CHROMATEC

FLUID ANALYZER on 2 GCs

Determination of Fluid composition after separation into 2 phases liquid and gas using 2 Chromatec GCs

AN 09-112-8002EN

Overview

Chromatec offers a gas chromatographic (GC) system for the analysis of live fluid samples after their separation into 2 phases: gas and liquid at ambient conditions. Fluid sample is brought to ambient conditions resulted into phase separation: degassing gas (gas sample) and degassed condensate (liquid sample).

The GC system incorporates 2 instruments:

- First GC, analyzing degassing gas, determines components N2, O2, CO2, CO, H2S, hydrocarbons C1 – C12.

- Second GC, analyzing hydrocarbons in degassed condensate

The results of the analyses obtained from 2 GCs, are consolidated in a single PVT report.

Analysis test methods

1. 1. STO Gazprom 5.5-2007. Unstable Gas Condensate. Test Method for determining the component-fractional and group hydrocarbon composition (Method A - procedure for determining the composition of gas unstable gas condensate with preliminary degassing).

2. GPA 2186. Method for the Extended Analysis of Hydrocarbon Liquid Mixtures Containing Nitrogen and Carbon Dioxide by Temperature Programmed Gas Chromatography.

3. GPA 2286. Method for the Extended Analysis for Natural Gas and Similar Gaseous Mixtures by Temperature Program Gas Chromatography.

4. ASTM D2887. Standard Test Method for Boiling Range Distribution of Petroleum Fractions by Gas Chromatography.

GC system capabilities

Two Gas Chromatographs, running independently and connected to a personal computer, work as a single chromatographic system.

The results of analysis of fluid samples (degassing gas and degassed condensate) divided into two phases are combined in the "Chromatec SimDist" software according to the methodology of STO Gazprom 5.5 (method A) and reported as PVT data.

Each single GC can work independently:

- The GC for analysis of gas samples performs analysis of gas degassing as well as extended analysis of natural gas using the GPA method 2286, GOST 31371, ISO 6974;

- The GC for analysis of liquid samples performs analysis of degassed condensate, as well as analysis of fractional composition of petroleum products and crude oil according to the methods ASTM D2887, ASTM D7096, ASTM D5307.

Chromatograph (A) – gas analyzer

The GC (A) incorporates 2 TCD detectors and valve system for sample injection and switching columns, providing N_2, O_2, CO_2, CO, H_2S, methane and ethane analysis. The hydrocarbons C_3-C_{12} are analyzed simultaneously on a 60-meter capillary column with high separation efficiency and sensitivity at FID detection. The built-in split/splitless inlet allows calibrating by liquid reference samples on FID channel and also to analyze light liquid hydrocarbon products, if necessary.

Chromatograph (B) – liquid sample analyzer

Chromatograph for determining the component-fractional composition of a stable (degassed) condensate is furnished with FID detector, PTV inlet for on-column injection, as well as an oven cooling system to set oven temperature from -10 ° C, for efficiency separation of the light hydrocarbons. Oven cooling system doesn't require cryo-agents (liquid carbon dioxide or liquid nitrogen) for operation. Integrated pre-column back-flushing option allows crude-oil heavy components to be cut off and removed from the pre-column in backflush to shorten run time.

Software

"Chromatec Analytic" is a basic software to control GC instruments and integrated peripherals operation, to acquire and process chromatograms, to carry out calibration, and export data to external software applications. The software has a variety of features for processing chromatograms, including the overlaying, subtraction of chromatograms and others.

The "Chromatech SimDist" application software combines the results of analysis of the liquid and gas sample and performs a number of calculations based on the measurement results:

- consolidated (general) calculation of the component-fractional composition for original fluid,

- tables and a graph of of initial boiling point (IBP) distribution for the consolidated fluid sample,

- calculation of thermo-physical parameters of gas degassing (in accordance with ISO 6976),

- metrological data (average value, accuracy repeatability, acceptability) separately for a liquid and gas sample in several repeat runs.

- consolidated (general report) of the component-fractional composition of fluid sample reported in relative and absolute, mole and mass percentages.

When analyzing liquid samples (diesel, crude oil and other petroleum products), "Chromatec SimDist" software performs calculations in accordance with ASTM D2887, D5307, D7169 test methods.

Optional "Chromatec Gas" software can be used for reporting of neat gas sample analysis. The software calculates thermo-physical parameters of the analyzed gas (according to ISO 6976), including the determination of the average molar mass, compressibility factor, molar / mass / volumetric heat of combustion (upper and lower) for real and ideal gas, absolute and relative density, Wobbe index for real and an ideal gas.

Instruments configuration *

Chromatograph (A) – gas analyzer:

Determination of N2, O2+Ar, CO, CO2, H2S, hydrocarbons C1, C2 with valve sampling / switching system and TCD.

