

What's in Your Beer?

Part 2: GC/MS Static Head Space with a Highly Inert 624 Capillary GC Column

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Introduction

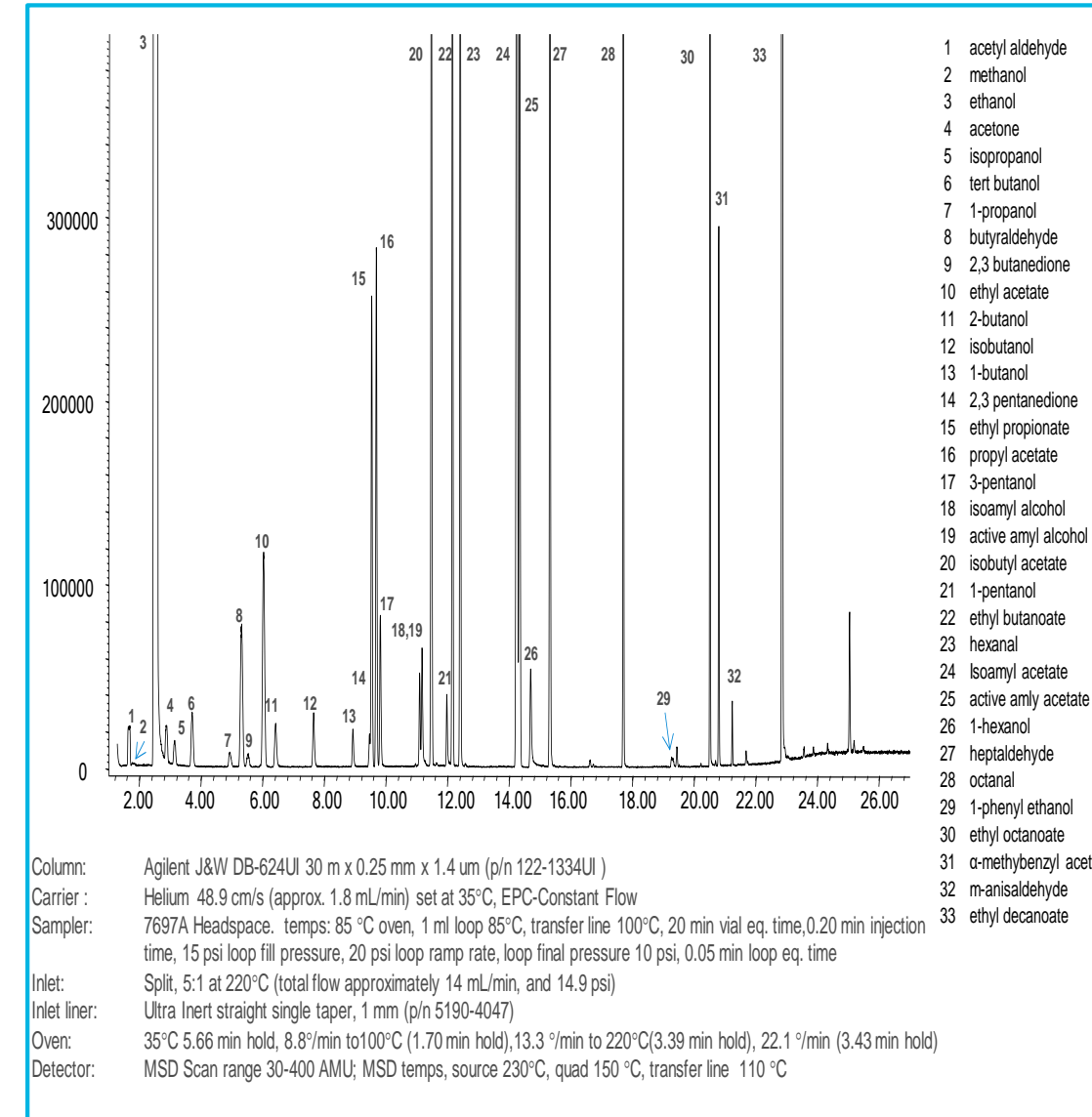
Some ingredients in beer can be challenging to separate and chromatograph. Common beer flavor components include; fusel oils, aldehydes, esters, and organic acids. The polarity of a 6% cyano propyl phenyl stationary phase (624) has been a traditional choice for this type of analysis and works well. However, peaks shapes and low level detection of organic acids have been problematic for this phase. When inertness performance verified 624 columns are used, consistent organic acid performance is achieved.

