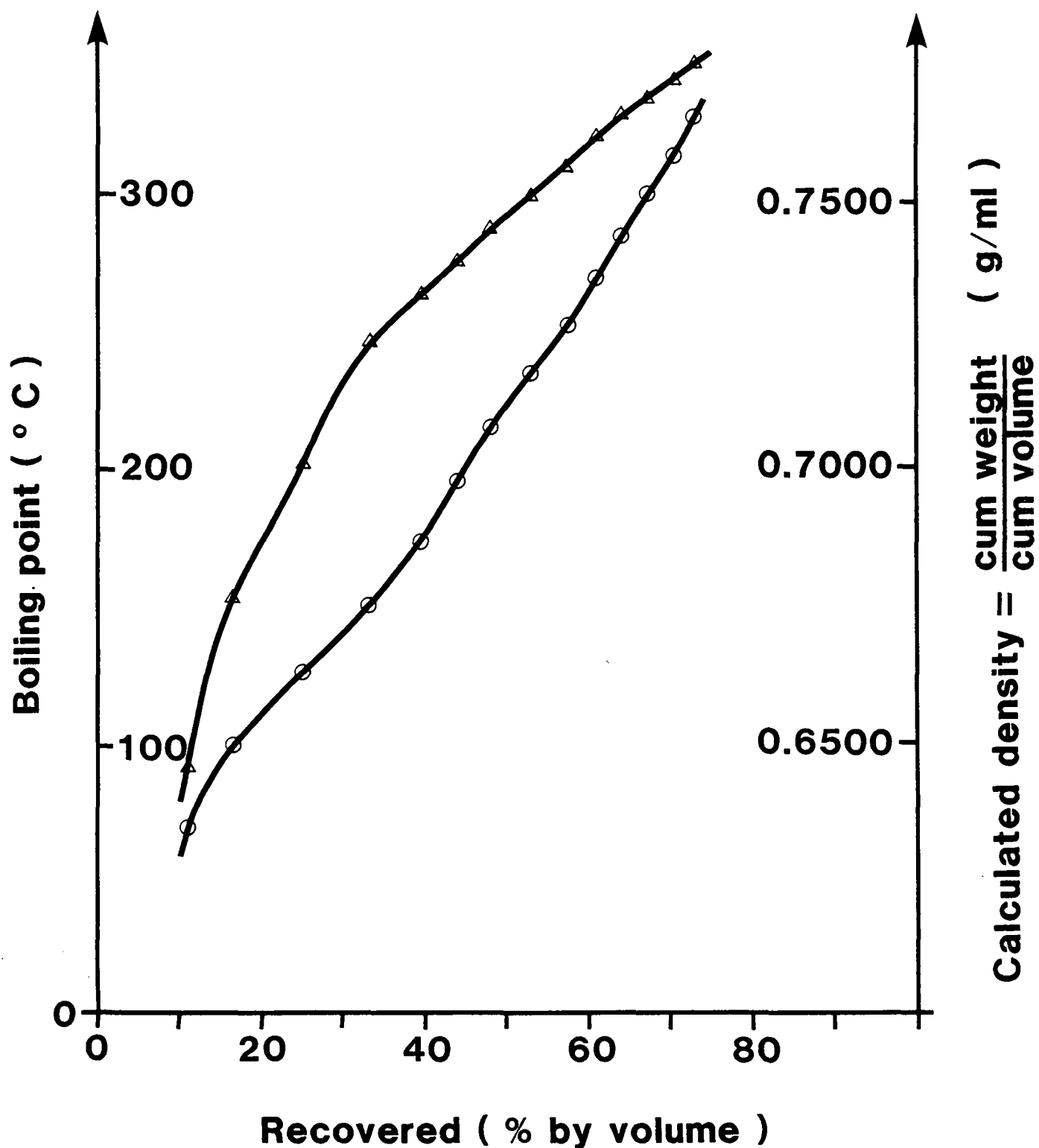
Weight % of the condensate: 22.781%.

Hydrocarbon group	weight % of the condensate
C ₁	0.1346
C ₂	0.1387
C ₃	0.0880
iC ₄	0.1499
nC ₄	0.6443
iC ₅	0.9128
nC ₅	1.4408
C ₆ cut	3.4711
C ₇ cut	5.9795
C ₈ cut	9.8210

○ Boiling point VS % by volume recovered.