Determination of hydrocarbons C3 – C14 using capillary column 60 m.

Split-Splitless inlet is available for liquid samples.

- GC "Chromatec-Crystal 9000"
- Detectors: 2xTCD, FID
- Split-Splitless inlet
- Valves for sample injection and columns switching (3 pcs)
- Auxiliary temperature zone for packed columns
- Packed columns (Hayesep & NaX - 3 pcs)
- Capillary column BP-1, 60m*0.32mm*1.0μm, Cat.N 054810 or equivalent

Chromatograph (B) – liquid sample analyzer

Determination of hydrocarbons C1 – C44 in liquid samples of stable condensate

- GC "Chromatec-Crystal 9000"
- Detector FID
- Programmable split-splitless inlet (PTV), on-column injection
- Autosampler AS-2M
- Capillary column CP-Sil 5 CB 30m*0.53mm*1.5μm, Cat.N CP8735 or equivalent
- Backflushing system to heavy components from precolumn (optional)
- Oven cooling system (optional).

Software:

- "Chromatec Analytic" software for instruments control and chromatogram processing
- "Chromatec SimDist" software simdist reporting of liquid samples and consolidated report for fluid samples obtained on 2 GCs.
- "Chromatec Gas" software (optional) calculating thermo-physical parameters of the analyzed gas (according to ISO 6976) after chromatographic analysis.

* - Configuration of the GCs can be flexibly changed according to customers demand.

Operating mode

GC A	Gas analysis		
Run time	20 min		
FID channel			
Valve-1	Sample injection		
Temperature	100 °C		
Sample loop	0.1 ml		
Switching time:	#1: 0 min		
Inlet	(Inlet-1)		
Injection mode	split, 1:10		
Inlet temperature	150 °C		
Capillary column			
Carrier flow	2 ml/min		
Oven temperature	(main oven)		
Isotherm 1:	60 °C	5 min	15 °C/min
Isotherm 2:	220 °C	5 min	
Detector FID			
Temperature	250 °C		
H2 flow	25 ml/min		
Air flow	250 ml/min		
Make up flow	25 ml/min		
TCD-TCD channel			
Valve-2	Sample injection / columns switching		
Temperature	100 °C		
Sample loop	1 ml		
Switching time:	#1: 0 min; #2: 9 min		
Valve-3	columns switching		
Temperature	100 °C		
Sample loop	1 ml		
Switching time:	#1: 2.3 min		
Packed columns			
Carrier flow	30 ml/min		
Columns temperature	(Aux thermostat, NaX)		
Isotherm 1:	100 °C		
TCD detectors			
Carrier flow	30 ml/min		
Temperature	150 °C		

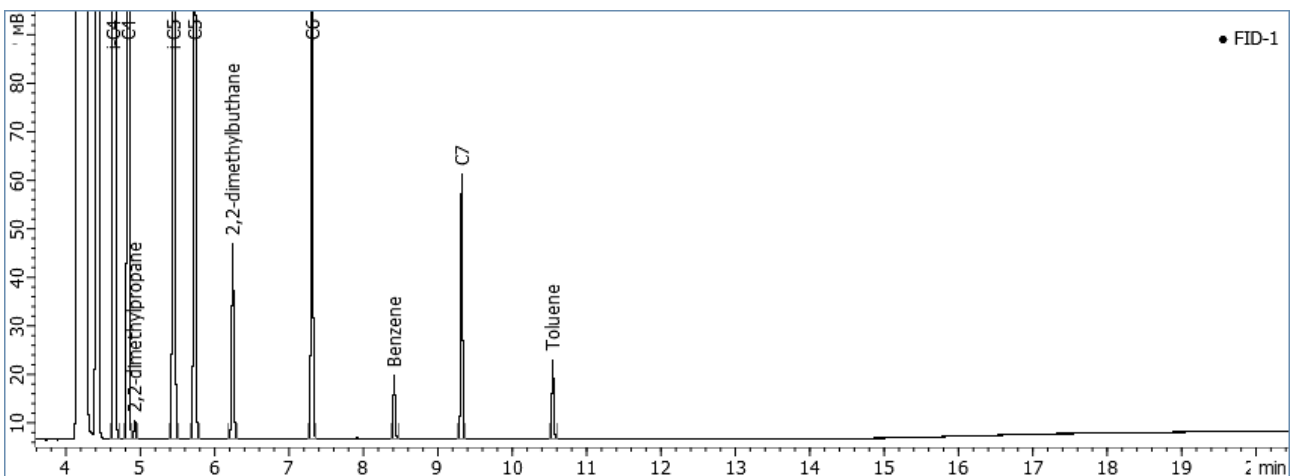| GC B	Liquid analysis		
Run time	25 min		
Inlet			
Injection mode	on-column		
Inlet temperature			
Isotherm 1:	40 °C	0 min	50 °C/min
Isotherm 2:	310 °C		
Capillary column			
Carrier flow	10 ml/min		
Oven temperature			
Isotherm 1:	0 °C	2 min	15 °C/min
Isotherm 2:	305 °C	1 min	
Backflushing	(if applicable)		
Switching time:	Selected by experiment		
Detector FID			
Temperature	320 °C		
H2 flow	25 ml/min		
Air flow	250 ml/min		
Make up flow	25 ml/min		