Static head space GC/MS is an excellent way to profile alcoholic beverages such as a centuries old favorite malted barley beverage, beer. The recipes and components in these beverages are as diverse as the individual yeast strains and varietal hops that are on the list of ingredients. What flavor components are positive indicators of a good beer and which are not is one facet of the craft of making fine beer. Single Quad GC/MS is a great starting point for helping to identify and monitor flavor components.

Static headspace GC/MS chromatograms of beers and spirits illustrate the value of using inertness performance verified 624 columns for this type of analysis. Key elements of this type of analysis are the separation of amyl and iso-amyl alcohols, their esters, aldehyde peak shapes and detector response for organic acids. Obtaining headspace profiles can be a tremendous aid in understanding flavor development, tracking flavor stability and authentication of fine crafted alcoholic beverages. Comparing GC/MS profiles of various summer beers and some of their flavor elements with things hopping.

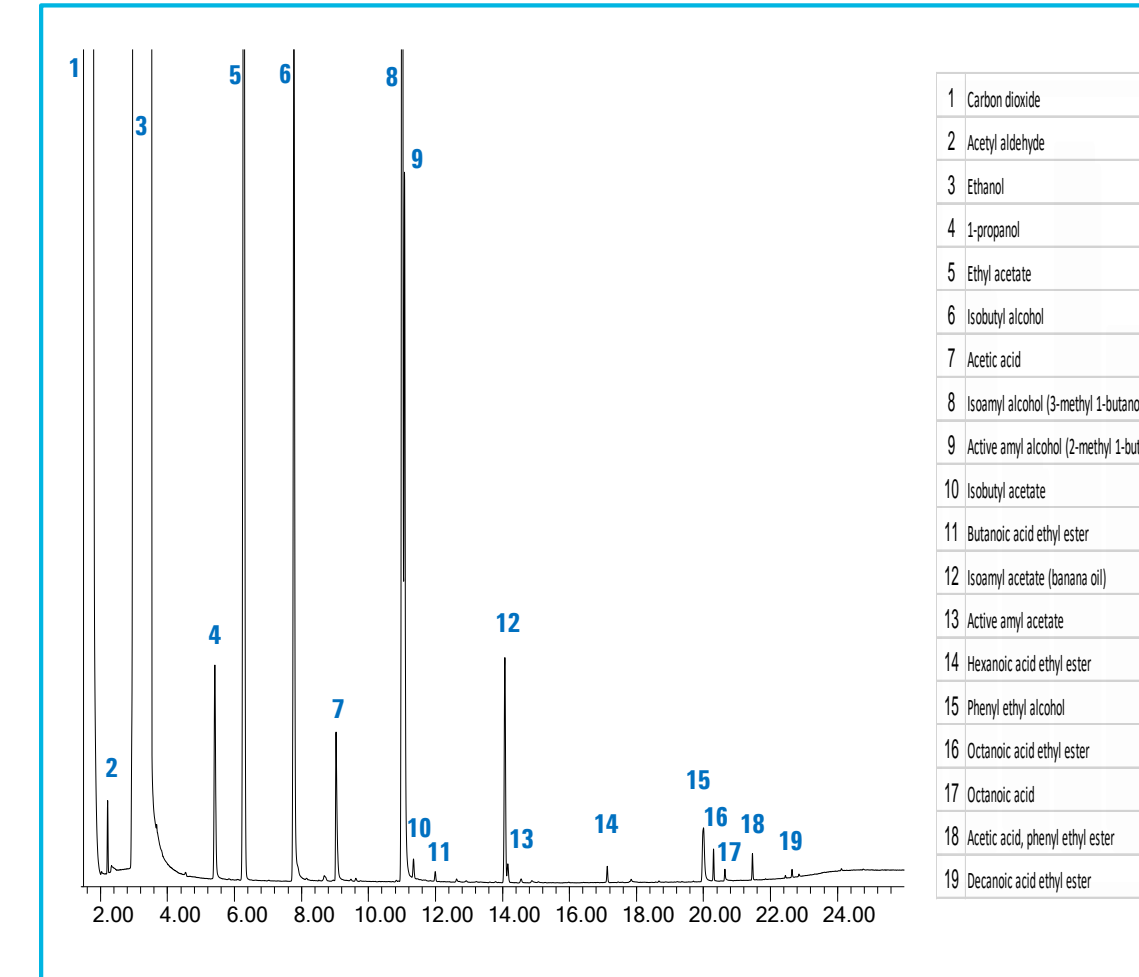
Experimental

Example Total Ion Chromatogram
2 ppm aldehydes, alcohols and esters in water

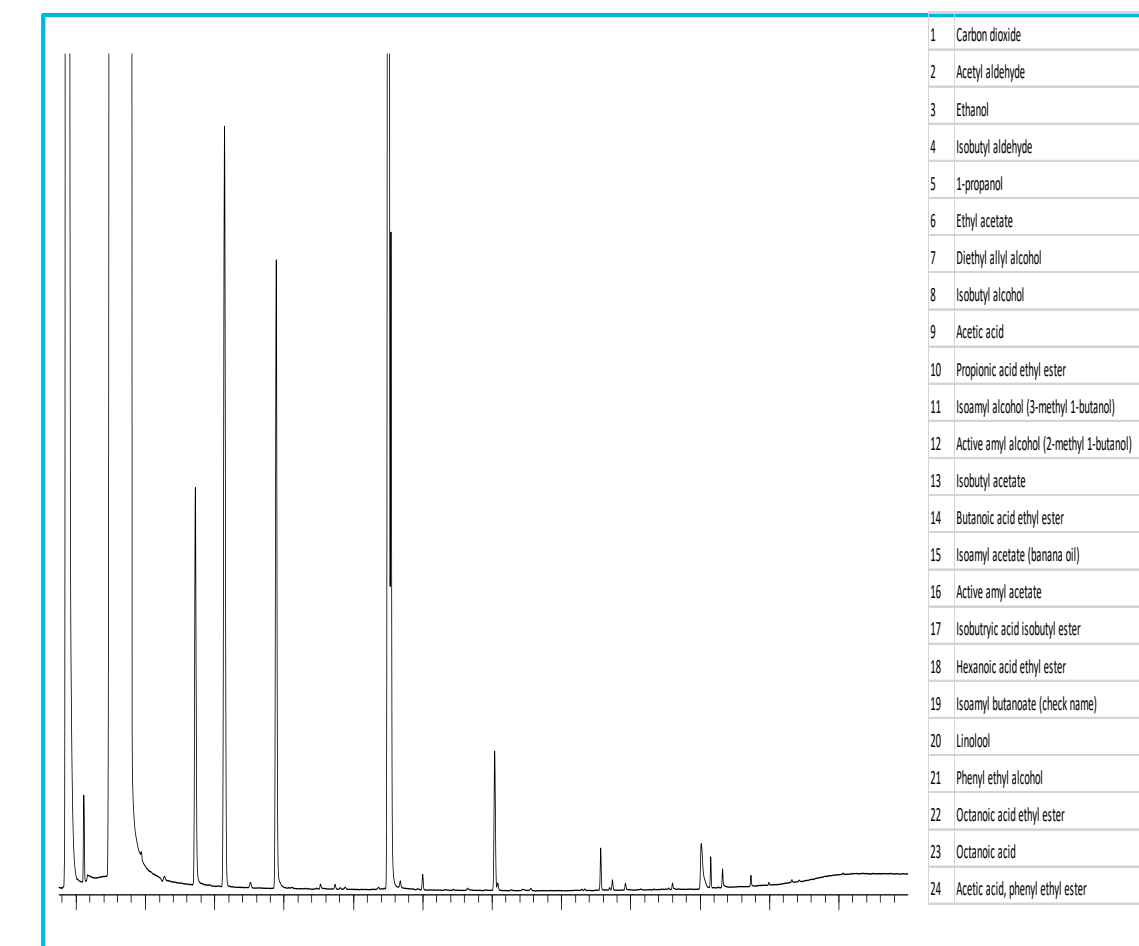


Results Summer Style Beers

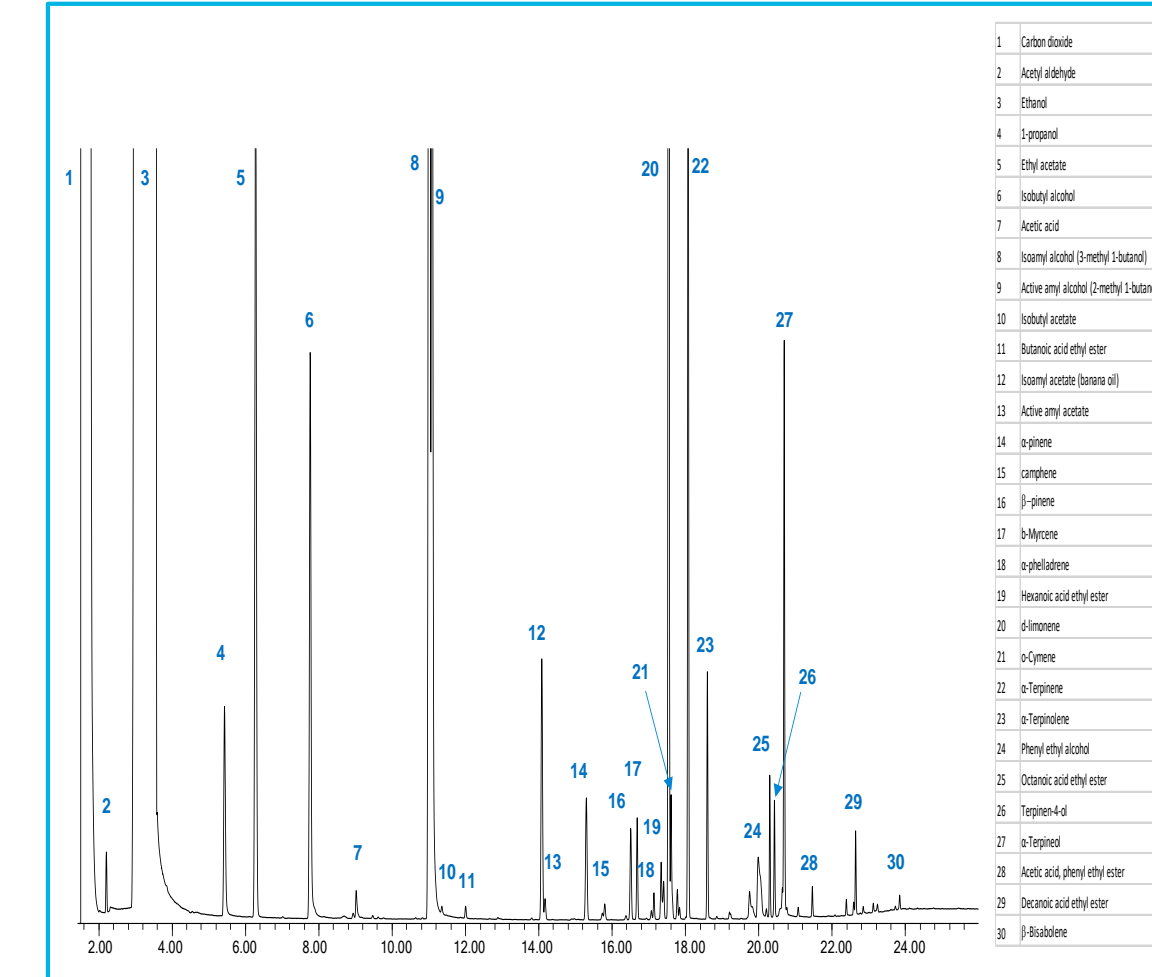
Total Ion Chromatogram
Hefe-Wizen, summer style wheat beer



