

VICI ValcoBond® GC Capillary columns

Using VALCO HayeSep® PLOT Columns and the Pulse Discharge Detector to Fine-tune Chromatographic Separations

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The effects of HayeSep® column polarity on gas chromatographic separation are examined in this study. The advantages of using the Valco pulse discharge detector in conjunction with Valco HayeSep® columns are also demonstrated.

Problems associated with the quantification of a component in the presence of interfering species are frequently encountered in gas chromatographic analysis. One example is the quantification of minor contaminants in a predominantly one-component system. When minor contaminants elute immediately after the primary component, peak swamping, overlap, and distortion often occur. Modifying the stationary phase may alleviate these quantification difficulties. Peak identification and quantification are significantly simplified if the stationary phase can be altered so that minor components elute before the principle component. When peak reversal is not possible, increasing the retention time separation may produce the desired results. In this article, the gas chromatographic analyses of C₁–C₅ hydrocarbon mixtures using a variety of ValcoPLOT HayeSep® porous polymer columns are compared.

Historically, the use of porous polymer columns for sensitive gas chromatographic analysis has been hindered due to particle spiking, which occurs with most common porous polymer columns and detectors. This problem is virtually eliminated when ValcoPLOT HayeSep® porous polymer columns are used in conjunction with the Valco pulsed discharge helium ionization detector (PDHID). Valco HayeSep® porous polymer columns are produced by a unique process that binds particles more securely, resulting in less particle spiking. In addition, the PDHID is a universal detector that is not subject to particle spiking and provides improved sensitivity for most applications.

Experimental

C₁–C₅ hydrocarbon standards obtained from Scott Specialty Gases were injected into a Hewlett Packard 6890 GC equipped with a Valco PDHID D5 model detector and an assortment of ValcoPLOT HayeSep® porous polymer capillary columns. GC run conditions were as follows: injector temperature: 180 °C, detector temperature: 170 °C, oven temperature: 60 °C isothermal. Carrier gas was helium at 15 psi. All column dimensions were 30 m × 0.32 mm × 10.0 μm.

Results and Discussion

Chromatograms of a C₁–C₂ hydrocarbon mixture separated on various VALCO HayeSep® porous polymer columns are shown in Figure 1. The chromatograms are displayed in order of increasing polarity. On the most nonpolar phase, D, acetylene elutes second following methane. As phase polarity increases, acetylene migrates with respect to the nonpolar species. Acetylene elutes between ethylene and ethane on S and R, and after ethane on the more polar phases. Ethylene, which is less polar than acetylene, also migrates but to a lesser degree.

Conclusions

The wide array of available Valco HayeSep® columns provides a means of read-

ily customizing GC analyses for a vast number of applications. Use of a Valco HayeSep® column coupled with the Valco PDHID detector provides a highly sensitive, spike-free means of analysis for low molecular weight components.

Table 1: C₁–C₅ hydrocarbon retention indices on selected HayeSep® columns

Hydrocarbons	D	P	S	R	C	A	B	T
methane	100	100	100	100	100	100	100	100
ethylene	183.5	185.5	185.5	185.3	188.4	189.2	200	192.7
ethane	200	200	200	200	200	200	200	200
acetylene	180.2	185.5	194.7	198.2	203.7	214.5	220.4	229.2
propylene	290.1	292.9	292.8	292.4	297.1	297.5	292.8	302.8
propane	300	300	300	300	300	300	300	300
methyl acetylene	303.9	315.8	315.3	314.6	329.2	334.8	307.6	352.3
isobutane	381.1	378.2	400	400	380.4	400	380.9	405.3
butane	400	400	400	400	400	400	400	400
1-butene	388.8	391.8	408.2	408.3	394.5	411.3	389.4	423.2
1,3-butadiene	390	307.2	420.6	421.3	406.9	415.5	391.9	438.5
cis-2-butadiene	404.3	411.8	412.2	412.5	411.4	419	406.1	438.5
trans-2-butene	400	403.5	416.3	416.8	403.8	420.1	400	432.3
isopentane	484.7	484.5	487.9	487.2	485.6	488.4	485.9	513.4
pentane	500	500	500	500	500	500	500	500

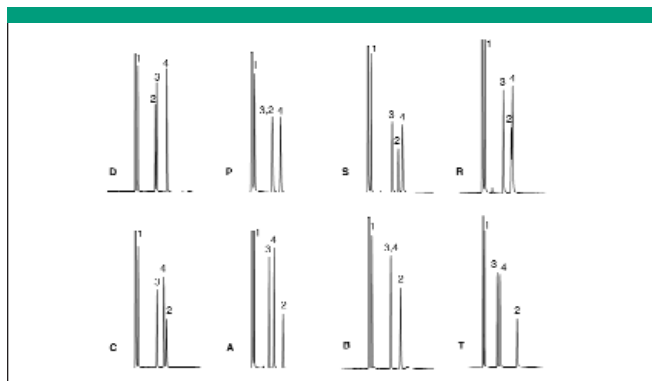


Figure 1: GC chromatograms of C₁ and C₂ hydrocarbons on various HayeSep® columns. Analytes: 1 = methane, 2 = acetylene, 3 = ethylene, and 4 = ethane.

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