

Denne rapport
tilhører

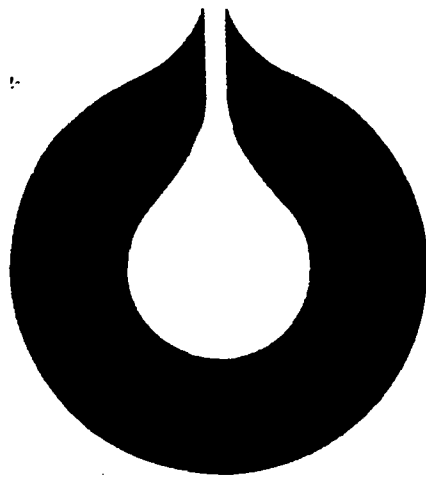
 **STATOIL**

LTEK DOK.SENTER

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KODE Well 1/9-6 nr29

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statoil

TBP distillation of condensate
from 1/9-6 DST 3 A

STATOIL
EXPLORATION & PRODUCTION
LABORATORY

Kjell Øygard

Jan. 83

LAB.8

Den norske stats oljeselskap a.s



Classification

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Title

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LAB.82.55

Prepared

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27/1-85 | T. Thomassen

SUMMARY.

This report presents the results from a true boiling point distillation, performed on a 250 ml sample from a single flash of separator condensate, bottle no. 1116/458 from 1/9-6 DST 3.

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

Representative data of the condensate are given in table 1.

Table 1.

Summary of representative data for condensate from 1/9-6 DST 3.

	Density at 15°C (g/cm ³)	Molecular Weight	Weight % of the condensate
Condensate	0.786	151	100
C ₁₀ ⁺	0.824	219	65.66
C ₂₀ ⁺	0.872	378	22.20

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: Chrompack 25m x 0.22mm WCOT,
Cp sil 5 on fused silica,
filmthickness 0.14 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.

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 C₁₁-C₁₉ fractions. The chromatograms of the fractions are enclosed in the appendix.

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

Densities were determined by Paar DMA 602 frequency densiometer at 15°C.

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 shows 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. Collected fractions and their densities and molecular weights.

Hydrocarbon group	boiling point(°C)	% by weight of the tot. condensates	% by weight distilled	Density at 15°C(g/cm ³) of condensate	% by volum	Mol. weight g/gmol
gass		0.335	0.335	0.4968*	0.529	45*
C ₅	<36.5	5.888	6.223	0.6209*	7.454	68.8*
C ₆	69.2	2.458	8.681	0.682	2.833	84.7*
C ₇	98.9	7.899	16.580	0.721	8.611	94.3*
C ₈	126.1	8.440	25.020	0.746	8.892	106
C ₉	151.3	8.294	33.314	0.771	8.456	118
C ₁₀ [†]	>151.3	65.656		0.824	62.628	219
C ₁₀	174.6	5.745	39.059	0.781	5.782	133
C ₁₁	196.4	5.432	44.491	0.777	5.495	147
C ₁₂	216.8	4.800	49.291	0.782	4.824	160
C ₁₃	235.9	5.408	54.699	0.800	5.313	178
C ₁₄	253.9	4.538	59.237	0.815	4.376	189
C ₁₅	271.1	4.601	63.838	0.816	4.432	211
C ₁₆	287.3	3.450	67.288	0.824	3.290	225
C ₁₇	303.0	3.779	71.067	0.823	3.609	238
C ₁₈	317.0	2.741	73.808	0.831	2.593	249
C ₁₉	331.0	2.951	76.759	0.837	2.772	261
C ₂₀ [†]	>331.0	22.195	98.954	0.872	20.006	378

Recovered

98.9548

loss

1.0468

* Calculated value from the GC-composition.

Table 3: Cumulative weight, cumulative vol. and

$$\text{calculated density} = \frac{\text{cum. weight}}{\text{cum. vol.}} \quad (\text{g/ml})$$

Component	Cum. weight	Cum. vol. (ml)	Cum S = $\frac{\text{Cum. weight}}{\text{Cum. vol.}}$	% volum distilled
gas	0.640	1.288	0.497	0.529
Condensate	11.904	19.429	0.613	7.983
C ₆	16.606	26.323	0.631	10.816
C ₇	31.716	47.957	0.661	19.427
C ₈	47.861	68.922	0.694	28.319
C ₉	63.728	89.502	0.711	36.775
C ₁₀	74.718	103.574	0.721	42.557
C ₁₁	85.110	116.949	0.728	48.052
C ₁₂	94.292	128.691	0.733	52.876
C ₁₃	104.637	141.622	0.739	58.189
C ₁₄	113.318	152.651	0.742	62.265
C ₁₅	122.120	163.060	0.749	66.997
C ₁₆	128.719	171.068	0.752	70.287
C ₁₇	135.949	179.853	0.756	73.896
C ₁₈	141.193	186.163	0.758	76.489
C ₁₉ ⁺	146.839	192.909	0.761	79.261
C ₂₀	189.297	241.599	0.784	99.267

Table 4:

Cross checking of molecular weights and densities.

