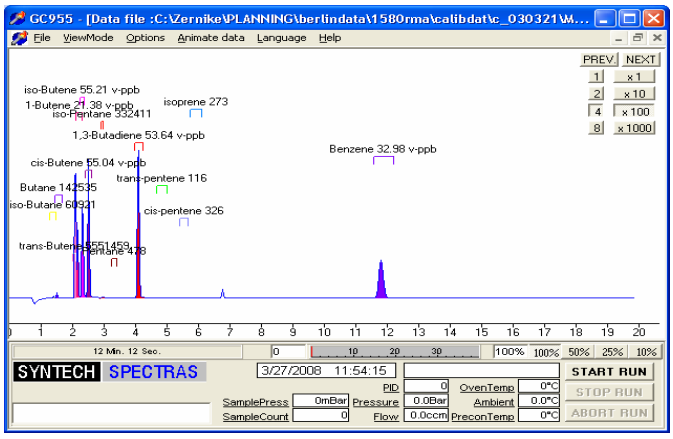
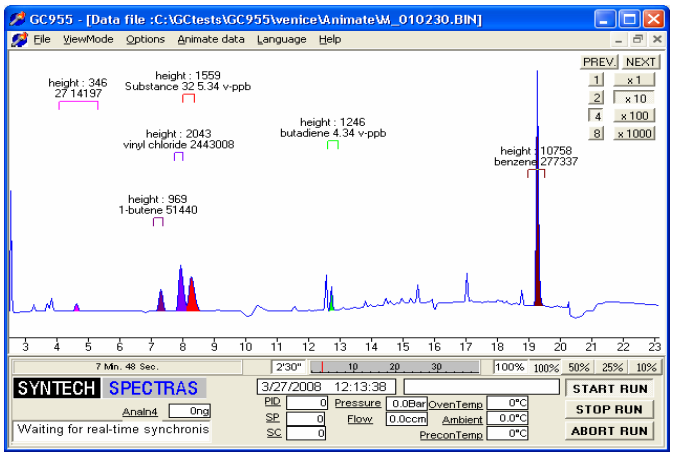
SYNTECH SPECTRAS
BENZENE BUTADIENE ANALYSER



Calibration of benzene, 1,3-butadiene and butenes



Ambient measurement with of benzene, 1,3-butadiene vinyl chloride and butene

WHY MONITOR BUTADIENE AND BENZENE?

According to European regulations measurement of the carcinogenic benzene in ambient air is now obligatory. The concentration of benzene varies from below 0.03 to above 100 micrograms per m^3.
1,3-Butadiene is also carcinogenic and gets increasing attention. The 1,3-Butadiene concentration is generally a factor 10-20 lower than the benzene concentration.
This makes it a difficult hydrocarbon to monitor. 1,3-Butadiene is also very reactive in the formation of ozone: in ozone smog the stability of 1,3-butadiene is a factor 80 lower than benzene. This means that measurement is best done immediately after sampling.

HYDROCARBON SELECTION

Butadiene is present in the light fraction fuels, like LPG. It is also used as a monomer in polymer industry, it may be emitted from either of these industries.

Benzene is also emitted by traffic as well as from incomplete burning processes. In addition to this, it can also be emitted by refineries in the process of removing benzene out of crude oil when producing car fuel.

In the butadiene-benzene analyser other components, like ozone precursors can be monitored. A few examples of these substances are: n-butane, i-butane, 1-butene, iso-butene, pentanes, pentanes and isoprene. This will however require calibration of these substances. The system can be set to monitor toluene as well. But, as toluene has a much higher boiling point the cycle time will be longer.

SYNTECH SPECTRAS GC955 604 BENZENE BUTADIENE ANALYSER

The instrument is a gas chromatograph with a built-in pre concentration system. Hydrocarbons are pre-concentrated on Carbopack B, desorbed by heating and separated on a special column combination.
To reach optimal separation from interfering hydrocarbons in the C4-range a PLOT column is used. On this column 1,3-Butadiene is separated at 60 °C. Benzene elutes at 110 °C from this column, while toluene will not elute. The setting for the column has been optimized to avoid interference from water and higher boiling hydrocarbons.

Analysis of Butadiene together with BTEX

It seems attractive to measure butadiene as well as BTEX in one analyser. Synspec is not in favour of doing this. The boiling point range is then 150 °C from the lowest to the highest boiling compound. This means that the column type chosen will not be the most suitable for the hydrocarbons with the lowest boiling point, which is 1,3-butadiene.
The problem with butadiene is that ambient concentration is very low. It will normally a factor 5 to 20 lower than some hydrocarbons with very similar boiling point, notable iso-butene and n- and iso-butane. These compounds are always present in the ambient air, where 1,3-butadiene disappears completely with high ozone concentrations. This means that Synspec can supply an analyser for butadiene and BTEX that works well with a calibration gas mixture containing only these hydrocarbons. In a real sample the 1,3-butadiene will disappear below the other compounds with similar boiling point.

The alternative solution would be to analyze also up to the xylenes with the column suitable to separate butadiene from its neighbours. This leads in practice to a system that will not clean up easily and lead to wandering peaks. The xylene peaks will appear as broad low shapes and quantification is difficult.
Offers from competitors for such a butadiene / BTEX system should be reviewed on its ability to do the measurement with field samples against a test that quantifies the butenes and butanes as well.

Technical details of the benzene butadiene analyser

In the GC a standard industrial PC with Windows is used. The user-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily with this intuitive software. Data can also be transferred by network and modem connection. Besides this, analog and digital output options are available to communicate with other data logging systems using several data protocols.
Simple operation, good reliability and low maintenance cost are important to us. With a worldwide network of distributors you can be sure that your instrument comes complete with an individualised training and that support is available to help if you do encounter problems.

603	1,3-Butadiene , C4 and C5 alkenes and benzene
General	SERIES 600, cycle time 15 min, temp program 60 - 110 °C
Detector	PID detector. Lowest detection level for benzene 0.03 µg/m3 (0.01 vppb), for butadiene 0.02 µg/m3 (0.01 vppb). Range: up to 300 ppb.
Column	AT5, 5 m, 0.32 mm ID, 1.8 µm film, and 5 M Al2O3/KCl, 0.32 mm
Reproducibility	Typical <3% at 1 ppb (benzene, with capillary column)
Dimensions	19" rack, 5 standard Height Units, depth 39 cm net
Consumption of gas	Nitrogen: quality 5.0, 4 bar, 10 ml/min
Power demand	220 V AC, 100 VA (110 V AC available)
Included hardware	Computer Pentium III class, hard disk ≥40Gb, 2.5 ",display LCD 10.4 " colour, various data connection options
Included software	WindowsXPe, PC Anywhere host, Synspec gaschromatography package
Options	- One PC can control 2 gas chromatographs - It is possible to monitor also toluene in a 30 minute cycle. The quality of the nitrogen is essential, as well as a good dry zero air supply
Communication	Control of instrument: direct control via keyboard or mouse, or via remote host (RS232 / modem), ethernet, data exchange protocols available on demand
Certification	CE approval for EMC conformity: EN 61010-1, EN 61000-6-2 and EN 60111-6-3

Extra equipment needed	For the application 603 a permapure dryer will be supplied with the system. Zero air as dry as possible should be provided at a flow of 250 ml/min.
Calibration gases	For the application 603 if only butadiene and benzene are measured: gas 5 ppb or 1 to 5 ppm and dilutor For the application 603 if also toluene and/or the other C4 and C5 alkenes are measured: multi component mixture, advised Spectra Gases or NPL

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