Detailed Separation of C_1-C_5 Light Hydrocarbons on CP-Al_2O_3/Na_2SO_4 PLOT GC Column

Application Note

Author

Laura Provoost
Agilent Technologies, Inc.

Introduction

Aluminum oxide PLOT columns are specifically designed for detailed C_1-C_{10} hydrocarbon analysis in chemical and petrochemical industries. Due to the high selectivity of CP-Al_2O_3 PLOT columns, it is possible to analyze ppm to percent levels of any C_1-C_5 impurities, including isomers, in main stream C_1-C_5 products. CP-Al_2O_3 PLOT columns offer a higher level of analytical selectivity and efficiency compared to super-thick film non-polar liquid stationary phase columns.

Agilent Technologies

The aluminum oxide column carries a sodium sulfate (Na_2SO_4) deactivation layer. The deactivation provides a reproducible and stable selectivity up to 200 °C. Sodium sulfate deactivation results in a more polar surface than potassium chloride (KCl)-treated alumina, retaining unsaturated compounds such as ethylene, acetylene (ethyne) and methyl acetylene (propyne) more strongly than their unsaturated peers.

The analysis of light hydrocarbons is performed in refinery gas, liquefied petroleum gas (LPG) and natural gas. Refinery gas is a mixture of gases generated during refinery processes used to process crude oil into various petroleum products as intermediate products or high grade end-products. The composition of refinery gas may vary. Common components include butanes, butenes (butylenes), methane, ethane and ethene (ethylene). The aluminum PLOT column offers added value in separating all of the components.

Natural gas consists of methane, light hydrocarbons such as ethane, propane and butane, and small quantities of derivatives such as carbon dioxide and nitrogen. The precise composition of natural gas may differ from region to region. LPG is a mixture of light hydrocarbons. It occurs naturally in crude oil and natural gas production fields and is also produced in the oil refining process. The main component gases of LPG are propane and butane.

The CP-Al_2O_3/Na_2SO_4 GC column provides separation of the main components and gives detailed quantitative data on the impurities.

This application note shows the analysis of 18 light hydrocarbons on a CP-Al_2O_3/Na_2SO_4 GC column.

Materials and Methods

Technique:	GC-FID
Column:	CP-Al_2O_3/Na_2SO_4, 50 m x 0.32 mm, df=5 µm (part number CP7565)
Temperature:	70 °C, 3 °C/min, 170 °C
Carrier Gas:	Hydrogen, constant pressure, 100 kPa (1.0 bar, 14.5 psi)
Injection:	250 °C, split 1:50
Detection:	FID, 275 °C
Sample:	Gas mixture, for concentrations see Table 1
Injection Volume:	5 µL

Results and Discussion

Figure 1 shows the chromatogram of the detailed analysis of 18 hydrocarbons within 20 minutes. The CP-Al_2O_3/Na_2SO_4 column provided very good peak shape and baseline separation. The alkynes, acetylene and propyne, show some tailing. This tailing is typical for Na_2SO_4 deactivated Al_2O_3 PLOT and is caused by the higher interaction of the polar alkynes with the polar Na_2SO_4 deactivation layer.

Table 1. Peak Identification

Peak	Compound	Concentration % (moles in He)
1	Methane	24.9
2	Ethane	5.0
3	Ethene (ethylene)	24.9
4	Propane	5.0
5	Cyclopropane	0.50
6	Propene (propylene)	5.1
7	Isobutane	0.50
8	n-Butane	1.00
9	Propadiene	0.60
10	Ethyne (acetylene)	1.01
11	*trans*-2-Butene	0.50
12	1-Butene	0.50
13	Isobutene	1.00
14	*cis*-2-Butene	0.50
15	Isopentane	0.50
16	n-Pentane	0.199
17	1,3-Butadiene	1.00
18	Propyne (methyl acetylene)	1.01