	Condensate	C ₁₀ ⁺	C ₂₀
measured mol. weights		217	378
Calculated mol. weight using C ₁₀ ⁺ mol.weight	150		
Calculated mol. weight using C ₂₀ ⁺ mol. weight	151	220	
Measured densities (g/cm ³)	0.786	0.824	0.872
Calculated density (g/cm ³) using C ₁₀ ⁺ density	0.783		
calculated density (g/cm ³) using C ₂₀ ⁺ density	0.784	0.826	

Table 5.

Weight % fraction overlap of each cut.

Component	Weight % of the condensate	Weight % of fraction overlap
gas	0,335	96-4
C ₅	5.888	77-23
C ₆	2.458	3-79-18
C ₇	7.899	13-66-21
C ₈	8.440	8-84-8
C ₉	8.294	8-83-9
C ₁₀	5.745	6-88-6
C ₁₁	5.432	16-76-8
C ₁₂	4.800	16-80-4
C ₁₃	5.408	12-79-9
C ₁₄	4.538	11-79-10
C ₁₅	4.601	12-77-11
C ₁₆	3.450	10-76-14
C ₁₇	3.779	13-75-12
C ₁₈	2.741	9-84-7
C ₁₉	2.951	20-75-5

Table 6

Total composition of the gas and the light-end fractions determined by G.C. Weight % of the condensate: 6.223%.

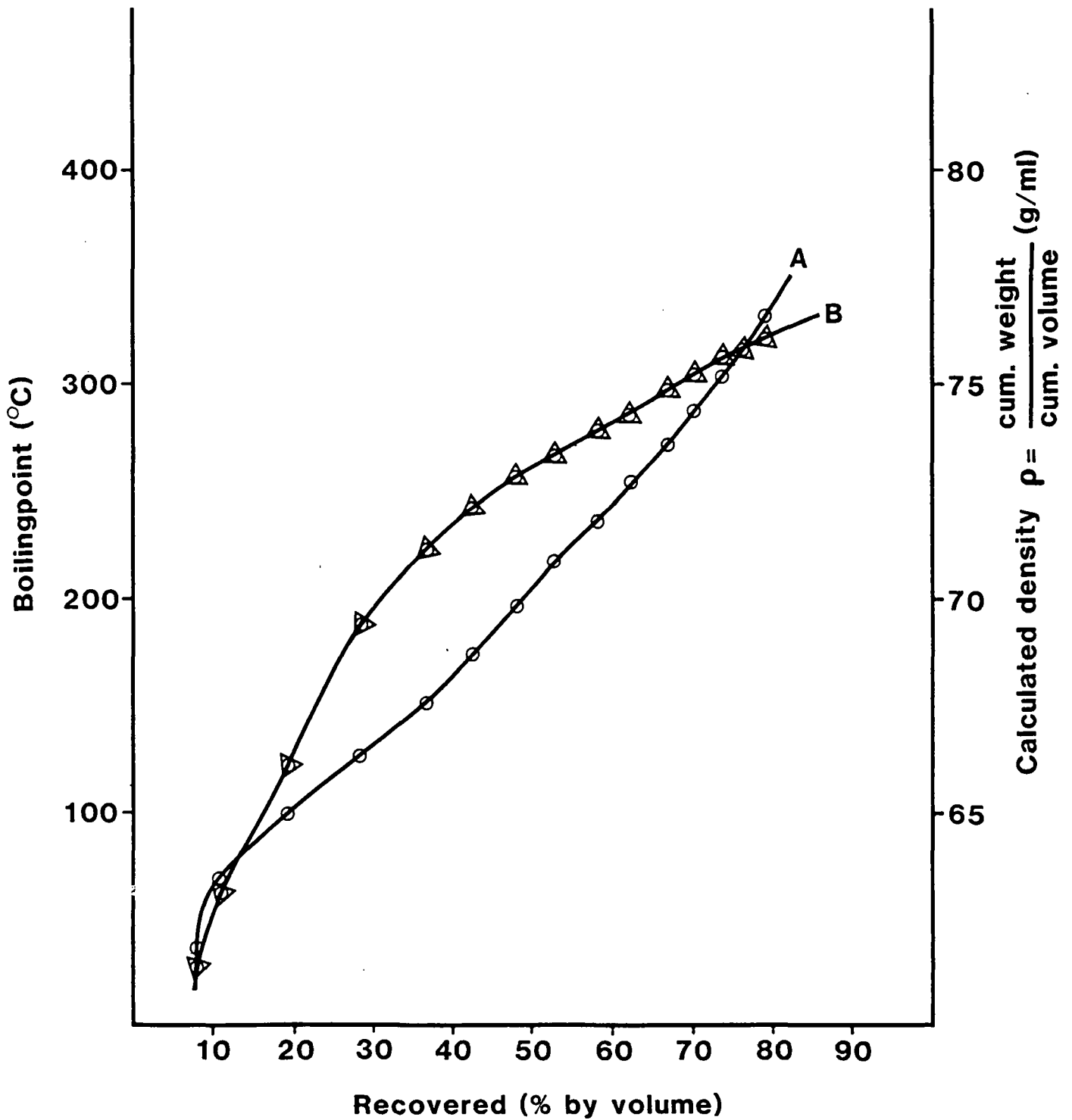
Hydrocarbon group	Weight % of condensate
C ₁	0.015
C ₂	0.060
C ₃	0.353
i-C ₄	0.324
n-C ₄	1.118
i-C ₅	1.234
n-C ₅	1.753
C ₆	1.108
C ₇	0.235
C ₈	0.023