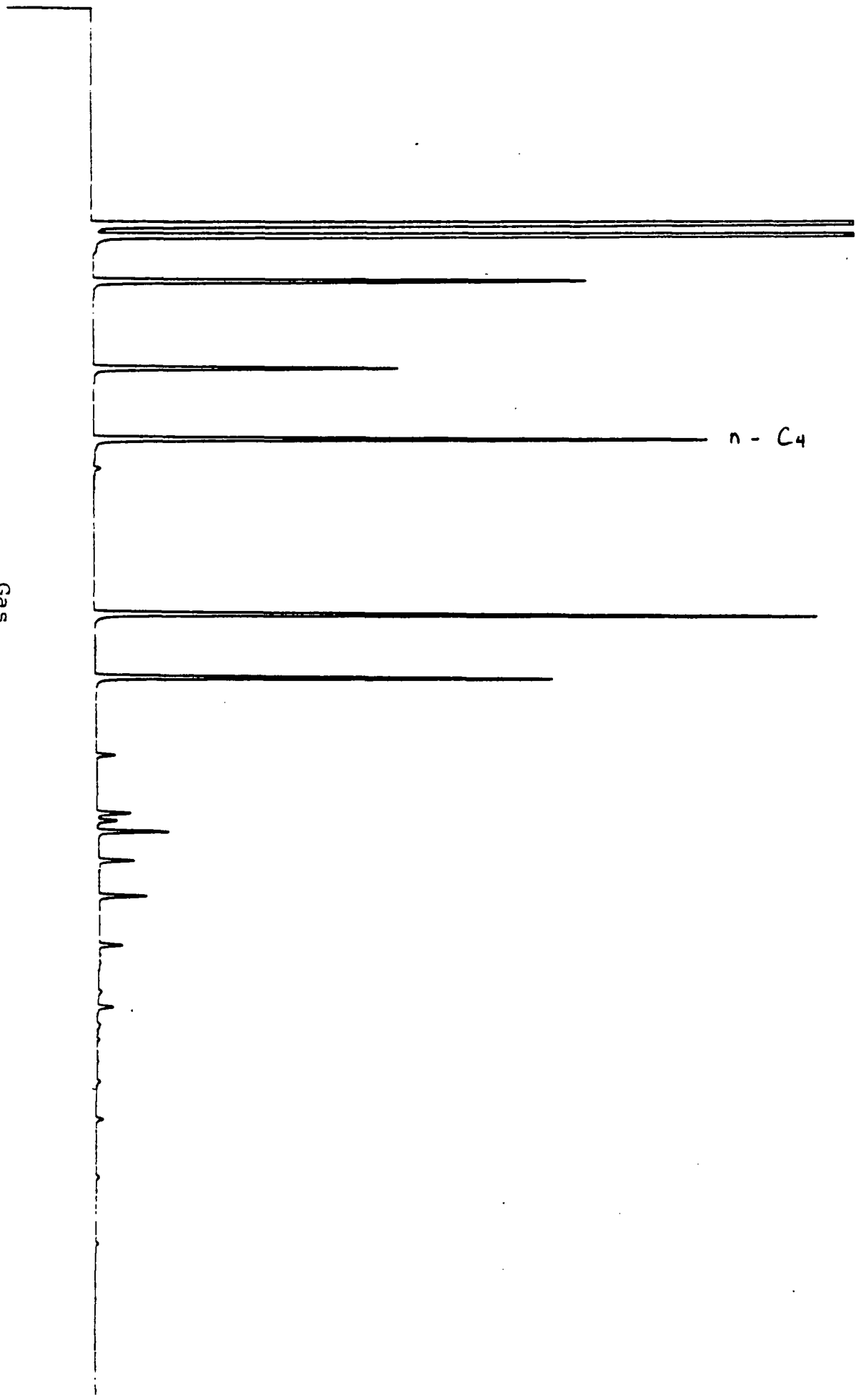
△ Calculated density of distillate recovered

