Pure Gases Monitoring Applications

CO_2 quality control for food industries

ChromaS-COS and airmoVOC BTEX

Context & Challenges

CO2 used in food industries can be produced by two families of processes: natural or chemical. The multiple production possibilities are involving different kind of impurities inside CO_2 (BTEX, Sulfur compounds…).
To help producers to control the quality and purity of Carbon Dioxide, some specialists are proposing limit values for impurities in compliance with health and safety regulations: Compressed Gas Association of America (CGA) (www.cganet.com), International Society of Beverage Technologists (ISBT) (www.bevtech.org), European Industries Gases Associations (EIGA) (www.eiga.be).

One of the most commonly used technologies to control CO_2 quality and purity is Gas Chromatography.

Sample presentation and specifications

Carbon dioxide is colorless, odorless and is not a fuel gas. It can be found under two phases: liquid or gas at temperature between -56.6°C and 31.1°C.

Toxicity

CO2 is naturally present in ambient air at concentrations changing between 0.03% (300 ppm) and 0.06% (600 ppm), depending on the measurement area. CO2 becomes hazardous at concentration above 5% volume, or 50,000 ppm) and the limit value (TLV: threshold limit value) or daily maximum exposition limit recommended for an adult is 0.5% (5,000 ppm).

Impurities concentration limits:

Compounds	**Concentration**
Acetaldehyde	0,2 ppm v/v max.
Benzene	0,02 ppm v/v max.
Total Sulfur (TS equivalent S)*	0,1 ppm v/v max.
* if Total Sulfur concentration (TS) is over 0,1 ppm v/v Sulfur, a speciation of each impurity must be done and must be in compliance with the following limits:	
Sulfide Carbonyl (COS)	0,1 ppm v/v max.
Hydrogene Sulfide (H2S)	0,1 ppm v/v max.
Sulfur Dioxyde (SO2)	1,0 ppm v/v max.

source: CGA/EIGA limiting characteristics commodity specification for carbon dioxide from "carbon dioxide source certification, quality standards and verification", IGC Doc 70/99/E.

Chromatotec® Solutions

Chromatotec® proposes its CO_2 analytical system. It is a fully independent and automatic cabinet including several modules adapted to impurities measurement:

- C51022 – chromaS-COS: module 5U for Total Sulfur analysis: speciation of H2S, mercaptans, DMS, DMDS, COS, CS_2 and SO_2 is done with FPD Detector (dual Flame Photometric Detector) and a filter specific to sulfur compounds. No quenching with this detector.

- A21022 – airmoVOC BTEX: module 4U for acetaldehyde and BTEX (Benzene, Toluene, Ethylbenzene and Xylenes) analysis with FID Detector (Flame Ionization Detector).

>>> airmoVOC BTEX: MCERTS certified (2013) for benzene measurement following EN 14662-3
TÜV certified for BTEX analysis (1996)

Technical information and results

Sulfur compounds analysis:

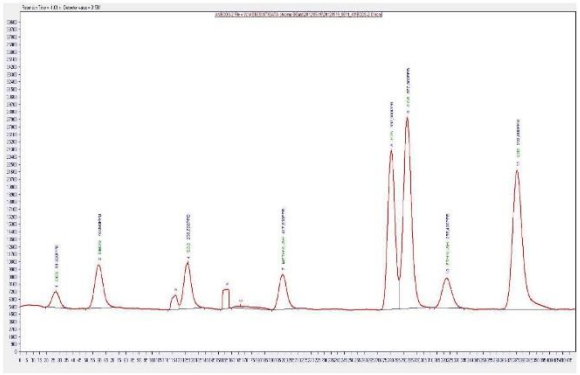
Sulfur analysis (#57960512)	
Cycle time	600 seconds
Amplification	middle (2)
Sampling loop	250 µl
Limit of quantification (H2S)	< 10 ppb

Acetaldehyde and BTEX analysis:

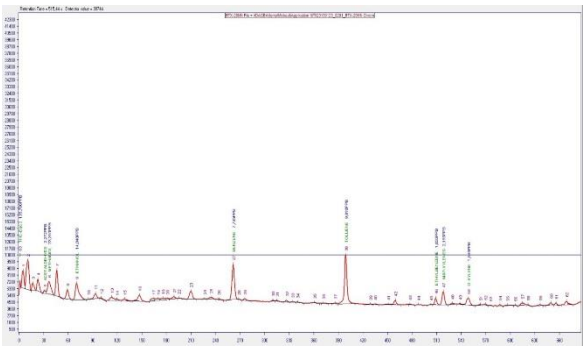
Acetaldehyde and BTEX analysis (#28730712)	
Cycle time	1200 seconds
Amplification	high (3)
Trap	3 phases
Limit of quantification (acétaldéhyde)	< 5 ppb

To verify the BS and to validate the results, a benzene permeation tube is used. The permeation tube is installed in a regulated temperature oven placed inside the analyzer. The oven is swept by a constant flow of air or nitrogen and delivers a constant gas concentration. Other concentrations are known due to the response factor relating to Benzene.

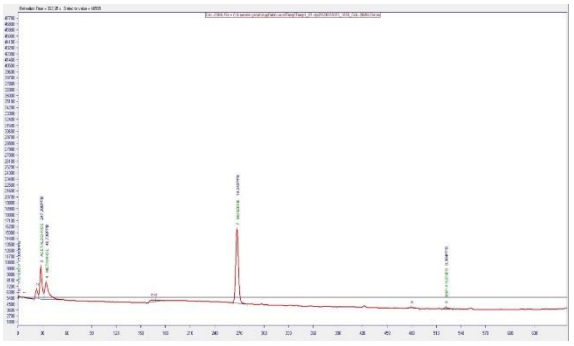
Sample: DES, DMDS, SO2, Me-SH, H2S, COS, Et-SH and CS2



Chromatogram



Standard chromatogram:



48h continuous analysis of acetaldehyde, standard deviation (Relative Standard Deviation):
< 0,3% over 48H (on retention time)
< 2% over 48H (on concentrations)

Conclusion:

To ensure people's safety, CO_2 monitoring is crucial in food industries; Chromatotec® has therefore developed different modules to answer customer needs.

The high stability and the ease of use are making Chromatotec's analyzers the perfectly suitable analysis devices for carbon dioxide quality control.

To validate and control the stability of the measure, internal calibration systems are used: autoCALIB function is available on the Vistachrom software.