Reinforcing the GC Fundamentals with ZB-DHA-PONA for your Detailed Hydocarbon Analysis

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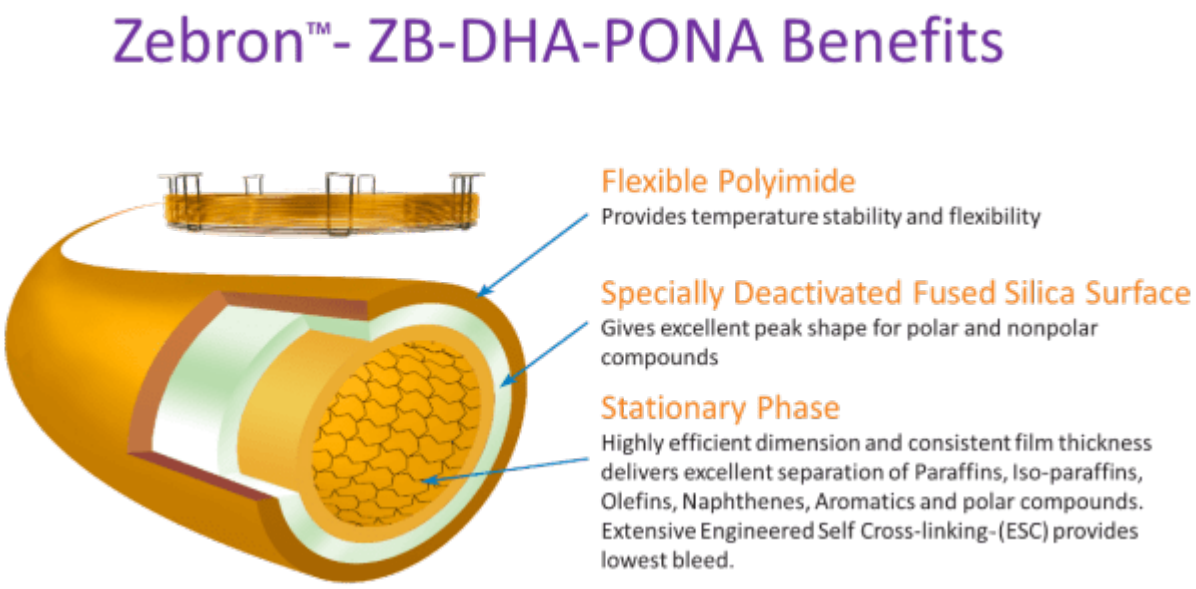
Detailed Hydrocarbon Analysis Challenges:

Working with detailed hydrocarbon analysis provides several challenges and regulations. Petroleum fuels are required to meet federal and state environmental regulations to mitigate their impact on the environment. In the United States, the refineries use test methods that are approved by the EPA. In other countries there are similar national regulations to ensure that the required performance criteria are met. There are different regulated test methods to measure the physical characteristics of the fuel as well as its specific chemical components. Depending on global location, spark ignition fuel is called gasoline, petrol, or benzin, and it is distilled from crude oil as part of the naphtha stream (C1-C12). Straight-run product is blended with other processed streams which makes it critical to have a detailed understanding of the hydrocarbon components for a consistent product.

There are hundreds of chemical components in spark ignition fuels, and so to make the testing and regulation manageable they are measured in categories by chemical group-type. These category group-types are based on molecular similarities that give them common performance behaviors. These tests are referred to as Detailed Hydrocarbon Analysis (DHA) which includes several test methods that measure different hydrocarbon subset or group-type categories. DHA identifies the important individual components in spark ignition fuels and other refinery light hydrocarbon process streams. Common refinery naphthas are virgin, alkylate, reformate, FCC and Coker, and finished spark ignition fuels. This technique is sometimes also referred to as PONA, PIONA, or PIANO analysis since specific test methods

are measuring the group-type paraffins, isoparaffins, olefins, naphthenes, aromatics, and oxygenates. The DHA analysis helps optimize the production processes in addition to meeting the regulatory requirements

Introducing The New ZB-DHA-PONA GC Column



The new ZB-DHA-PONA column presents an opportunity for the analysis of detailed hydrocarbons which includes structurally similar positional isomers of paraffins and olefins, along with naphthenes and aromatics that are common within spark ignition fuels. That is a rather a convoluted and complex mixture for a GC column to handle and presents an opportunity to reinforce some fundamentals of gas chromatography, and to demonstrate those principles through applications for which the ZB-DHA-PONA presents considerable advantages!

