Hydrocarbons C_1 – C_9

Application Note

Environmental

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Introduction

Gas chromatography using an Agilent CP-Al_2O_3/KCl column separates 35 C_1 to C_9 hydrocarbons in air in 60 minutes.

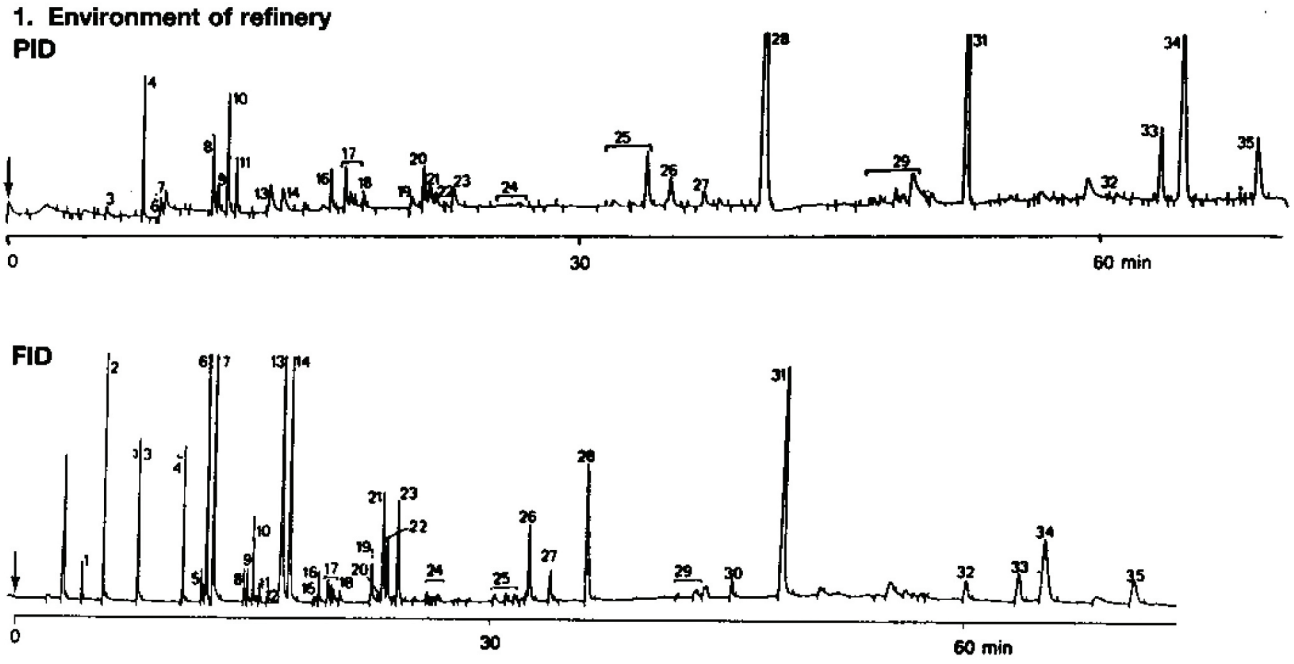
Agilent Technologies

Conditions

Technique	: GC-capillary
Column	: Agilent CP-Al_2O_3/KCl, 0.32 mm x 50 m fused silica Al_2O_3/KCl PLOT (Part no. CP7515)
Temperature	: 0 °C → 135 °C, 10 °C/min 135 °C → 205 °C, 2 °C/min
Carrier Gas	: He, 130 kPa (1.3 bar, 19 psi)
Injector	: Air sample (hydrocarbons sample from 1-2 L air during 20 min)
Detector	: FID 1 x 10^{-12} Afs (PID 8 x 10^{-12} Afs (10, 2 eV lamp) Chromatogram 1 only)

Peak identification

1. ethane
2. ethene
3. propane
4. propene
5. ethyne
6. methylpropane
7. n-butane
8. trans-2-butene
9. 1-butene
10. 2-methyl-1-propene
11. cis-2-butene
12. unknown
13. methylbutane
14. n-pentane
15. trans-2-pentene
16. 1-pentene
17. methylbutenes
18. cis-2-pentene
19. methylcyclopentane
20. cyclohexane
21. 2-methylpentane
22. 3-methylpentane
23. n-hexane
24. unsaturated C_6
25. saturated branched C_7
26. 2-methylhexane
    3-methylhexane
27. n-heptane
28. benzene
29. saturated branched C_8
30. n-octane
31. toluene
32. n-nonane
33. ethylbenzene
34. m-,p-xylene
35. o-xylene



Analysis of C_1-C_9 hydrocarbons in environmental air

Sampling and analysis of mixtures of light hydrocarbons (C_1-C_9) in environmental air has been a problem for several years. Gas chromatographic systems for the separation of the hydrocarbons working with two or three columns have been used. The new Al_2O_3/KCl PLOT column has now made it possible to separate complex mixtures of light hydrocarbons on one column. The column has been tested in a system for the analysis of hydrocarbons in environmental air. The system is based on a Carlo Erba 2900 gas chromatograph and has a thermal desorption oven followed by a liquid nitrogen cooling trap. The effluent from the column is split to three different detectors, one FIO (Carlo Erba FID 20), one ECD (Carlo Erba AT-25) and one PID (HNU P1-52). Glass tubes filled with different layers of adsorbents and a personal monitoring pump were used for the sampling of hydrocarbons in air. A more detailed description will be published elsewhere.

