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Application Data Sheet

No.50

System Gas Chromatograph

Benzene Toluene and Aromatic Analysis
Nexis GC-2030_3606-4815-5580_1

This system contains two analysis lines, one is for benzene, toluene analysis (ASTM-D3606), the other is for aromatic component analysis (ASTM-D5580). Flow diagram of ASTM-D4815 is exactly same as ASTM-D5580. So, this system can be used for oxygenate analysis as well.

[Benzene, toluene analysis]
An appropriate internal standard such as butanone is added to the gasoline sample which is then introduced into a gas chromatograph with two columns and a column switching valve. The sample first passes onto a non-polar pre-column (OV-1) which elutes components according to their boiling points. After the elution of isooctane, the valve is switched to back-flush those portions whose boiling points are higher than isooctane and vent them to the atmosphere. Isooctane and lighter portions are directed into the polar analysis column, while benzene and toluene are eluted through the polar column and detected by TCD.

[Aromatic component analysis]
A two column chromatographic system equipped with a column switching valve and a flame ionization detector is used. A reproducible volume of sample containing an appropriate internal standard such as 2-hexanone is injected onto a pre-column containing a polar liquid phase (TCEP). The C9 and lighter non-aromatics are vented to atmosphere as they elute from the pre-column. A thermal conductivity detector may be used to monitor this separation. The TCEP pre-column is back-flushed immediately before the elution of benzene, and the remaining portion of the sample is directed onto a second column containing a non-polar liquid phase (WCOT). Benzene and toluene, and the internal standard elute in the order of their boiling points and are detected by a flame ionization detector. Immediately after the elution of the internal standard, the flow through the non-polar WCOT column is reversed to back-flush the remainder of the sample (C8 and heavier aromatics plus C10 and heavier non-aromatics) from the column to the flame ionization detector. The analysis is repeated a second time allowing the C12 and lighter non-aromatics, benzene and toluene to elute from the polar TCEP pre-column to vent. A thermal conductivity detector may be used to monitor this separation. The TCEP pre-column is back-flushed immediately prior to the elute of ethylbenzene and the remaining aromatic portion is directed into the WCOT column. The internal standard and C8 aromatic components elute in the order of their boiling points and are detected by a flame ionization detector. Immediately after o-xylene has eluted, the flow through the non-polar WCOT column is reversed to back-flush the C9 and heavier aromatics to the flame ionization detector. From the first analysis, the peak areas of benzene, toluene, and the internal standard (2-hexanone) are measured and recorded. Peak areas for ethylbenzene, p/m-xylene, o-xylene, the C9 and heavier aromatics, and internal standard are measured and recorded from the second analysis. The back-flush peak eluting from the WCOT column in the second analysis contains only C9 and heavier aromatics. The flame ionization detector response, proportional to the concentration of each component, is used to calculate the amount of aromatics that present with reference to the internal standard.

[Oxygenates analysis]
An appropriate internal standard such as 1,2-dimethoxyethane (ethylene glycol dimethyl ether) is added to the sample which is then introduced into a gas chromatograph equipped with two columns and a column switching valve. The sample first passes onto a polar TCEP column which elutes lighter hydrocarbons to vent and retains the oxygenated and heavier hydrocarbons. After methycyclopentane, but before DIPE and MTBE elute from the polar column, the valve is switched to back-flush the oxygenates onto a WCOT non-polar column. The alcohols and ethers elute from the non-polar column in boiling point order, before elution of any major hydrocarbon constituents. After benzene and TAME elute from the non-polar column, the column switching valve is switched back to its original position to back-flush the heavy hydrocarbons. The eluted components are detected by a flame ionization or thermal conductivity detector. The detector response, proportional to the component concentration, is recorded; the peak areas are measured; and the concentration of each component is calculated with reference to internal standard. The system includes Lab Solutions GC workstation software.

Analyzer Information

System Configuration:
Two valves / packed and capillary columns with TCD/ FID detectors

Sample Information:
Determination of MTBE, ETBE, TAME, DIPE, tertiary-Amyl Alcohol and C1 to C4 alcohols in Gasoline

Methods met:
ASTM-D3606, D4815, D5580

Target Compound Table for Benzene Toluene

No.	Name of Compound	Concentration Range	
		Low Conc.	High Conc.
1	Benzene	0.1%	5.0%
2	Toluene	1.0%	15.0%
3	C8 aromatics	0.5%	10.0%

Target Compound Table for Aromatic Components

No.	Name of Compound	Concentration Range	
		Low Conc.	High Conc.
1	ethers	0.1%	20.0%
2	alcohols	0.1%	12.0%

Target Compound Table for Oxygenate

No.	Name of Compound	Concentration Range	
		Low Conc.	High Conc.
1	Benzene	0.1%	5.0%
2	Toluene	2.0%	20.0%

Detection limits may vary depending on the sample.
Please contact us for more consultation.