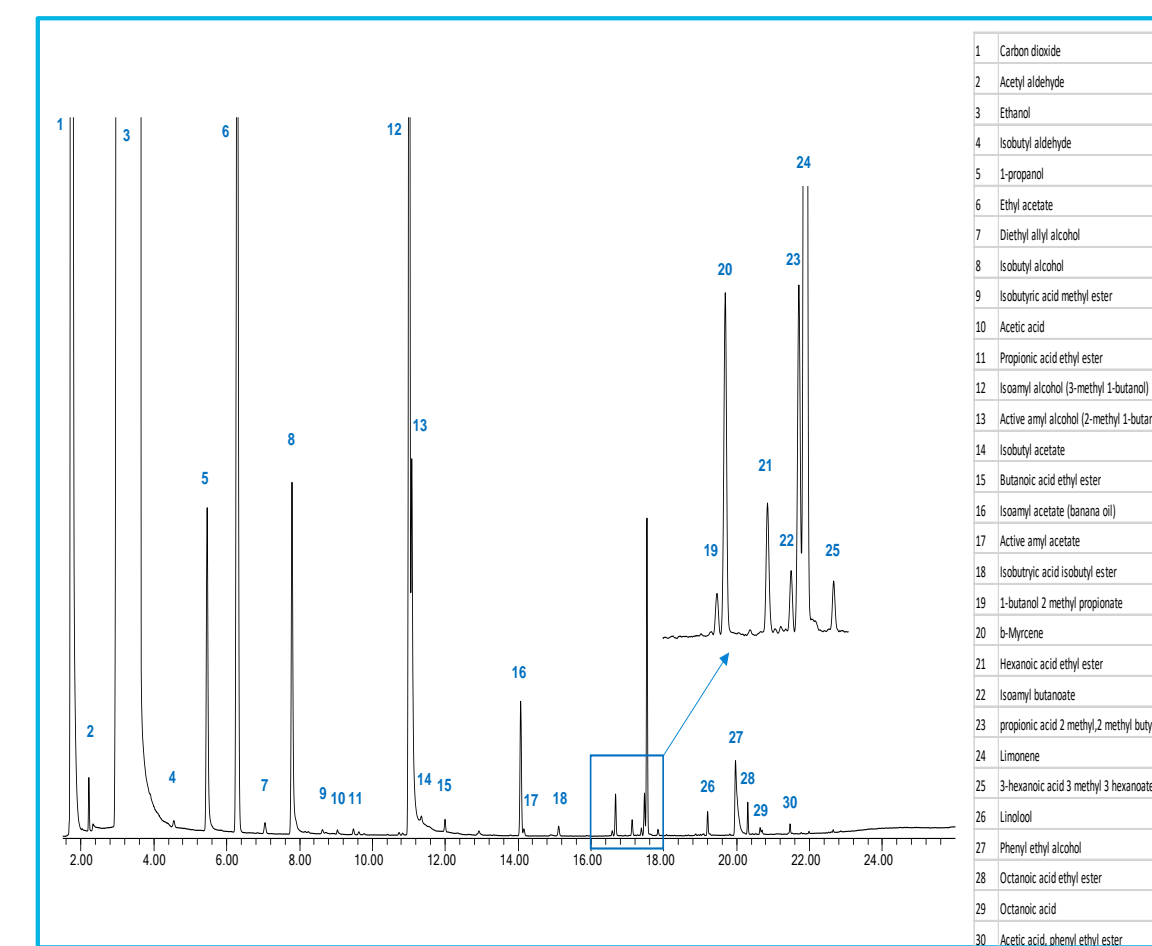
Total Ion Chromatogram
Kolsch, clear crisp finish Pilsner style hops