Fig. 1

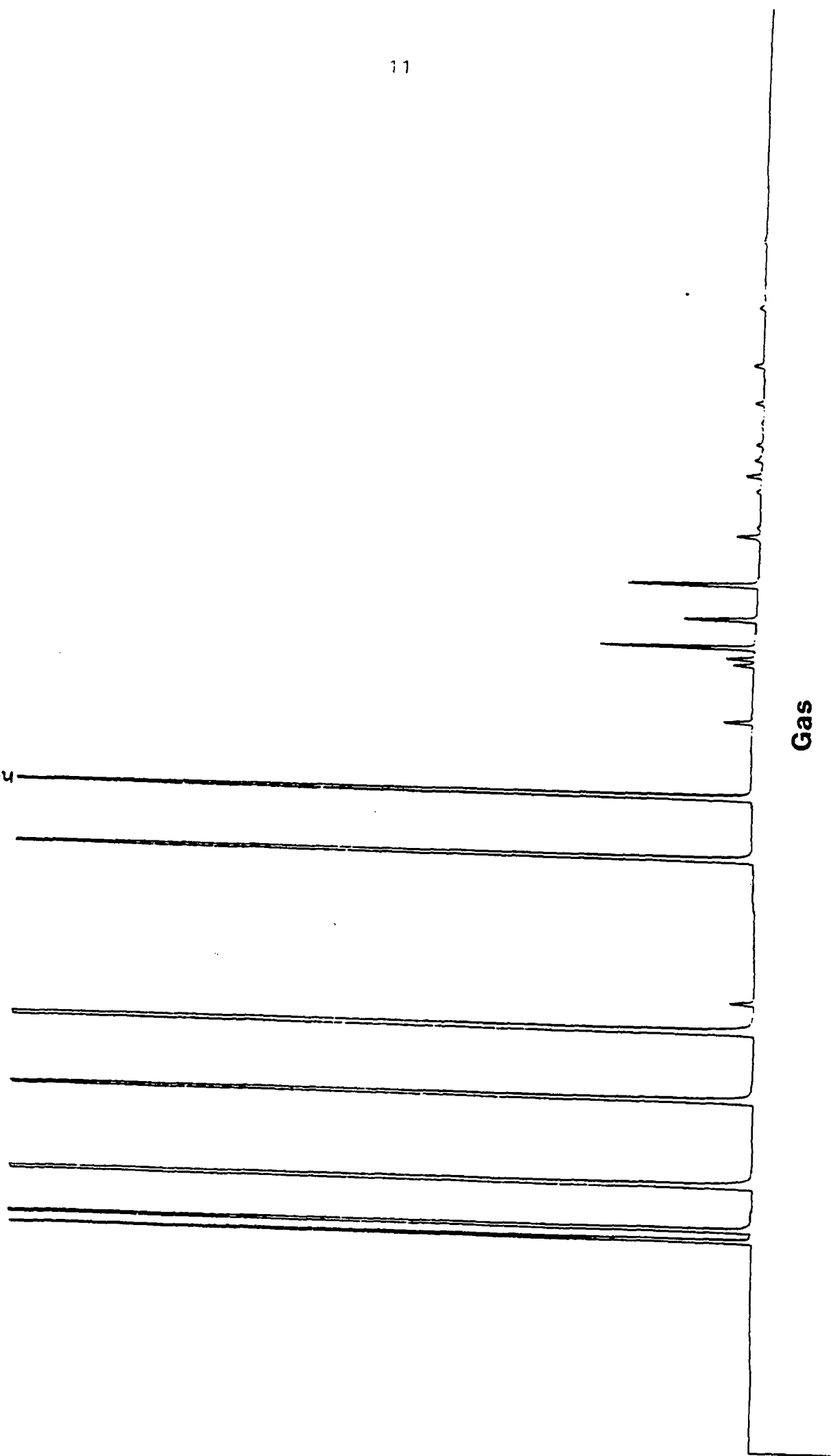
Curve A: Boilingpoint vs. % by volum recovered

