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Alumina/KCl PLOT Capillary GC Columns Provide Different Elution for Light Hydrocarbons

W. Betz, M. Keeler, Gas Separations, Supelco, Bellefonte, PA, USA

Typically, porous solid and non-porous solid adsorbents have been used to analyze permanent gases and low boiling analytes by gas-solid chromatography. The transition over the last decade from using adsorbents in packed bed to adhering the particles to the inner surface of narrow-bore capillary columns allows more efficient separations.

Supelco™ porous layer open tubular (PLOT) columns are coated with a wide range of adsorbents, such as carbon molecular sieves, zeolite molecular sieves, porous polymers, and activated aluminas. Physical characteristics of the adsorbents can be tabulated based on size, shape, porosity, and surface area.

Table 1 lists adsorbents for the stock PLOT columns. These adsorbents are adhered to the columns using a proprietary, patented "glue," which immobilizes the particles. As a result of this column coating method, no particle loss occurs and reproducibility is maintained.

Our new Alumina-KCl column is produced using alumina particles, which are sub-micron in size. The alumina surface is deactivated with potassium chloride (KCl) to diminish activity of the alumina surface. This column provides a different elution pattern for light hydrocarbons than that provided by the more active Alumina column.

Figure A illustrates the differences between Alumina (alumina/Na₂SO₄) and Alumina-KCl PLOT columns. Note the elution pattern of the acetylene peak with respect to the n-butane peak. The diminished activity of the Alumina-KCl column shifts acetylene so that it elutes before n-butane, whereas the activity of the Alumina column causes acetylene to elute after n-butane.

Column-to-column reproducibility has been evaluated for both columns and is shown in Table 2.

Table 1. Adsorbents for Stock PLOT Columns

| Adsorbent Description | Surface Area | Particle Shape* | Adsorbates |
|--|---------------------------|-----------------|------------------------------------|
| Carboxen™-1006** carbon molecular sieve | ~725m ² /g | spherical | permanent gases/light hydrocarbons |
| Supel-Q™ porous polymer | ~700m ² /g | spherical | volatile to semivolatiles gases |
| Zeolite molecular sieve 5A | ~325m ² /g | granular | permanent gases |
| Activated alumina | ~250-350m ² /g | granular | C1-C12 hydrocarbons |

Figure A. Comparison of Alumina-KCl and Alumina PLOT Columns

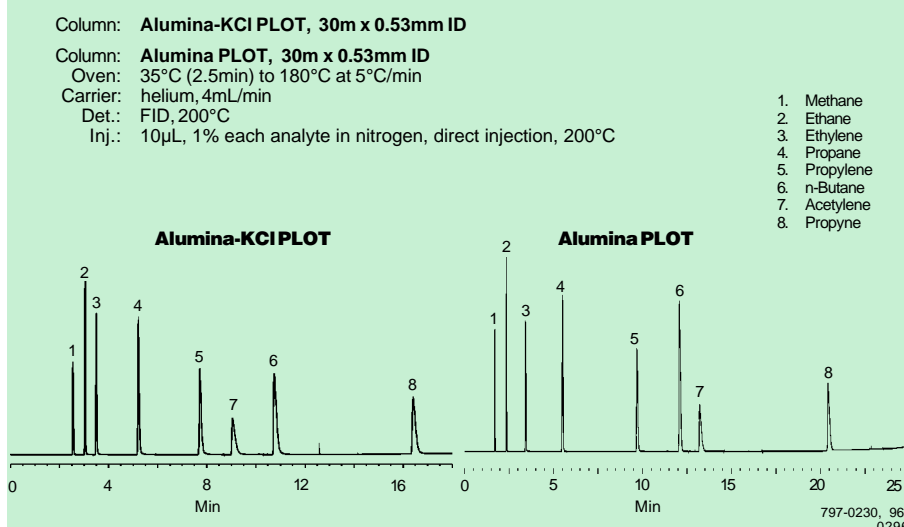


Table 2. Reproducibility of Alumina-KCl and Alumina PLOT Columns

| | n-Butane | Acetylene | Propyne |
|---|----------|-----------|---------|
| Alumina-KCl, 0.53mm ID (5 columns) | | | |
| Mean Retention Time (min) | 11.01 | 9.41 | 16.79 |
| Standard Deviation | 0.45 | 0.51 | 0.59 |
| Alumina, 0.53mm ID (15 columns) | | | |
| Mean Retention Time (min) | 13.03 | 13.80 | 21.20 |
| Standard Deviation | 0.95 | 0.91 | 0.99 |

Ordering Information:

| Description | Cat. No. |
|------------------------|----------|
| PLOT GC Columns | |
| Alumina-KCl PLOT | |
| 30m x 0.32mm ID | custom |
| 30m x 0.53mm ID | custom |
| Alumina PLOT | |
| 30m x 0.32mm ID | custom |
| 30m x 0.53mm ID | custom |

Carboxen, Supelco, and Supel-Q are trademarks of Sigma-Aldrich Co.

■US patents 5,599,445 and 5,607,580.

*All submicron-sized particles.

**US patent nos. 4,839,331; 4,957,897; 5,094,754; 5,104,530.



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