($S = \frac{\text{cum weight}}{\text{cum volume}}$) VS % by volume recovered

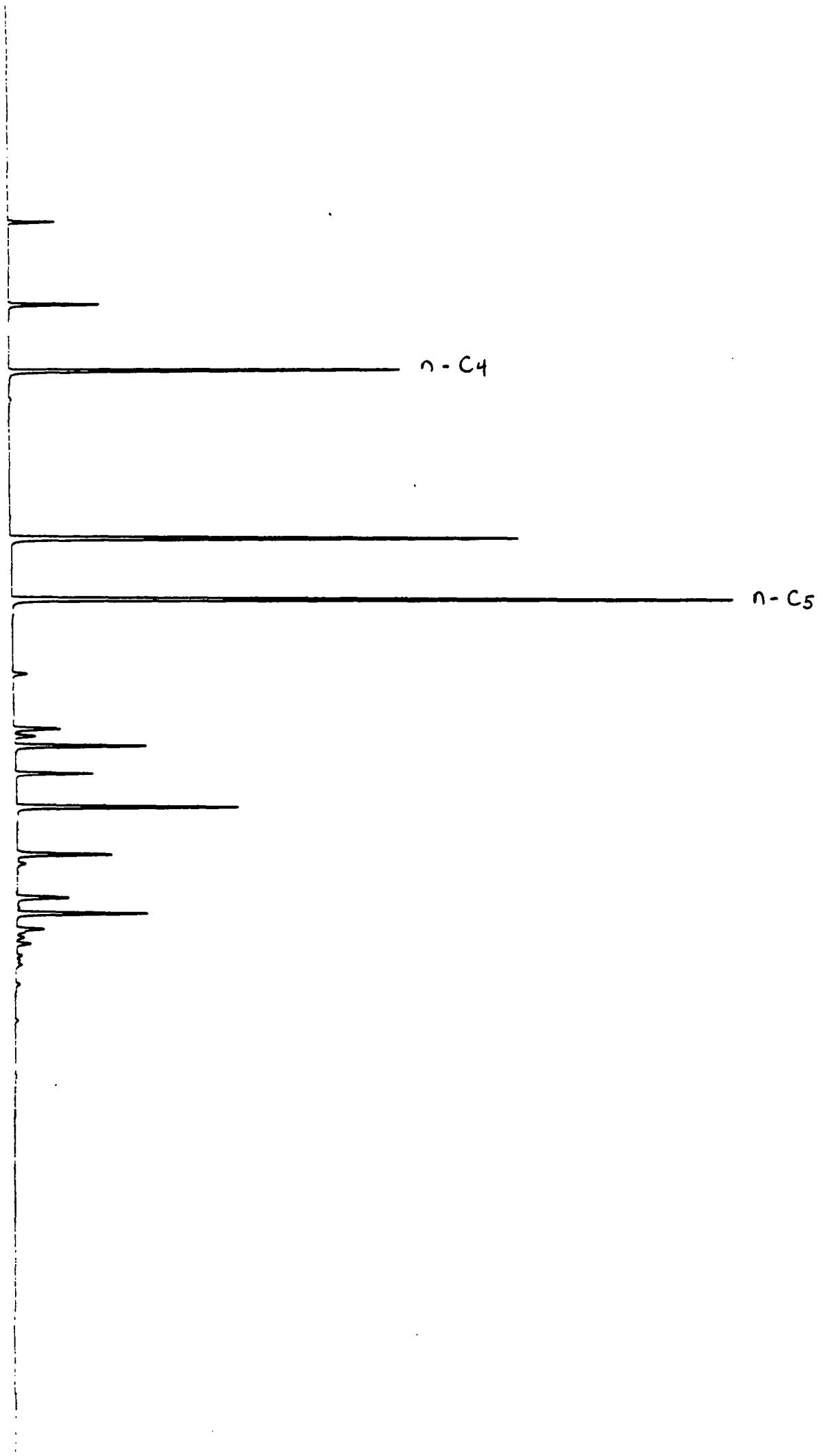