Curve B: Calculated density of destillete recovered

$$\rho = \frac{\text{cum. weight}}{\text{cum. volume}} \text{ vs. \% by volume recovered}$$



n-C₅



47-u

97-u

97-u

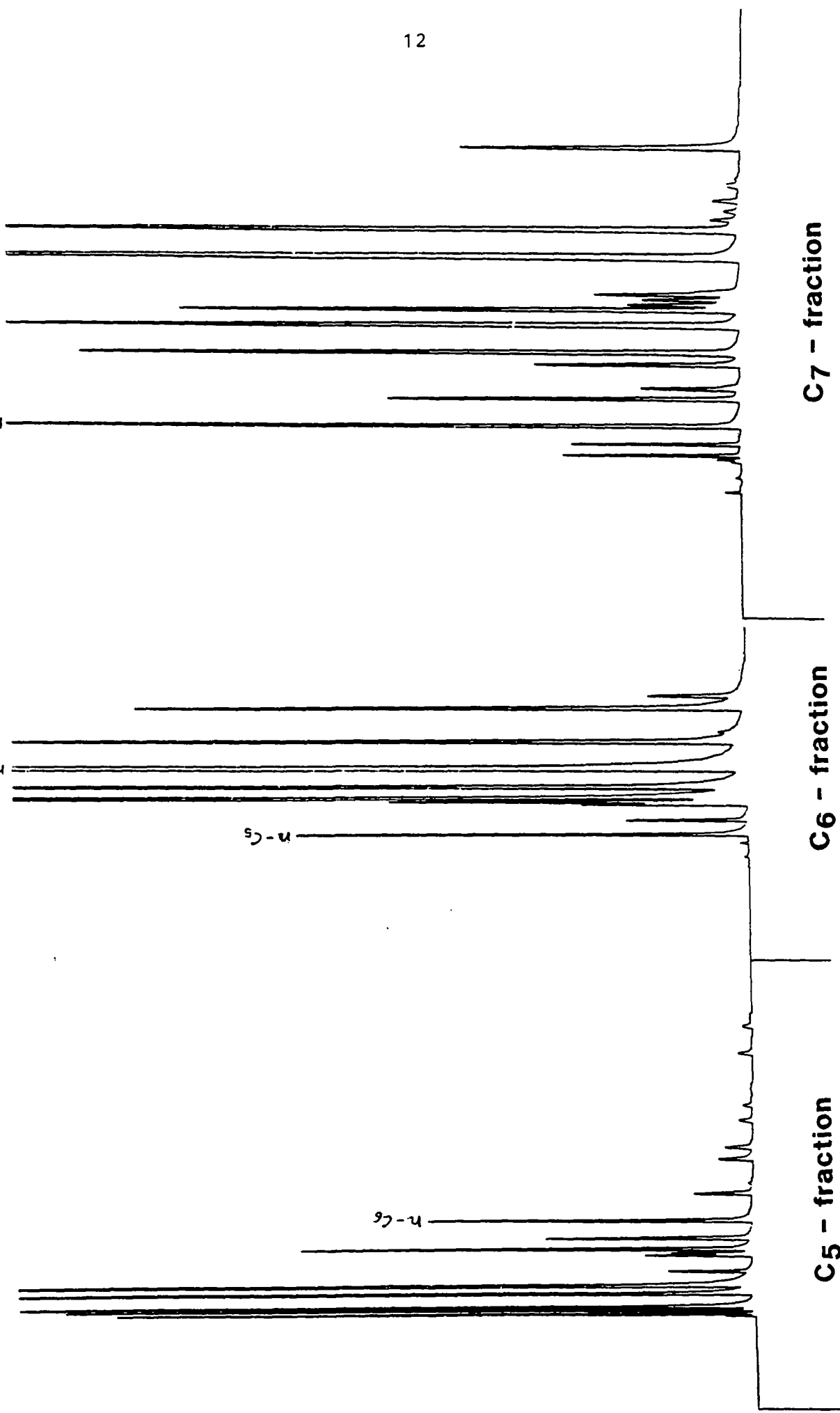
97-u

97-u

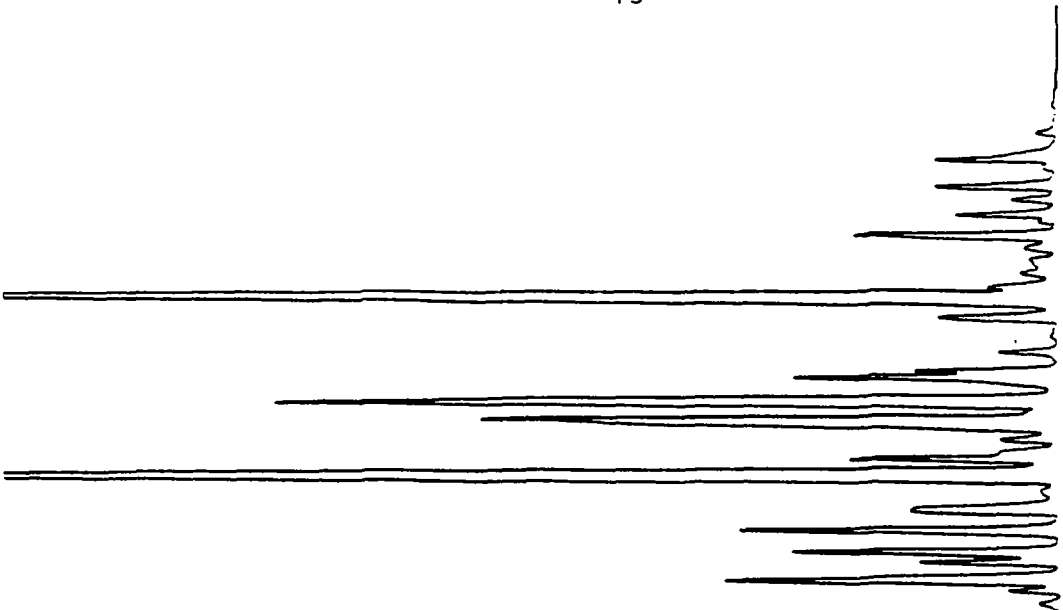
C7 - fraction

C6 - fraction

C5 - fraction

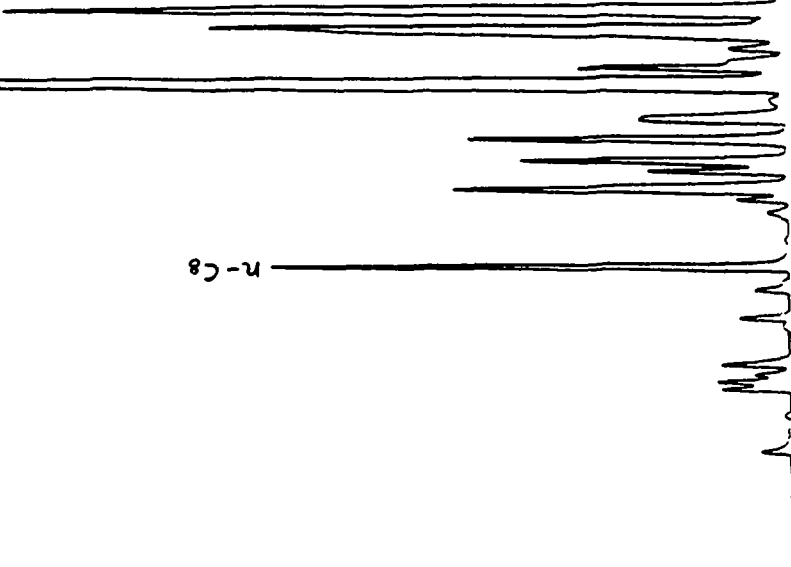


