

ASTM D-3606 7890 GC System

by Advanced Industrial Chemistry

ASTM D3606

ASTM D-3606 is a gas chromatographic method that is designed to measure benzene and toluene in spark ignition fuels such as gasoline. With an increased emphasis on reducing the amount of benzene in motor gasolines, this method is important to monitoring the concentration of benzene in the finished gasoline product.

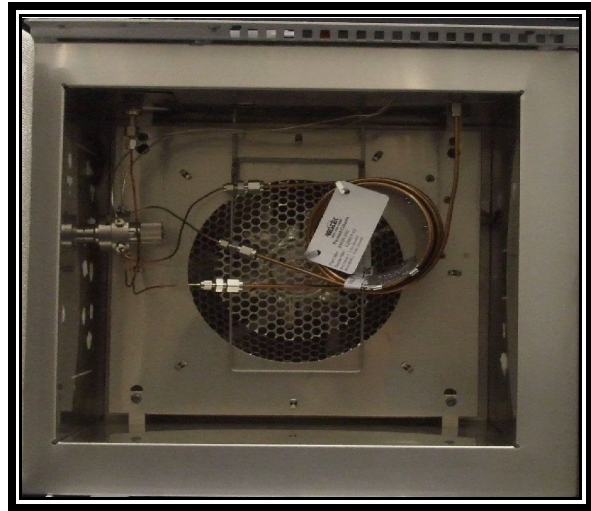
Instrument configuration

The method utilizes two 1/8" packed columns in series with a column switching valve in between the two columns (see Figure 2.) A neat sample is injected onto a short packed column containing a non-polar stationary phase. Light hydrocarbons are transferred onto the second analytical column while the heavier components are back-flushed off the pre-column to vent. The second, polar, analytical column then separates an internal standard, the benzene and toluene from the rest of the components in the gasoline mixture. Detection in this method is accomplished using a thermal conductivity detector.

Figure 1: Custom built D3606 instrument as built at customer facility.



Figure 2: Dual Columns for 3606 inside GC oven.



For this application, the valve actuator is installed in a pneumatics cabinet on the left hand side of the GC. The valve itself is installed inside the GC oven thus being maintained at the same temperature of the column in a simple and cost effective manner.

A unique aspect of this custom build was that all the work was accomplished on-site at the customers location. Working with Advanced Industrial Chemistry (A.I.C.), the customer purchased a 7890 GC as the base platform along with the appropriate pneumatics, valves, columns and an external pneumatics cabinet.

Once the GC system had arrived, A.I.C. personnel installed the external cabinet, installed the column selection valve in the GC oven with the actuator in the an external pneumatics cabinet, wired and plumbed the system, installed the appropriate columns and started up the system. While on site, we established a calibration curve and worked with site personnel to get them familiarized and comfortable with the GC system.

Results

Figure 3 below is a chromatogram from a 3606 standard containing ethanol analyzed on the custom built system. Several features of the chromatogram are of note. First, note the complete separation between the ethanol and the benzene in this analysis. Note, also, the minimal tailing from the ethanol due to the choice of tubing materials and inlet liners. Second, note that this customer uses sec-butyl alcohol as the internal standard as per the Appendix in ASTM D3606. Finally, note the near baseline separation of the sec-butyl alcohol peak and the benzene peak. This separation improves the reproducibility of the benzene quantitation.

Figure 4 below is a chromatogram of a gasoline sample from the 3606 system. With the increased emphasis on reducing the amount of benzene in motor fuels, it is immediately apparent from this chromatogram is the low level of benzene found in the motor fuel. In addition note the excellent separation obtained for the benzene, the internal standard, and the toluene peak.

Figure 3: Standard chromatogram from custom built D3606 instrument.

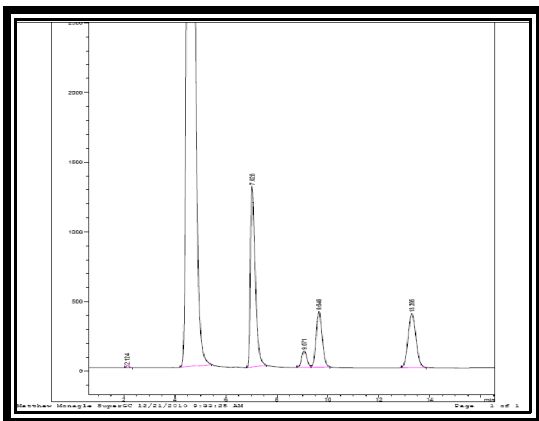
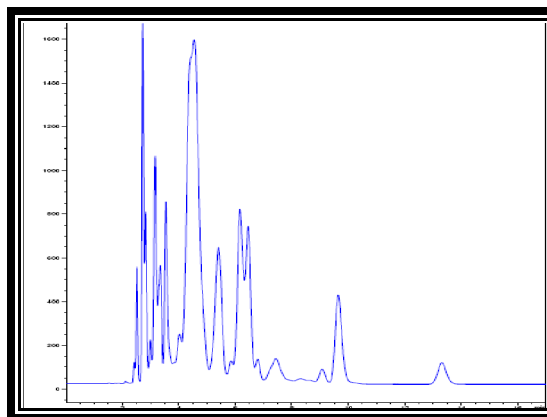


Figure 4: Chromatogram from a gasoline sample analyzed on the custom built D3606 instrument.



Advanced Industrial Chemistry

Advanced Industrial Chemistry has developed methods and built custom G.C. systems for a number of industries including environmental, petroleum, consumer products, and research and development. With over 13 years in the gas chromatography business, A.I.C. offers the experience and the know how to meet customer needs in a cost effective manner.

A.I.C. also manufactures and sells a suite of detectors unique in the chromatographic industry. This includes a helium ionization detector (H.I.D.), and argon ionization detector (A.I.D.), a non-radioactive electron capture detector (E.C.D.), and a photoionization detector (P.I.D.)

Other Applications

Examples of other custom built GC's include:

Trace gas analysis such as the measurement of fixed gases in UHP products.

Measurement of landfill gas constituents such as hydrogen, CO, CO₂ and methane using the DBD HID detector

Measurement of low p.p.m. levels oxygenates in liquified petroleum gases.