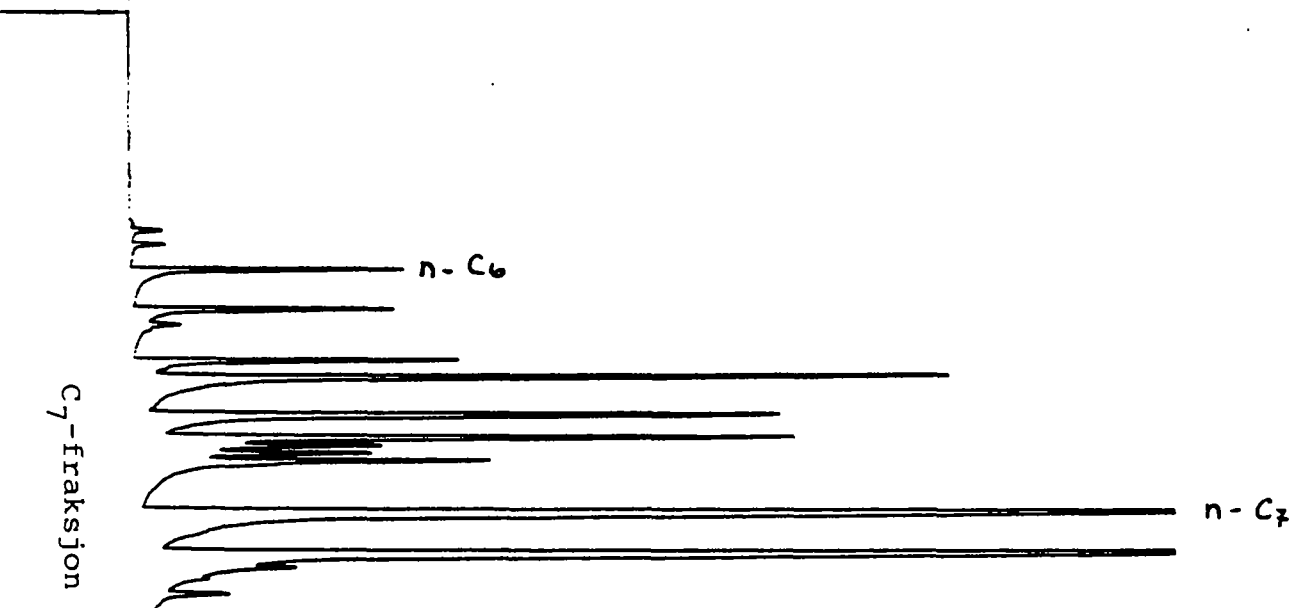
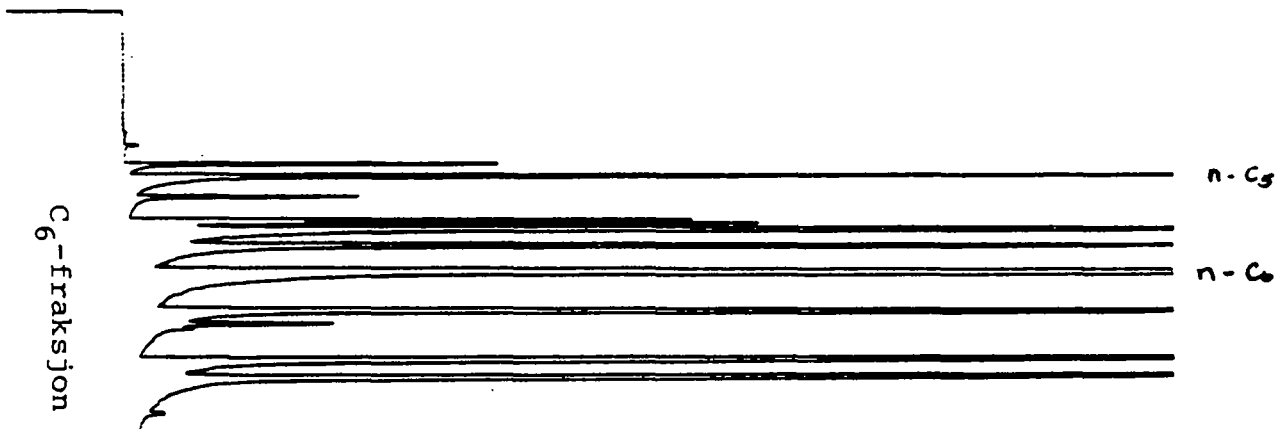
Gas