67-4



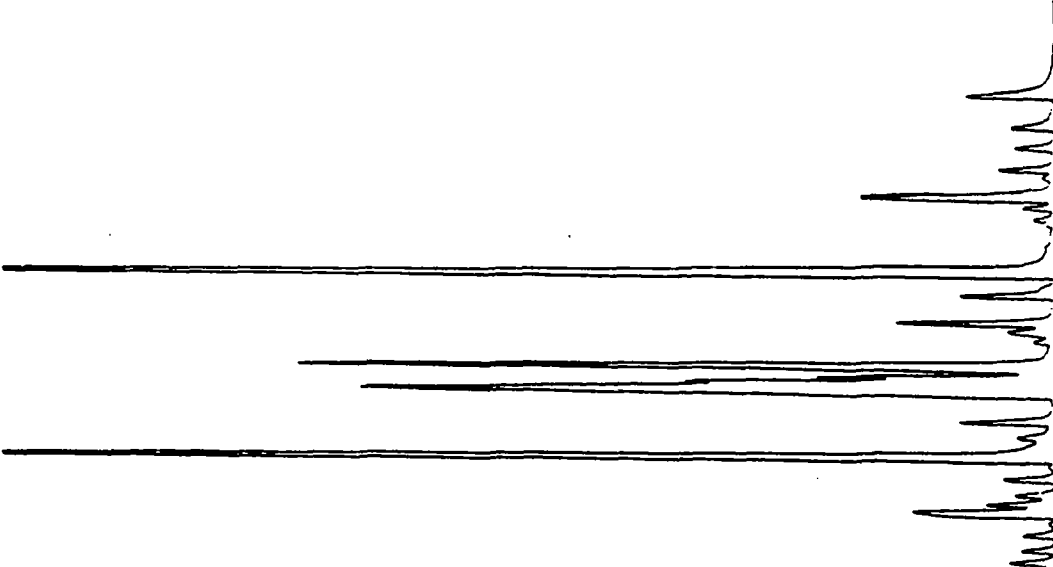
C9 - fraction

87-4

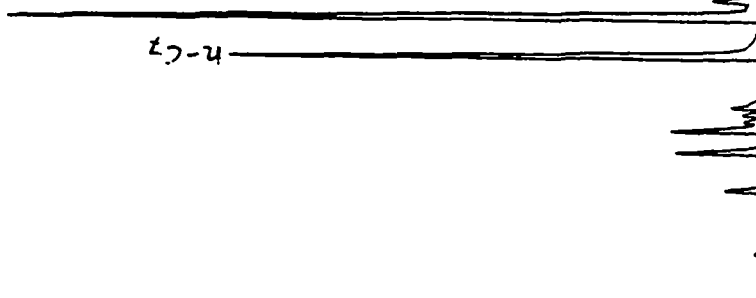


C8 - fraction

87-4



87-4



n-C₁₂

n-C₁₁

n-C₁₁