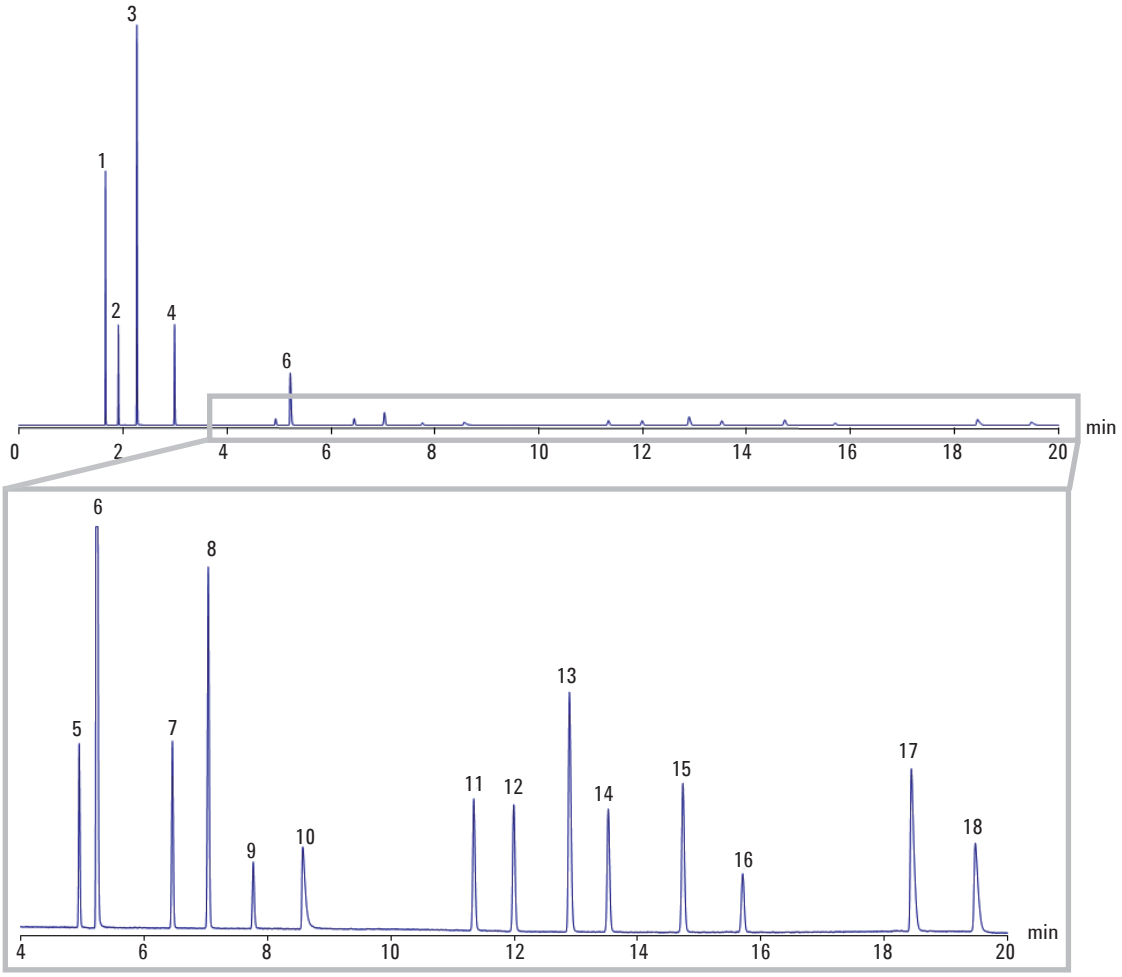

Figure 1. C_1-C_5 hydrocarbons analyzed on a CP-Al_2O_3/Na_2SO_4 column

Conclusion

The CP-Al_2O_3/Na_2SO_4 column is very suitable for the analysis of light hydrocarbons. The sodium sulfate deactivation provides additional resolution for separating all C_4 isomers.

The robustness of the column allows temperatures up to 200 °C to be used, enabling bake-out of the column at the end of the analysis without changes in selectivity.

References

http://www.gasterra.com/naturalgas/Pages/Whatisnaturalgas.aspx
http://www.wisegeek.com/what-is-refinery-gas.htm
http://www.environment.gov.au/atmosphere/fuelquality/standards/lpg/faq.html#lpg

www.agilent.com/chem

Published in UK, October 14, 2010
SI-02644

Agilent Technologies