We're Going Global

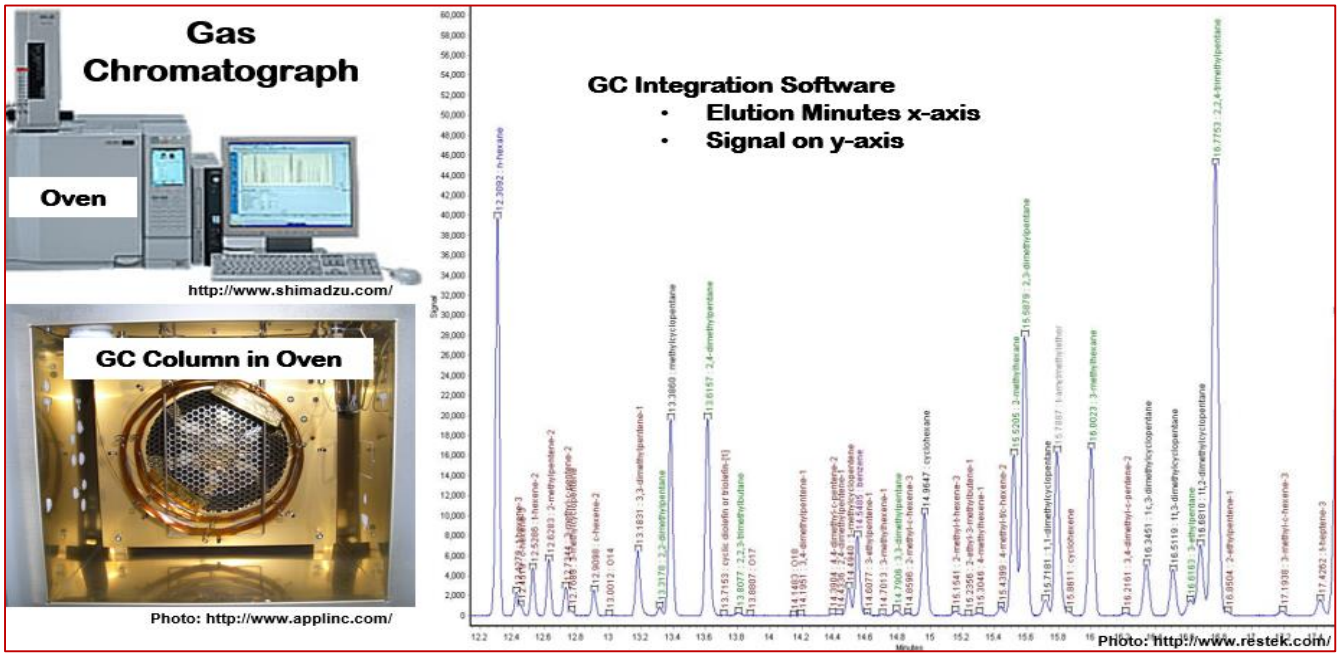
PONA PIANO

Gasolines are a complex mixtures of hundreds of compounds. Knowing the concentrations of the individual components is important for evaluating gasoline blending components, for product specification compliance and controlling refinery processes. We discussed determining gasoline composition D1319 FIA in TechTalk #42. In this issue we will discuss how to determine gasoline composition using gas chromatography methods.

P = Paraffins
O = Olefins
N = Naphthenes
A = Aromatics

P = Paraffins
I = Isoparaffins
A = Aromatics
N = Naphthenes
O = Olefins

A gas chromatograph (GC) method for detailed hydrocarbon analysis (DHA) of gasolines runs the unknown sample for PONA or PIANO. It is the analysis of hydrocarbon mixtures by separation and quantitation of fractions according to the carbon number or type of hydrocarbon. The sample is injected into the GC with a carrier gas which moves the sample through a GC column where the components are separated. A detector measures the quantity of the components as they elute. To measure an unknown sample, a standard sample with a known concentration is injected into the GC. The standard sample peak retention time and area are compared to the unknown sample.



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Also, please be advised individual / group AmSpec laboratory / operational tours can be arranged upon request.

There are two types of Gas Chromatographic (GC) methods that can be used to analyze gasolines or their blending components to give a detailed hydrocarbon analysis (DHA) depending on the information desired. In both procedures, a small sample is injected on to a column (or columns) in the GC.

One analysis will break the sample down into its components (PONA or PIANO) by carbon number. For this analysis an instrument using a series of columns and traps is used to separate the sample.

> Example: what percent of the sample consists of 4 carbon paraffin compounds or 8 carbon aromatic compounds.

The other procedure uses a single column and breaks the sample down into each of its individual components.

> Example: how much n-butane (4 carbon paraffin) or how much meta-xylene (C8 aromatic).

The following ASTM methods can be used to determine the composition of naphtha, gasoline and gasoline blending components.