n-C₁₀

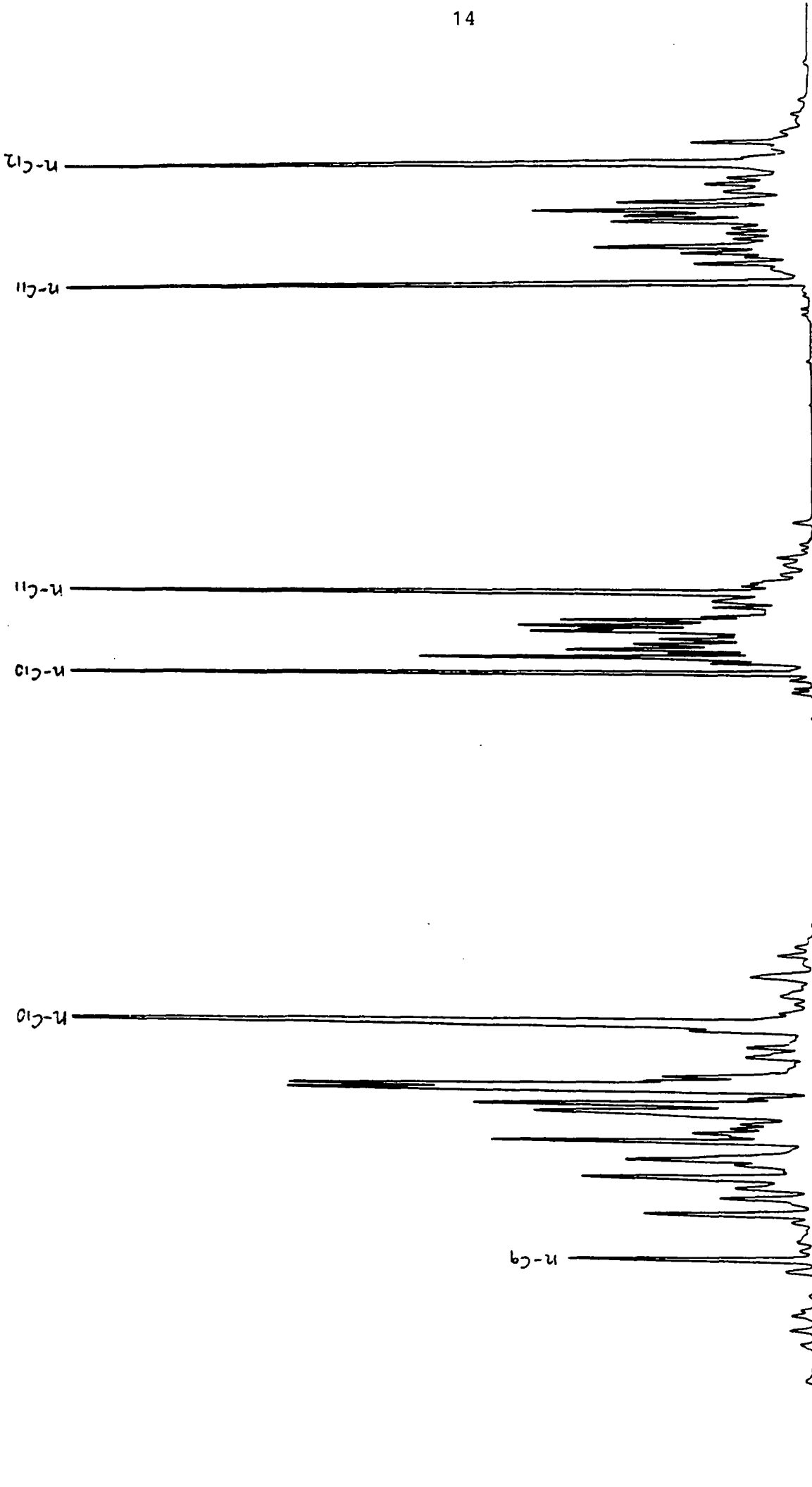
n-C₁₀

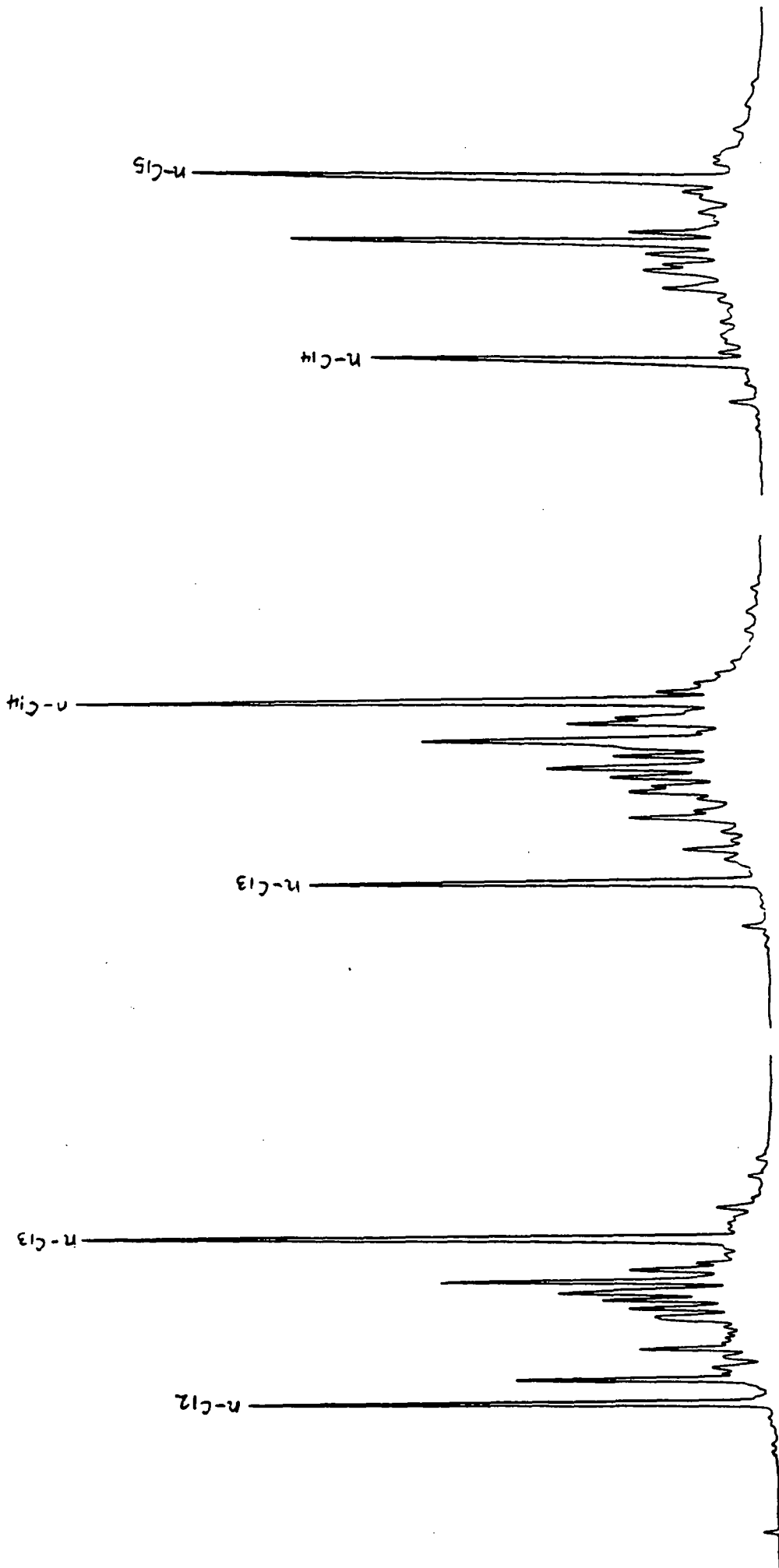
n-C₉

C₁₂ - fraction

C₁₁ - fraction

C₁₀ - fraction

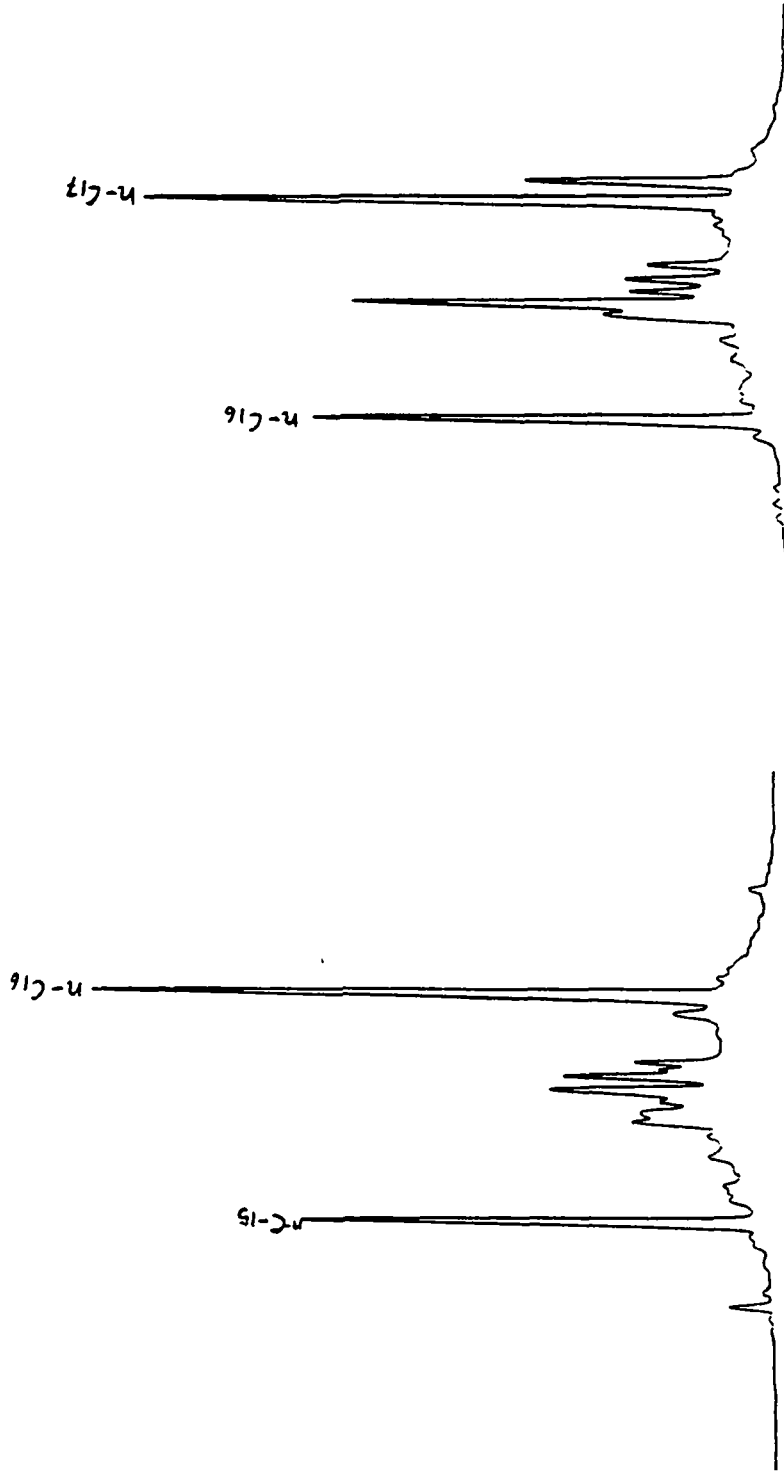