ZB- DHA-PONA Benefits:

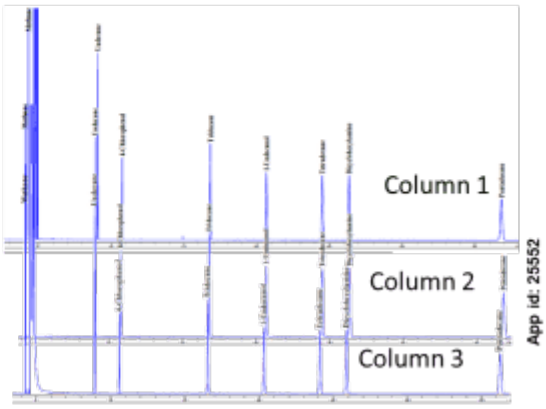
Experienced gas chromatographers in the fuel industry are familiar with column dimension optimization for a successful GC separation and are curious as to how ZB-DHA-PONA column presents advantages over traditional PDMS phases . New comers to gas chromatography will appreciate the means by which our column optimizes its length, internal diameter, and film thickness to benefit peak efficiency and resolution. The industry standard for DHA testing is to use 100% polydimethyl siloxane (PDMS), which primarily is conducive to boiling-point separations, will retain analytes based on non-polar Van Der Waals Interactions. ZB-DHA PONA GC columns are 100% polydimethyl siloxane (PDMS) phase that is specifically designed for Detailed Hydrocarbon Analysis. ZB-DHA-PONA GC columns are available in high efficient column dimensions for successful separation of Paraffins, isoparaffins,Olefins, naphthenes and aromatics.

How is ZB-DHA-PONA Better than Traditional PDMS Phase:

ZB-DHA-PONA GC columns undergo rigorous Engineered Self Cross-linking ESC™ to get an intact stationary phase while the fused silica layer is extensively deactivated to provide sharp peak for polar and non polar Analytes. To ensure that the column meets and exceeds industry's needs, specific probes including polar and nonpolar analytes are included in the QC test mix.

ZB-DHA-PONA Column to Column Reproducibility

Column	Retention Factor						
	C9	C13	C14	C15	4-Chlorophenol	Undecanol	Dicyclohexylamine
1	1.11	2.91	4.69	7.56	1.50	3.80	5.12
2	1.11	2.92	4.71	7.58	1.51	3.82	5.14
3	1.10	2.89	4.66	7.50	1.49	3.77	5.08
%RSD	0.52	0.53	0.54	0.55	0.67	0.66	0.60
	Peak Skew						
1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	1.0	1.0	1.0	0.9	1.0	1.0	0.9
3	1.0	1.0	1.0	1.0	1.0	1.0	0.9



ZB-DHA-PONA columns are distinguished by the uniformity of stationary phase film, extremely pure polymer and highly inter-linked stationary phase ladder through Engineered Self cross-linking (ESC™)of the strands of PDMS polymer. The resultant weaving lattice of cross-linked film is robust, which will minimize column bleed, and prevent the occurrence of active sites (exposed silica from the capillary tubing) to which analytes may bind. Such binding would cause peak tailing and a reduction of sensitivity. In addition, the high cross linkage provides extended column lifetime and low detector noise.

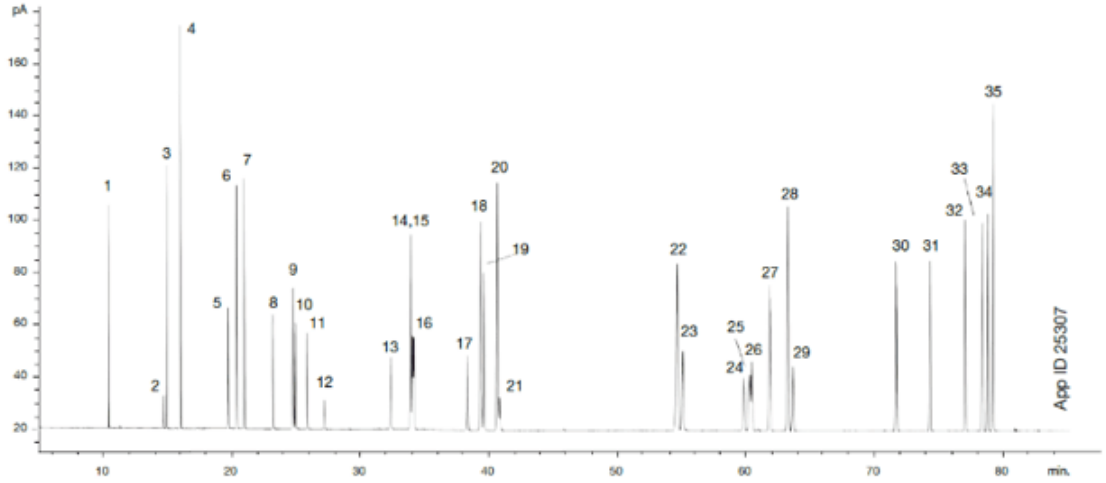
Optimal Column Dimension and DHA Separation:

Conditions for all applications:

Column: Zebron™ ZB-DHA-PONA
Dimensions: 100 meter x 0.25 mm x 0.50 µm
Part No.: 7MG-G042-17
Injection: Split 40:1 @ 300 °C, 0.2 µL

Recommended Liner: Zebron PLUS Straight Z-Liner™
Part No.: AG2-0A03-05
Carrier Gas: Helium @ 1.55 mL/min (Constant Flow)
Oven Program: 35 °C for 14 min, to 60 °C @ 1.1 °C/min for 19 min, to 280 °C @ 2 °C/min for 5 min
Detector: FID @ 320 °C

Separation of Isoparaffins



Sample:

1. Isopentane
2. 2,3-Dimethylbutane
3. 2-Methylpentane
4. 3-Methylpentane
5. 2,2-Dimethylpentane
6. 2,4-Dimethylpentane
7. 2,2,3-Trimethylbutane
8. 3,3-Dimethylpentane
9. 2-Methylhexane
10. 2,3-Dimethylpentane
11. 3-Methylhexane
12. 3-Ethylpentane
13. 2,2-Dimethyl hexane
14. 2,5-Dimethyl hexane
15. 2,2,3-Trimethylpentane
16. 2,4-Dimethylhexane
17. 2,3-Dimethylhexane
18. 2-Methylheptane
19. 4-Methylheptane
20. 3-Methylheptane
21. 3-Ethylhexane
22. 2,5-Dimethylheptane
23. 3,3-Dimethylheptane
24. 2,3-Dimethylheptane
25. 3,5-Dimethylheptane
26. 3,4-Dimethylheptane
27. 2-Methyloctane
28. 3,3-Diethylpentane
29. 3-Methyloctane
30. 2,2-Dimethyloctane
31. 3,3-Dimethyloctane
32. 2,3-Dimethyloctane
33. 3-Ethyloctane
34. 2-Methylnonane
35. 3-Methylnonane

GC Column dimension is very critical for achieving good separation. The length of the GC column contributes to the increasing the number of interactions between the analyte and the column's stationary phase. The fast mass transfer of the analyte in and out of the stationary phase contributes to the efficiency of an analyte peak. The combination of optimal column lengths and high efficient narrow internal diameter of ZB-DHA PONA columns (50, 100 and 150 mm) afford each analyte within a sample the efficiency needed to resolve PIONA. Specific example of iso-paraffins, chain isomers are shown here. Positional isomers of alkyl groups around a central benzene ring are also resolved when afforded the efficiency of a longer column, as shown under the same conditions of column and temperature gradient. The pitfalls of a longer column are often associated with extended run time. This is again where