We have used the column daily for more than 6 months and the number of analyses is over 1000. The separation of the hydrocarbons C_1-C_5 was excellent. Separation of hydrocarbons up to C_9 was possible with temperature programmed analysis. The column has been run both at low (< 20 °C) and high (205 °C) temperatures. Conditioning of the column at 200 °C over night has been used frequently. Water in the air samples has been the only problem.

In our case it was necessary to have a moisture filter between the desorption oven and the cooling trap. We have only used the column for air samples and no liquid samples have been injected.

The analytical system described has mainly been developed for the estimation of fugitive hydrocarbon emissions from chemical plants. The ECD is used for detection of SF_6 when tracer technique is applied. The system is also suitable for the analysis of halogenated hydrocarbons in environmental air.

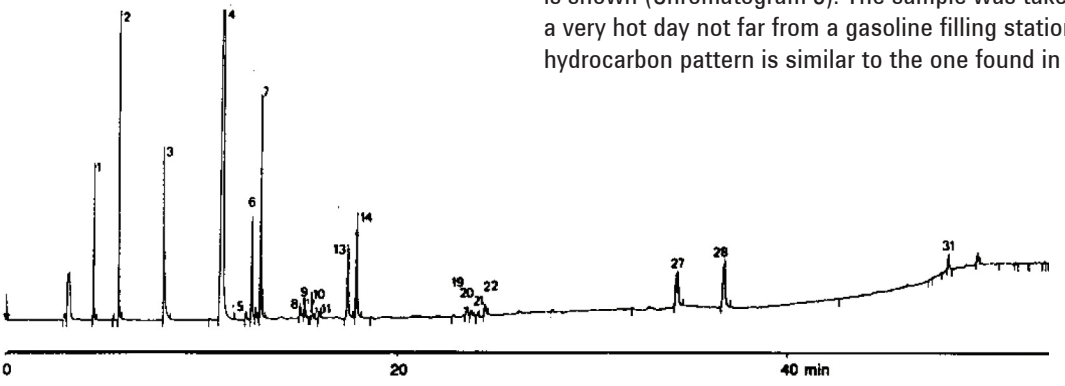
The first application is shown in Chromatogram 1. The sample was taken about 200 m downwind from a petrochemical refinery. The chromatogram shows a complex mixture of hydrocarbons where saturated aliphatics up to C_6 dominate. Aromatic hydrocarbons from the reforming unit of the refinery can also be seen.

The concentration of e.g. benzene was about 10 µg/m^3. In the second application a hydrocarbon pattern different from the first sample is found (Chromatogram 2). The sample was taken downwind from an ethylene plant.

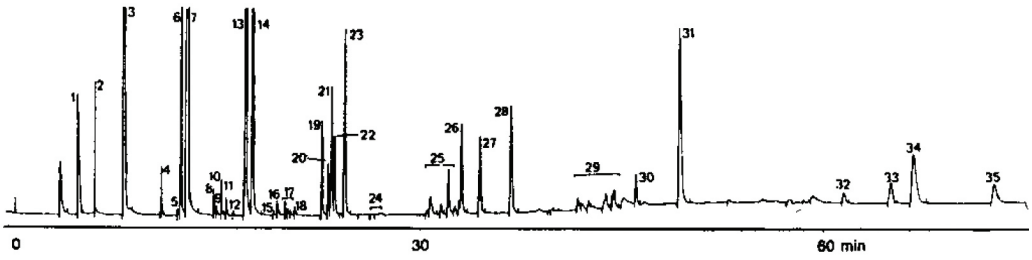
Unsaturated aliphatic hydrocarbons dominate here. The high concentration of propene probably indicates a leakage in the plant area. Aromatic hydrocarbons, mainly from the steamed cracked naphtha unit of the plant, are also determined.

Finally, an air sample from a street in the city of Göteborg is shown (Chromatogram 3). The sample was taken on a very hot day not far from a gasoline filling station. The hydrocarbon pattern is similar to the one found in gasoline.

2. Environment of ethylene plant



3. Environment of gasoline station



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