C15 - fraction

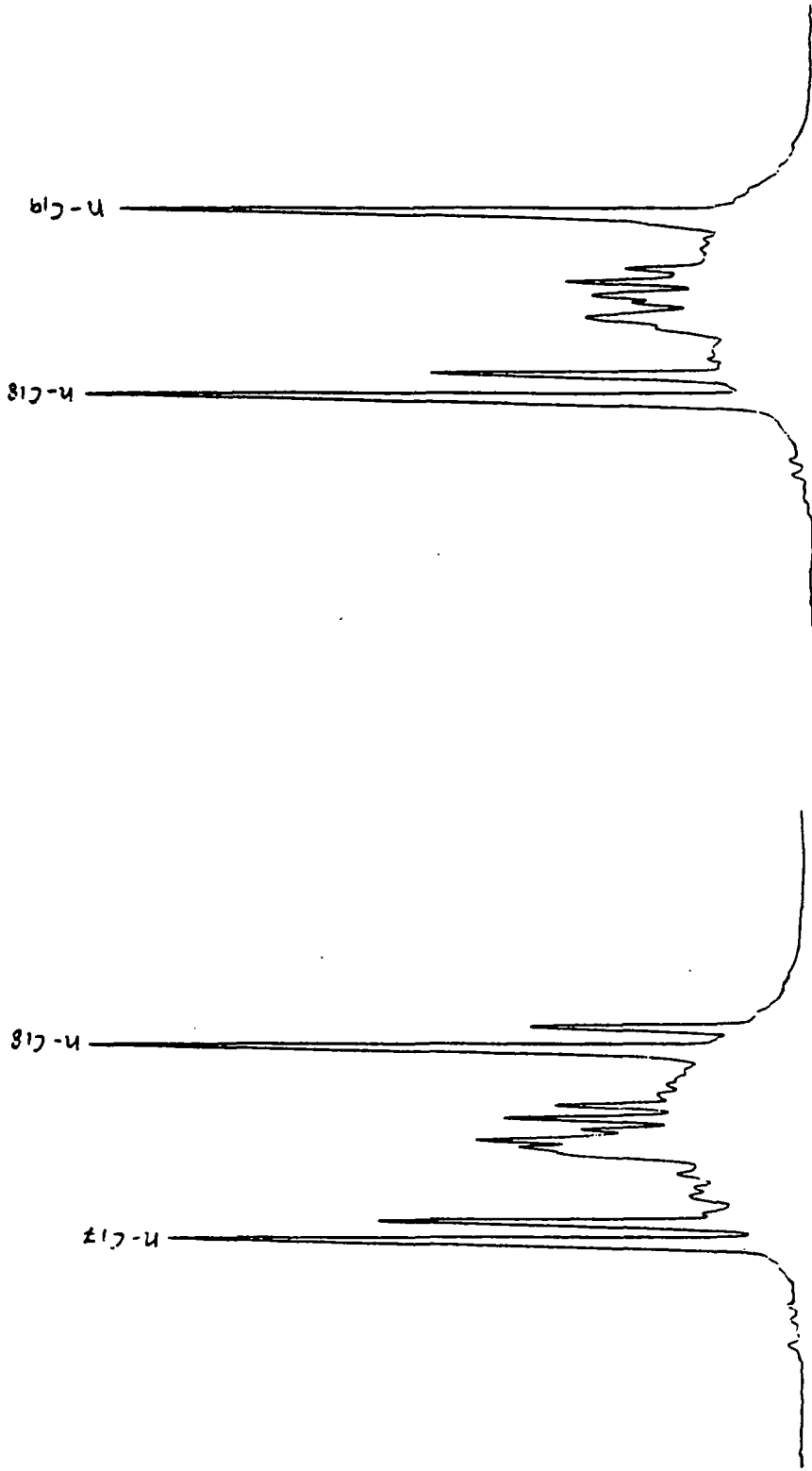
C14 - fraction

C13 - fraction



C17 - fraction

C16 - fraction



C19 - fraction

C18 - fraction