Total Ion Chromatogram
Lemon Shandi

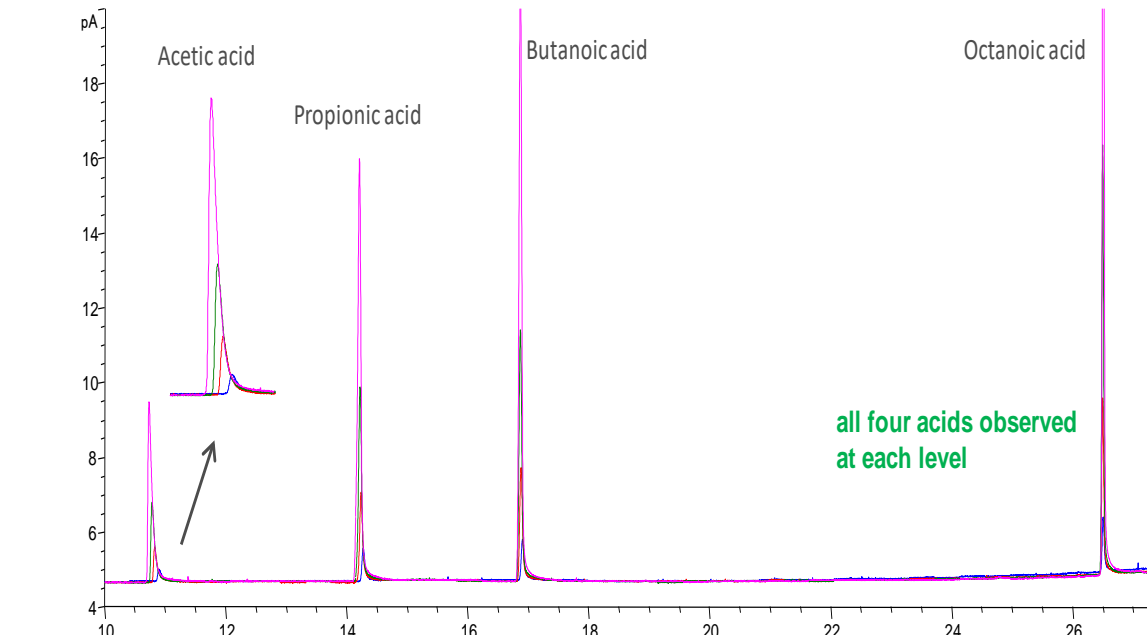


Total Ion Chromatogram
Tangerine Ale



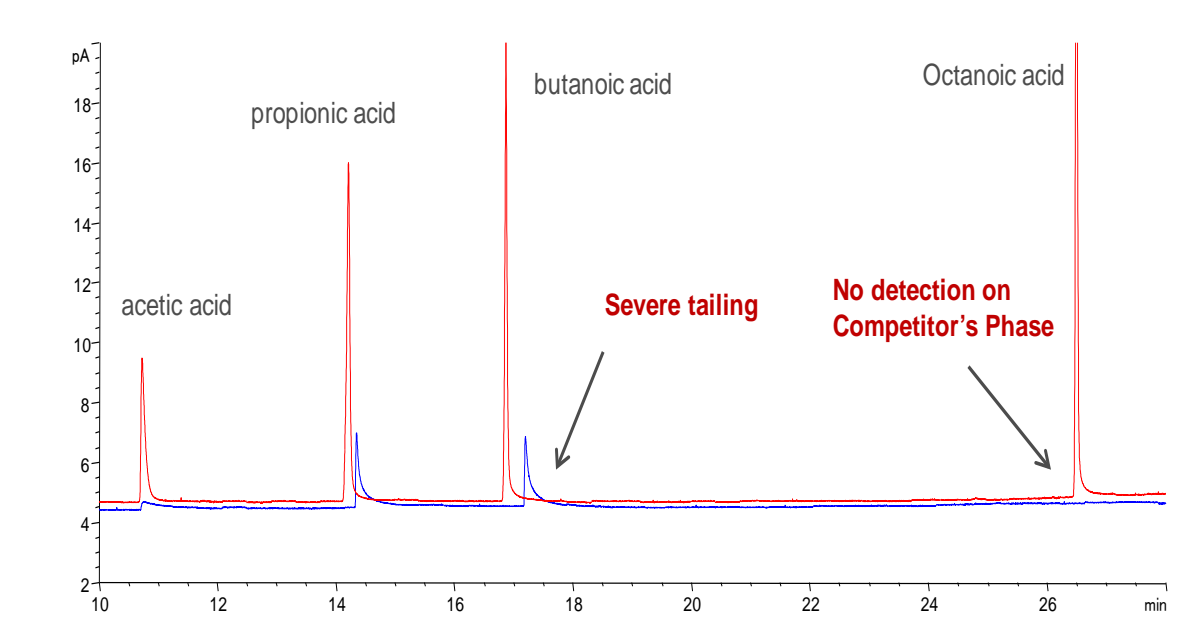
Results and Discussion – Superior Organic Acid Response

Superior Organic Acid Responses- Test Probe Mix



Column: Agilent J&W DB-624UI 30 m x 0.32 mm x 1.8 μm (p/n 123-1334UI)
Oven: 35°C 7.45 min hold, 6.72°/min to 100°C (2.23 min hold), 10.08°/min to 220°C (4.47 min hold), 16.79°/min (4.17 min hold)
Carrier: Helium 39.6 cm/s (approx. 2.6 mL/min) set at 35°C, EPC-Constant Flow
Inlet: Split, 20:1 at 250°C (total flow approx 51 mL/min, and 11.2 psi)
Inlet liner: Ultra Inert with wool
Detector: FID at 280°C, H₂ @ 40 mL/min, Air @ 400 mL/min, N₂ makeup @ 30 mL/min

Other Cyanopropyl phenyl columns absorb organic acids



Column: Agilent J&W DB-624UI 30 m x 0.32 mm x 1.8 μm vs competitor premium column
Oven: 35°C 7.45 min hold, 6.72°/min to 100°C (2.23 min hold), 10.08°/min to 220°C (4.47 min hold), 16.79°/min (4.17 min hold)
Carrier: Helium 39.6 cm/s (approx. 2.6 mL/min) set at 35°C, EPC-Constant Flow
Inlet: Split, 20:1 at 250°C (total flow approx 51 mL/min, and 11.2 psi)
Inlet liner: Ultra Inert with wool
Detector: FID at 280°C, H₂ @ 40 mL/min, Air @ 400 mL/min, N₂ makeup @ 30 mL/min

Conclusions

- Static headspace GC/MS profiles show differences and similarities among beer styles- good for profiling
- Organic acid response superior using a highly inert 624 column
- Choose inert components for optimal results
- Better analytical tools for making better beer-yes

References

Screen Beer by GC/MS Static Headspace with the Agilent J&W DB-624 Ultra Inert Capillary Column, K. Lynam, Agilent Publication # 5991-1136EN
Analysis of Distilled Spirits Using an Agilent J&W DB-Wax Ultra Inert Capillary GC Column, K. Lynam and Yun Zou, Agilent Publication # 5991-6638EN
Agilent J&W DB-624 Ultra Inert Capillary Column Screens Distilled Spirits by GC Static Headspace, K. Lynam, Agilent Publication # 5991-0659EN