n - C₄

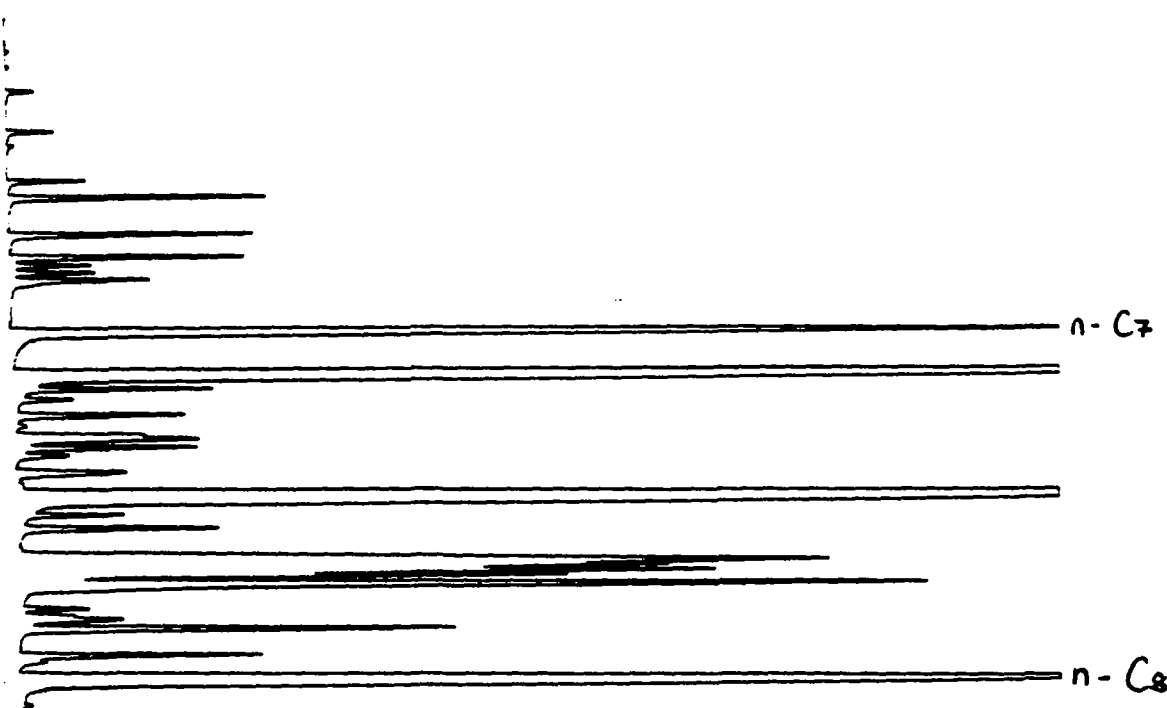


C₅-fraksjon

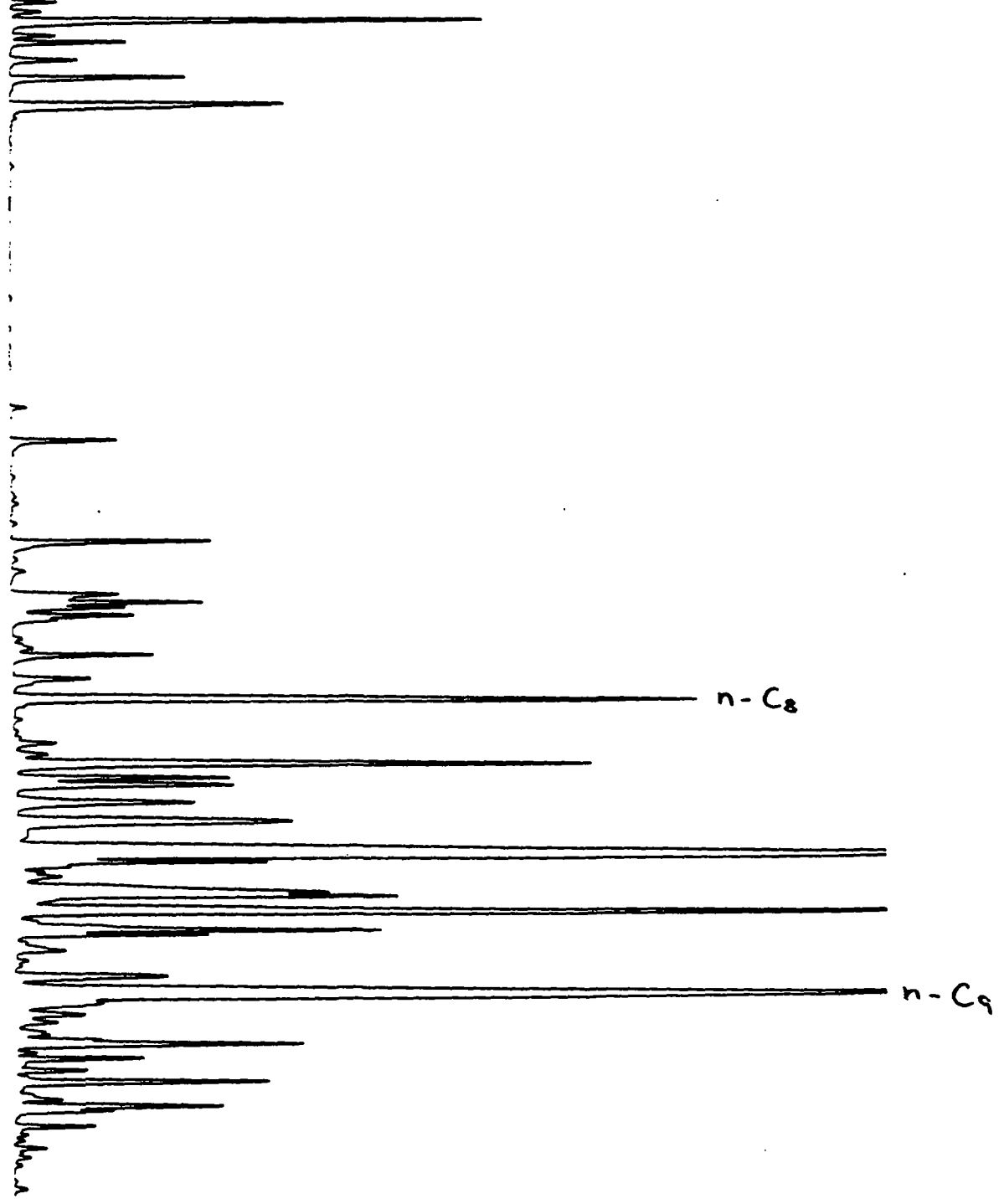




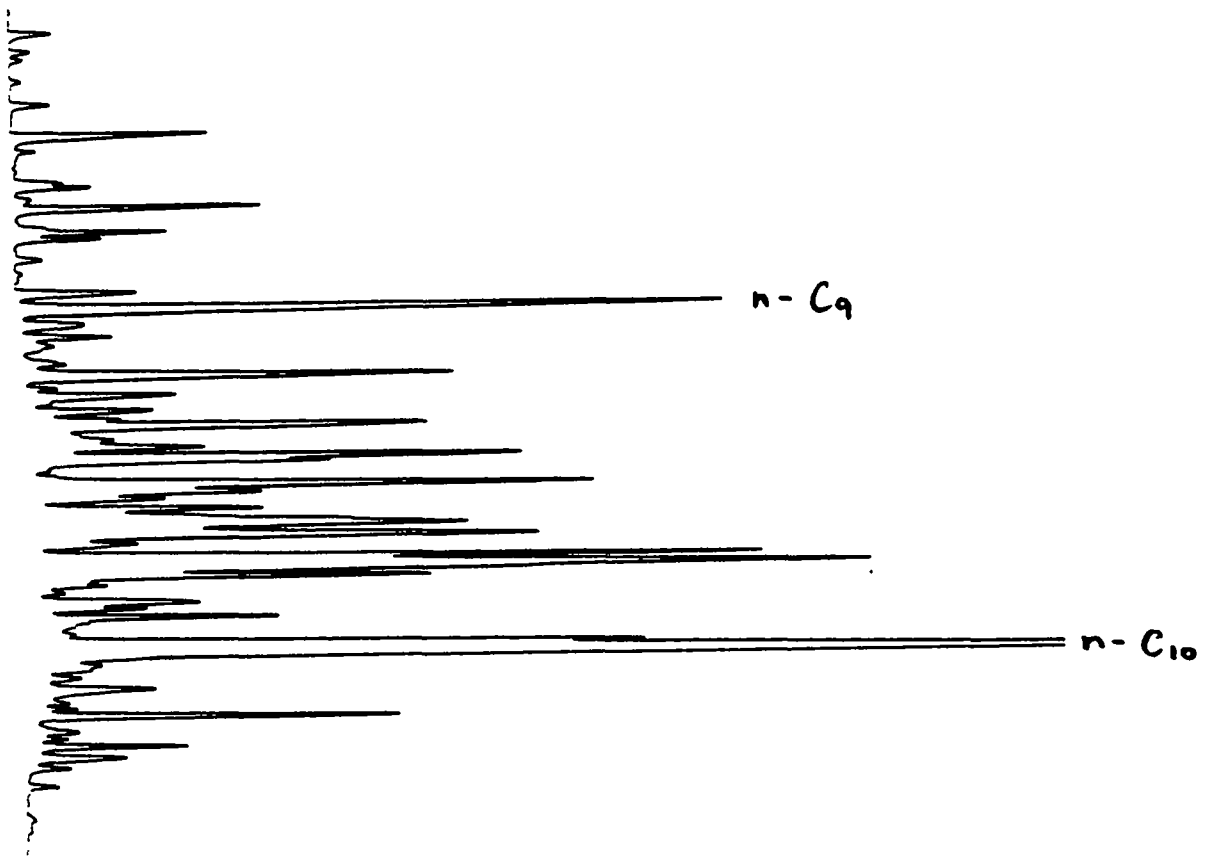