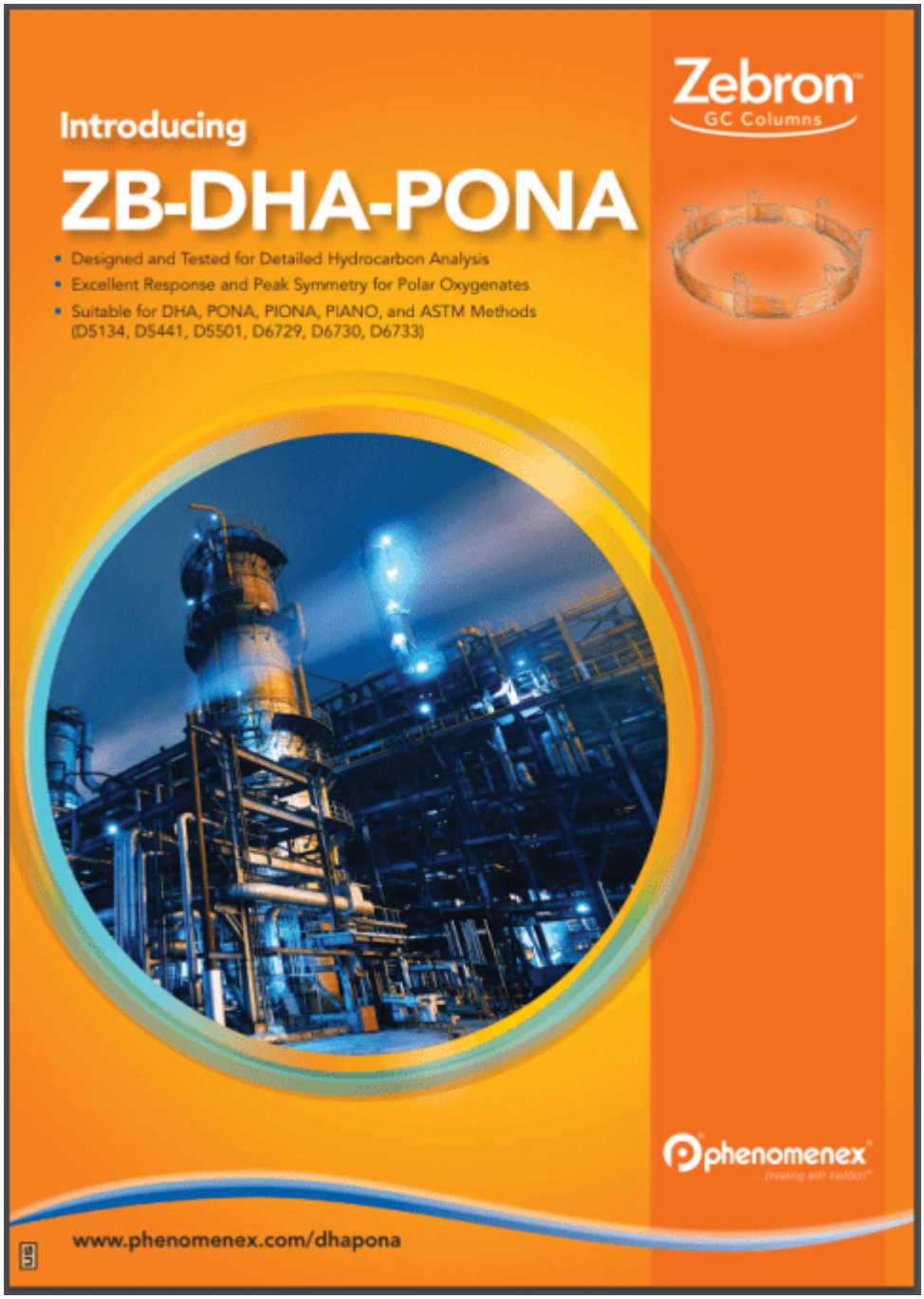
the ZB-DHA-PONA presents an advantage of Optimal Dimensions that can be chosen for your Detailed Hydrocarbon Analysis as listed in table.

Column Name	Part Number	Dimensions Stationary Phase	Temperature Limits	Stationary Phase	Benefits
ZB-DHA-PONA	7JE-G042-17	50 meter x 0.20 mm x 0.50 µm	-60 to 360/370[0]	100 % Dimethylpolysiloxane	50 meter column provides shorter run time. while the 0.2 µm tighter ID provides higher efficiency
	7MG-G042-17	100 meter x 0.25 mm x 0.50 µm	-60 to 360/370[0]		100 meter length provides high plate count/efficiency.
	7QG-G042-22	150 meter x 0.25 mm x 1.0 µm	-60 to 340/360[0]		150 meter length with a 1.0 µm thicker film provides better separation of lower boiling fractions and maintains high efficiency from the column length
ZB-DHA-PONA-TUNE	7AG-G042-22	5 meter x 0.25 mm x 1.0 µm	-60 to 340/360[0]C	5 % Phenyl, 95 % Polydimethylsiloxane	Optional tuning column provides phenyl selectivity in addition to true boiling point separation. This helps in resolving certain aromatics from alkanes and alkenes.

Longer columns alone may not resolve all peaks within a chromatogram, and can contribute to broader peaks with lower sensitivity. The balance of a GC capillary column's internal diameter to film thickness, otherwise known as the phase ratio, is very pertinent to maintaining a efficiency throughout the duration of a separation.

In the second part of the blog, We would like to elaborate on the advantageous phase ratio of ZB-DHA-PONA when evaluating the contents of spark ignition fuels, and the impurities within MTBE. We will also discuss the ZB-DHA-PONA-TUNE as an example of a tuning column to enhance resolution and its cross function as retention gap. Thank you for your interest, and we are excited to share more details on Specific Applications.

To learn more and read more information about this product, check out the ZB-DHA-PONA Guide by clicking the link or image below: CLICK HERE



Learn more about what Phenomenex has to offer for your gas management analysis:

"Introducing New Gas Management System for the Purest Gas Analysis"

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