System Features

- Dual channel system meets ASTM D3606, D4815, D5580
- 10-port valve is used for ASTM D4815, D5580 with FID detector
- 6-port valve is used for ASTM D3606 with TCD detector

Typical Chromatograms

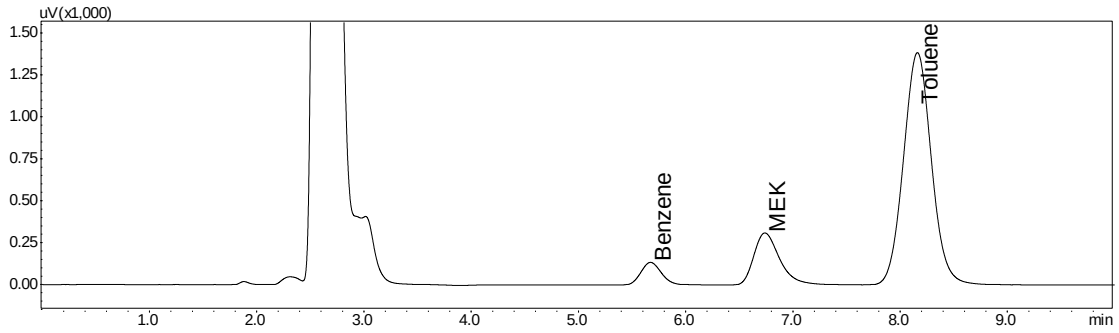

Fig. 1 Chromatogram - ASTM D3606

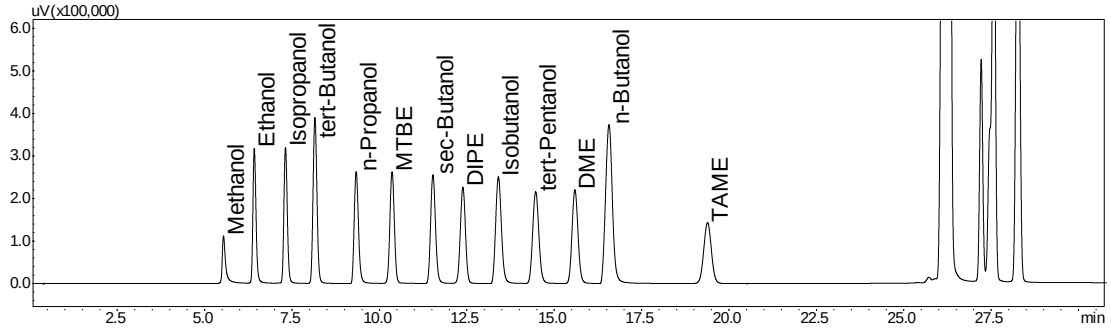

Fig. 2 Chromatogram - ASTM D4815

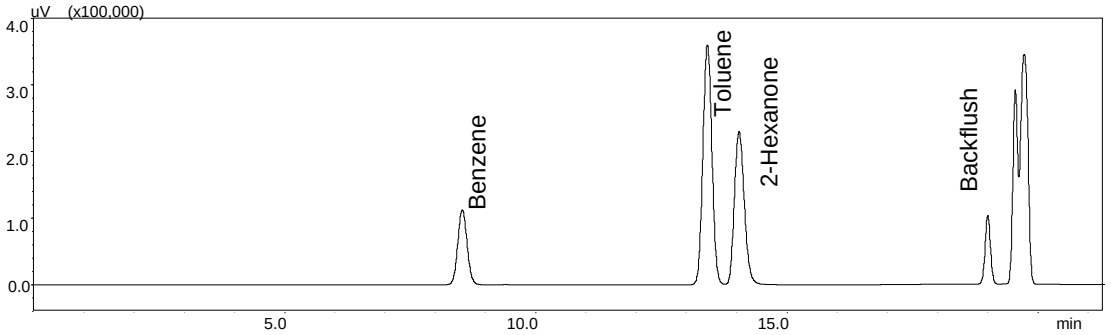

Fig. 3 Chromatogram - ASTM D5580-1

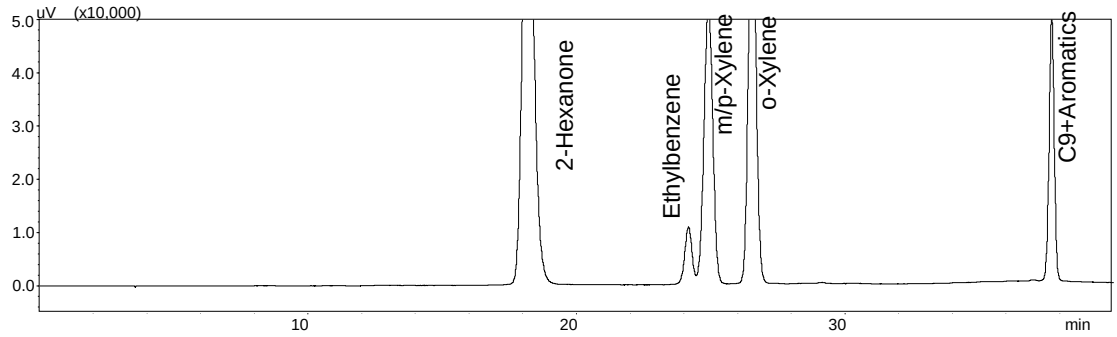

Fig. 4 Chromatogram - ASTM D5580-2

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