ASTM D5134

Detailed Analysis of Petroleum Naphthas through n-Nonane by Capillary Gas Chromatography

This detailed hydrocarbon analysis (DHA) test method covers the determination of hydrocarbon components paraffins, naphthenes, and monoaromatics (PNA) of petroleum. This test method is applicable to olefin-free (<2 % olefins by liquid volume) liquid hydrocarbon mixtures including virgin naphthas, reformates, and alkylates. This test method may not be completely accurate for PNA above carbon number C7; Test Method D5443 or D6839 may be used to verify or complement the results of this test method for carbon numbers >C7.

ASTM D5443

Standard Test Method for Paraffin, Naphthene, and Aromatic Hydrocarbon Type Analysis in Petroleum Distillates through 200 °C by Multi-Dimensional Gas Chromatography

This test method covers the determination of paraffins, naphthenes, and aromatics by carbon number in low olefinic hydrocarbon streams having final boiling points of 200°C (392°F) or less. If olefin content is >5% D5443 is not applicable.

ASTM D6293

Oxygenates and Paraffin, Olefin, Naphthene, Aromatic (O-PONA) Hydrocarbon Types in Low-Olefin Spark Ignition Engine Fuel by Gas Chromatography, is another method.

This test method provides for the quantitative determination of oxygenates, paraffins, olefins, naphthenes, and aromatics in low-olefin spark-ignition engine fuels by multidimensional gas chromatography. Each hydrocarbon type can be reported either by carbon number or as a total through C10, except for olefins, which can only be reported through C9. Higher boiling hydrocarbons cannot be reported by type and are reported as a composite group. The lower limit of detection for a single hydrocarbon component or carbon number type is 0.05 mass%.

ASTM D6296

Total Olefins in Spark-ignition Engine Fuels by Multidimensional Gas Chromatography

The fast total olefins (FTO) system analyzes streams with concentrations of 0.2%-35% olefins. This GC system determines C4 - C10 olefins in all finished motor gasolines, straight naphthas and FCC naphthas. It reports in weight% and liquid volume% and a full analysis takes just 20 minutes. The FTO analysis exceeds the repeatability capabilities of ASTM D1319 (the Fluorescent Indicator Absorption-FIA-method) and incorporates ASTM D6296 - Total Olefins in Spark-Ignition Engine Fuels by Multi-Dimensional GC.

ASTM D6729

Determination of Individual Components in Spark Ignition Engine Fuels by 100 Metre Capillary High Resolution Gas Chromatography,

This test method covers the determination of individual hydrocarbon components of spark-ignition engine fuels and their mixtures containing oxygenate blends (MTBE, ETBE, and ethanol) with boiling ranges up to 225°C (437°F). Other light liquid hydrocarbon mixtures typically encountered in petroleum refining operations, such as blending stocks (naphthas, reformates, alkylates) may also be analyzed.

ASTM D6730

Determination of Individual Components in Spark Ignition Engine Fuels by 100–Meter Capillary (with Precolumn) High-Resolution Gas Chromatography

The method is a Gas Chromotography method for the detailed hydrocarbon analysis (DHA) of gasolines. It covers the determination of individual hydrocarbon components of spark-ignition engine fuels and their mixtures containing oxygenate blends (MTBE, ETBE and ethanol) with boiling ranges up to 225°C (437°F). Other light liquid hydrocarbon mixtures and gasoline components such as naphthas, reformates, and alkylates may also be analyzed.

ASTM D6733

Determination of Individual Components in Spark Ignition Engine Fuels by 50 Metre Capillary High Resolution Gas Chromatography.

This test method covers the determination of individual hydrocarbon components of spark-ignition engine fuels with boiling ranges up to 225°C (437°F). Other light liquid hydrocarbon mixtures and gasoline components such as naphthas, reformates, and alkylates may also be analyzed. Component concentrations are determined in the range from 0.10 to 15 mass%.

AmSpec Houston Technical Center

If you are in the Houston area and would like to see PONA/PIANO testing, please talk to your AmSpec contact about a visit to our new AmSpec Houston Technical Center. It is a 61,780 sq. ft. state of the art laboratory and office facility. It boasts the largest inventory of sophisticated testing equipment in the country all under one roof.

It is equipped with multiple octane engines, distillation and gas chromatography units, crude assay equipment and research and development center. The Houston Technical Center offers a wide range of product testing capability which includes but is not limited to gasoline, jet fuel, distillate, residual fuel, ethanol, biodiesel, LPG, crude as well as petrochemicals.
This facility was built with upgraded, top level data management systems, backup generators with 24 hour emergency fueling service and on-site tech support. The AmSpec HTC also has an in-house learning facility not only for ongoing employee training / instruction but also for client classroom education commencing January, 2016.