C₈-fraksjon



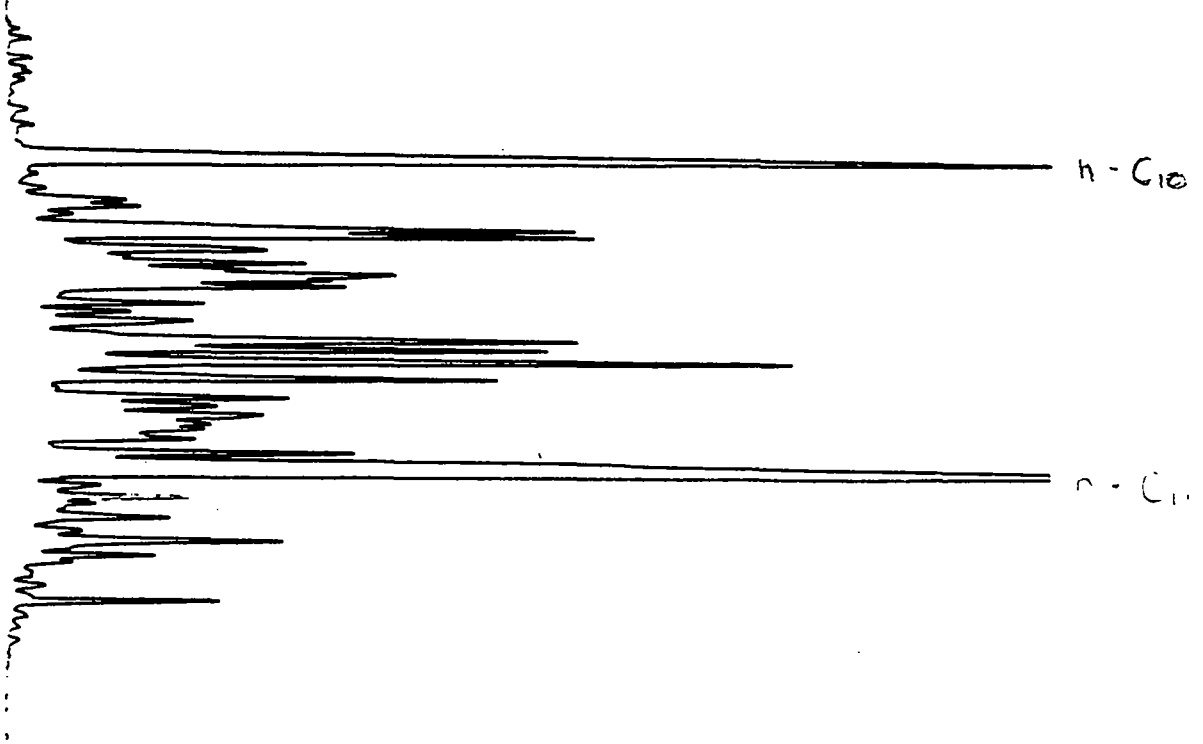
C₉-fraksjon



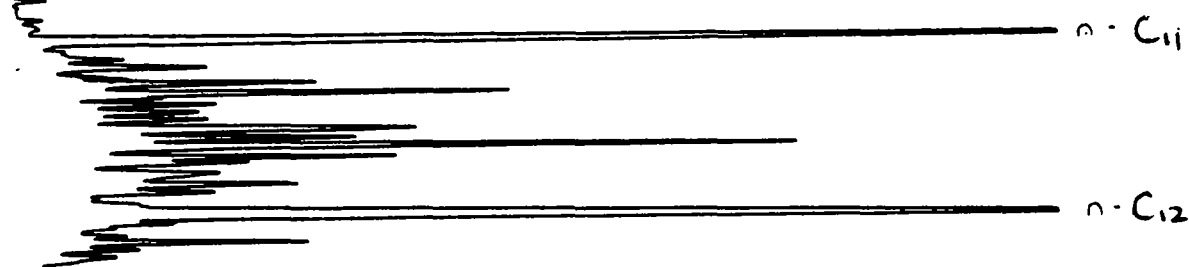
C₁₀-fraksjon



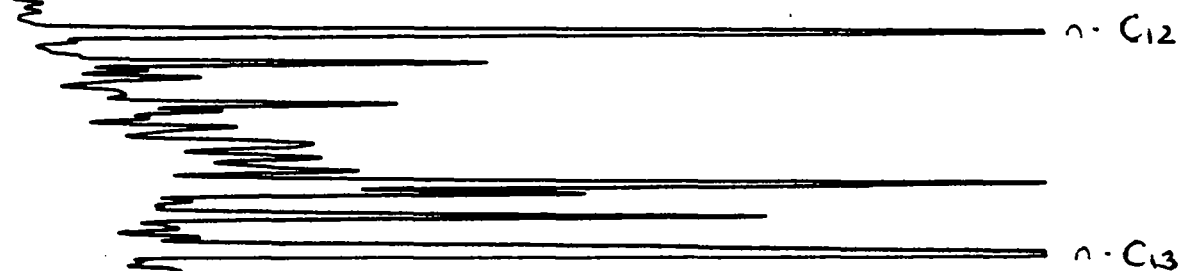
