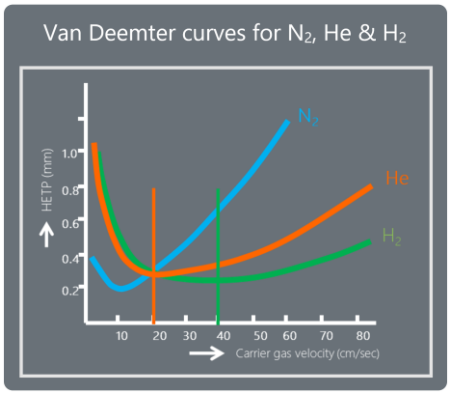
AC Fast DHA: feed stock composition analysis in less than 30 minutes

- Composition analysis of refinery products
- Significant reduction of analysis time
- No use of cryogenic oven cooling
- Hydrogen as carrier gas



Keywords: Fast DHA, analysis time, hydrogen carrier

Introduction:

Knowing the individual composition of refinery products and blend stocks is very useful for refinery quality control and product specification as it helps refiners with different processes optimization. The commonly gas chromatography analysis method used for the individual component composition analysis is based on using a long capillary column with a methyl silicone liquid phase, sometimes combined with a polar pre-column.

Inject → Separate → Detect → Identify → Quantify

A representative sample of the product is introduced into the carrier gas, typically Helium, which transports the vaporized sample through the column. It is separated into individual components detected with a flame ionization detector as they elute from the end of the column. Each component is identified by comparing its retention index to the one established by analyzing reference standards or samples under identical conditions. The concentration of each component in percent by mass is determined by normalization of the peak areas after correction with relative response factors.

This application is commonly known as DHA (Detailed Hydrocarbon Analysis) and it is described by various ASTM methods like: D6730, D6729, D6733 & D5134. These methods provide the analytical conditions such as oven temperature program, helium as a carrier gas, typical columns to be used, etc. and depending on these the analysis times vary from about 2 to 3 hours. In most cases the oven temperature program requires cryogenic oven cooling during the first part of the analysis.

As an alternative for the standard ASTM methods, AC Analytical Controls developed the "**AC Fast DHA**". The system is based on the same principle, with multiple advantages:

Application	Fast DHA	Conventional DHA
Carrier gas	hydrogen	helium
# Runs in 24 hrs.	48	8 - 16
Cryogenic cost	none	$$$$

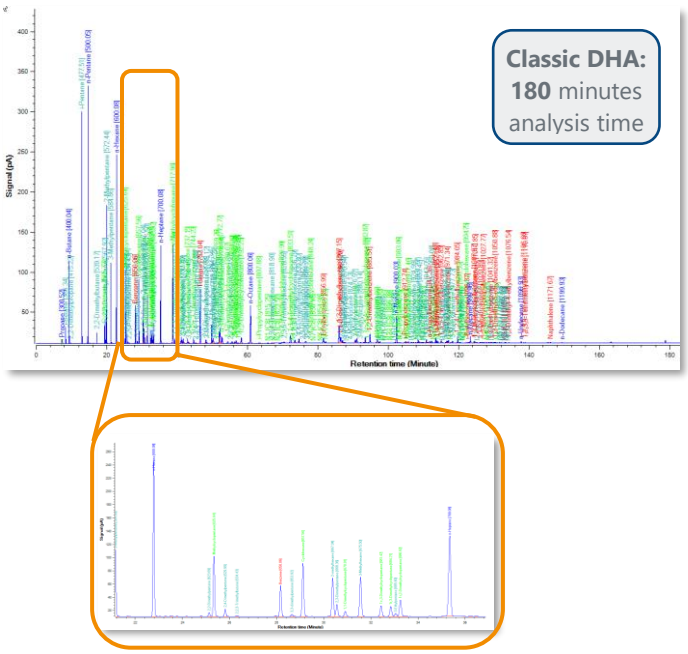
- Analysis time of less than 30 minutes
- Use of hydrogen as carrier gas which leads to cost savings and secures gas supply shortages
- No need of cryogenic oven cooling
- Same separation capacity as for most traditional DHA methods
- DHA^{xlnc} software with optimized and ready to use component database

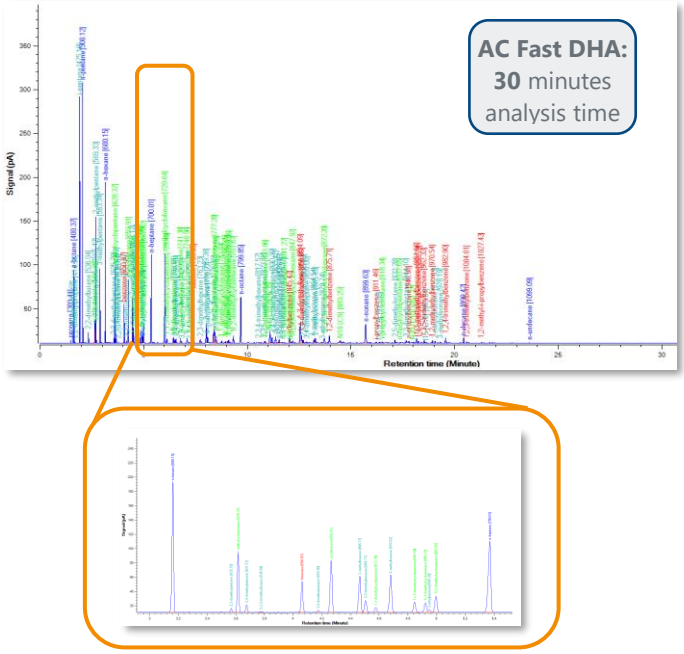
Separation & sample scope

This major gain in analysis time with the AC Fast DHA is primarily achieved by using a narrow bore column and hydrogen as carrier gas:

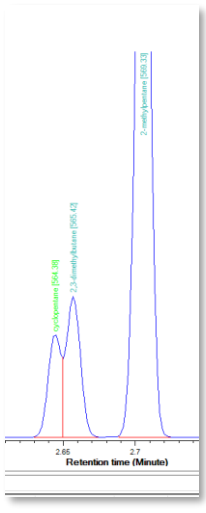
- In gas chromatography the optimal carrier gas velocity for hydrogen is approximately two times higher than helium, with about the same HETP (Height Equivalent Theoretical Plates). Thus, with the use of hydrogen analysis time can be shortened by a factor of two without losing separation.
- Narrow (or micro) bore columns with an ID of 0.1 µm have a theoretical column efficiency (plates per meter) which is about 2.5 times higher than a medium bore column with and ID of 0.25 µm. Therefore, using a 40m narrow bore column versus 100m medium bore column offers the same resolution.

The combination of using hydrogen as carrier gas in combination with narrow bore columns results in an approximately 2.5 to 3 times faster analysis without hardly any compromise on separation.





Above graphs show a chromatogram of a typical naphtha analyzed both on ASTM D6730 as well as AC Fast DHA. The column used in AC Fast DHA has a methyl silicon liquid phase and no additional pre-column which is required by ASTM D6730. The separation between cyclo-pentane and 2,3-dimethylbutane is the most critical one and these components are not baseline separated like in the other DHA methods.

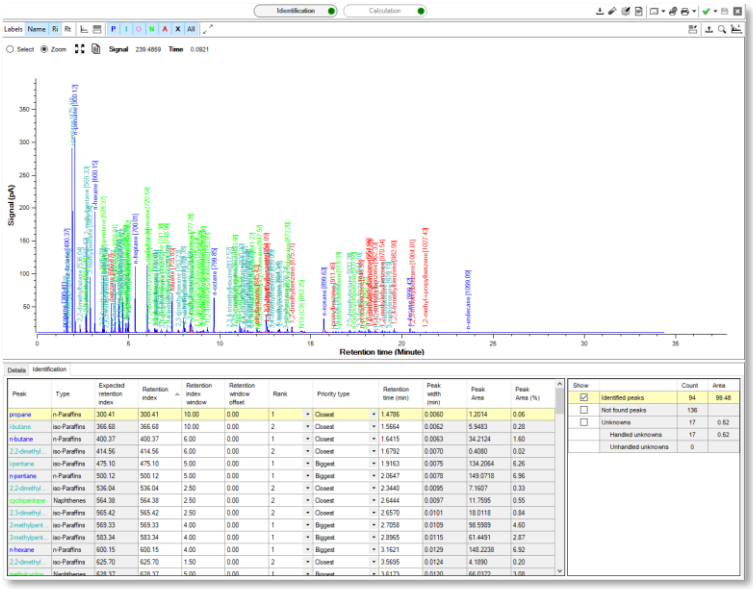


The AC Fast DHA is of great use for the analysis of intermediate refinery streams (naphtha, reformate, isomerate, etc.). It can also be used for the analysis of finished gasolines or BOB's (blendstocks before oxygenates blending). The AC Fast DHA is less suitable for analyzing complex gasolines containing multiple oxygenated components as they may potentially co-elute.

PAC DHA^{xlnc} software

PAC DHA analyzers include the IRIS based DHA^{xlnc} software. It is based on PAC's IRIS software platform, like other PAC chromatography packages such as Reformulyzer and Simdis. The workflow oriented DHA^{xlnc} software is compatible with any major Chromatography Data Software (CDS) packages and can be installed either as standalone workstation or in a network environment. It reduces data processing activities while increasing data quality, access and traceability. The entire process of data handling from the moment of sample injection up to and including export of the results to LIMS, can be automated.

DHA^{xlnc} features a unique identification mechanism using Kovats indexes and it is based on the concept of searching expected components related to the type of product analyzed and test method used. The Fast DHA test method component database is optimized for the fast application.



The fully configurable identification process includes compound identification based on ranking, co-elution handling with option to set compound ratio, drag-and-drop identification, smart filters, and automated recalculation upon changes in the chromatogram.

Reporting options include besides the individual components (mass%, volume% & mol%) also a carbon number versus group-type pivot table, boiling point distribution (for Simdis merge), RON, specific gravity, and molecular weight.

Conclusion

The AC Fast DHA is an excellent combination between speed and good separation which offers a full composition analysis of intermediate refinery streams, such as alkylate, reformate, naphtha, etc. with an analysis time of less than 30 minutes. For the user this means a much higher sample throughput and a faster response to their specific analysis requests. In addition, it benefits from the use of hydrogen as carrier gas without need of cryogenic oven cooling, achieving a significant reduction in operating cost as well as a greater ease of use given by DHA^{XLNC} software.

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