

Desulfurization process monitoring with energyMEDOR

Context & Challenges

Steam methane reforming, or SMR is an industrial process used to produce Hydrogen and carbon monoxide from methane coming from natural gas. At the beginning of the process, the hydrocarbon feed needs to be purified from sulfur compounds, as sulfur compounds affects the efficiency of the process. Therefore, natural sulfurs and other sulfur compounds such as odorant have to be measured in natural gas before and after desulfurization. At the end of the process, gas contaminants need to be controlled, even at very low concentrations (ppb), in order to verify the purity of the produced hydrogen. but how to analyze this compound, in such a moisturized and complex matrix ?

Chromatotec® Solutions

Chromatotec solution quantify all individual sulfur compounds such as natural sulfur Hydrogen Sulfide but also all other individual sulfur compounds such as mercaptans or sulfides at high (low ppm directly into natural gas pipe) and very low (low ppb after deodorization process) concentrations. This dual range system works with two different volume of sampling loops. The analyzer automatically switches between the two sampling ways to avoid the saturation of the system and/or signal.

Instrument: energyMEDOR

The energyMEDOR is capable of analyzing H₂S, mercaptans, DMS and/or total reduced sulfurs by collecting directly the sample, into the vent. Then, all the molecules are separated by chromatography and detected at a very low level (ppb and/or ppm). In this specific case, the energyMEDOR is equipped with two sampling loops adapted to two different ranges of concentrations (0-1 mg/Nm³ to 0-50 mg/Nm³) and integrated in an ATEX certified cabinet. Thanks to its internal calibration system, the results are validated automatically and there is no need of manual intervention. The LCD color touchscreen allows the user to view and edit the results directly in front of the analyzer without opening it. The data are also automatically exported to a supervision room, where the user is able to switch manually between the two sampling ways instead of automatic mode.

The energyMEDOR detects Sulfur compounds, thanks to a long-life sulfur (up to 10 years) specific Electrochemical Detector (ED). Here below some example of the analyzed sulfur compounds:

Example

Hydrogen Sulfide (H₂S)

Methyl Mercaptan (MM)

Ethyl Mercaptan (EM)

Dimethyl Sulfide (DMS)

Dimethyl Di-Sulfide (DMDS)

Iso Propyl Mercaptan (IPM)

Tert Butyl Mercaptan (TBM)

N Propyl Mercaptan (NPM)

Tetra Hydro Thiophene (THT)

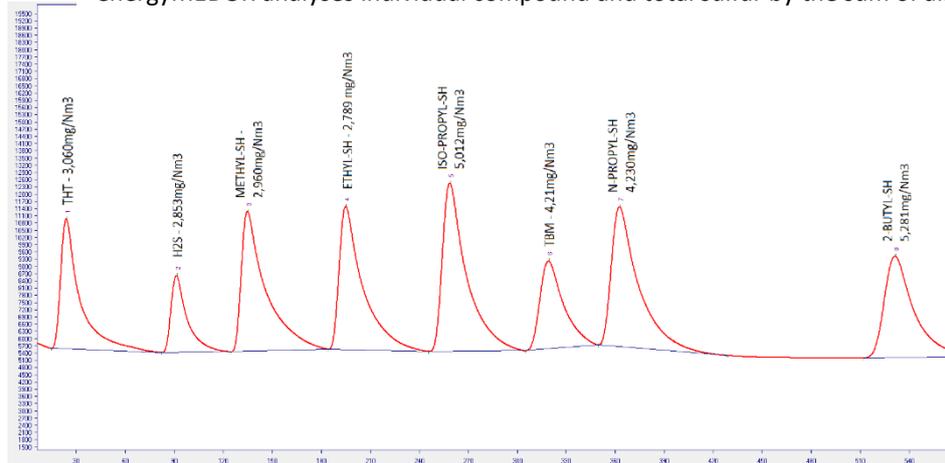
Iso-Butyl Mercaptan (IBM)

N-Butyl Mercaptan (NBM)

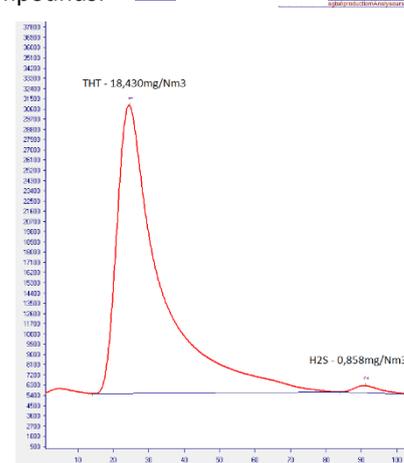
Total Sulfur by sum



energyMEDOR analyses individual compound and total sulfur by the sum of all the compounds.



Chromatogram obtained with energyMEDOR®



Chromatogram obtained with energyMEDOR® on natural gas sample with odorants (THT and H2S)

Ease of use:

- No auxiliary gas needed for operation and calibration
- Only N2 or air consumption (Nitrogen generator from instrument air in option)
- No required flammable gases to analyzer
- Integrated sampling pump enables analysis of atmosphere pressure sample
- Pressurized samples, don't need any sampling pump
- Automatic internal calibration with certified permeation tubes at ppm level
- **energyMEDOR also available in Ex Cabinet**

Data acquisition and treatment:

Data are automatically collected by Vistachrom software and interface. The user transfer datas like concentrations, retention times, analyzer status ... by Modbus protocol or 4-20mA analog output, directly to a supervision room. With the inbuilt LCD color touchscreen, the edition, consultation and transfer of the chromatograms becomes a lot easier. A calculation module manages the results to perform a daily average of the concentrations, retention times, etc ... of the selected compounds.

Conclusion

- Speciation with chromatography technique
- Unique sulfur specific detector technology recognized in WWTP, process and natural gas industry which responds directly to H2S, mercaptans and THT
- Linearity for each sulfur component
- Robust and compact instrument, minimum maintenance needed
- Compliant with ASTM D7493-14 guidelines and certified for hazardous areas ATEX, IECEx zone 1 and CSA C1D2
- State of the art PC and software solutions (Modbus, calculation modules, Windows embedded based software)
- Integrated calibration device with permeation tube for automatic data validation
- ppb or ppm analyzer version available