C₁₁-fraksjon



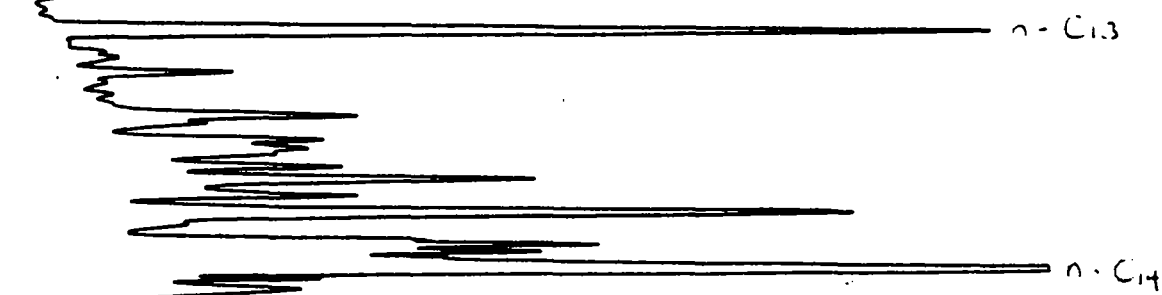
C₁₂-fraksjon



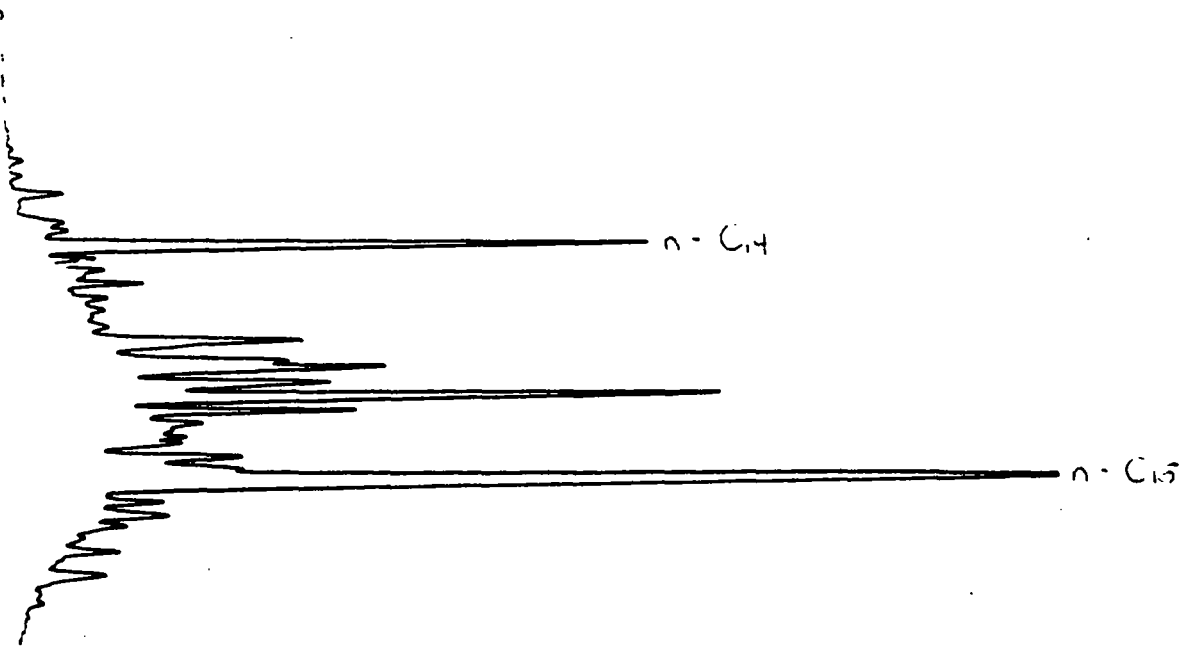
C₁₃-fraksjon



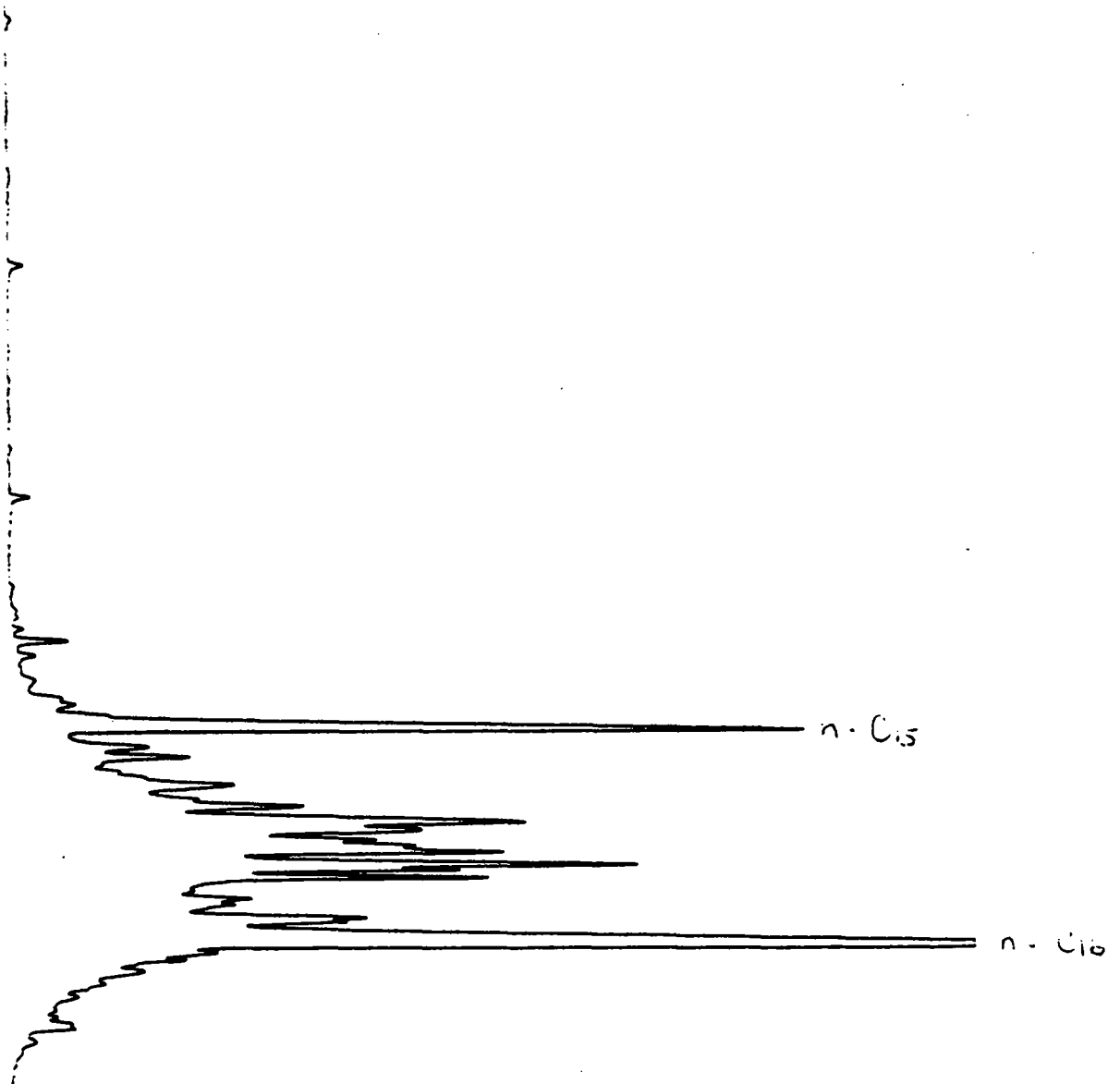
C₁₄-fraksjon



C₁₅-fraksjon



C₁₆-fraksjon



C₁₇-fraksjon

n-C₁₀

n-C₁₇

C₁₈-fraksjon

n-C₁₇

n-C₁₈

C₁₉-fraksjon

n-C₁₈

n-C₁₉