Chromatograms

Chromatograph (A) – gas sample analysis
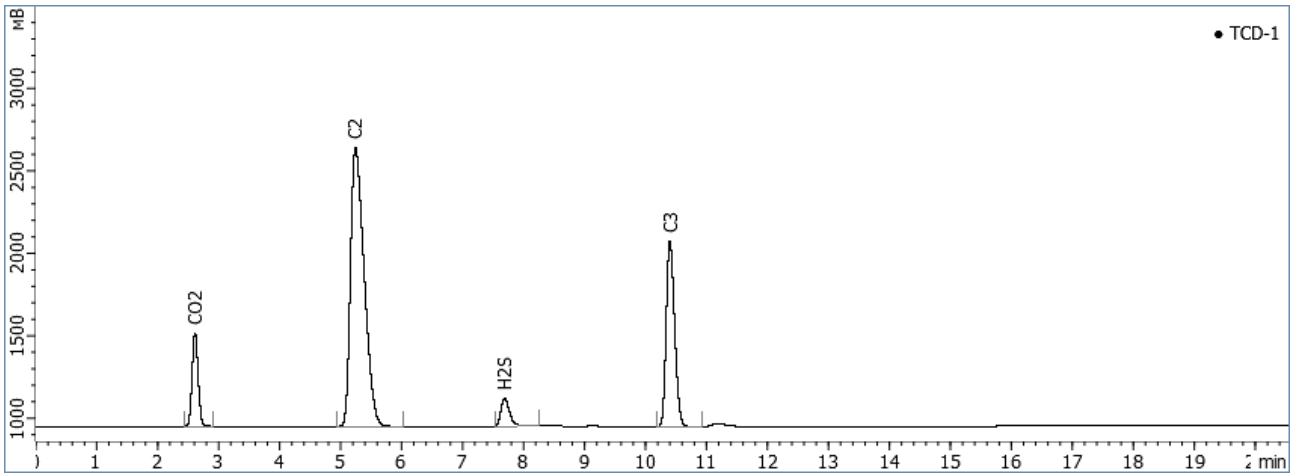
Signal TCD 1 – Chromatogram eluting CO2, C2H6, H2S, C3H8.
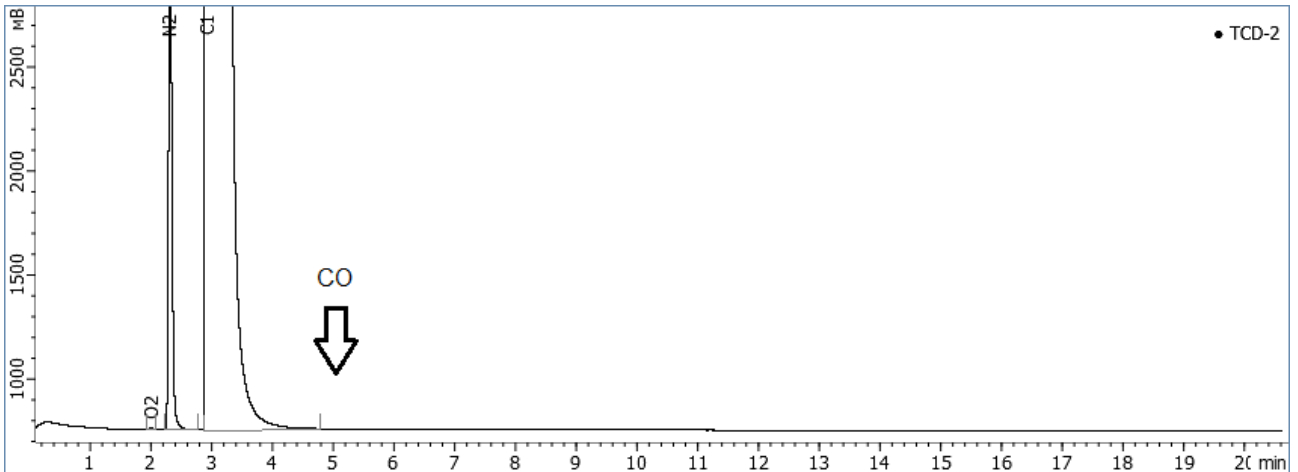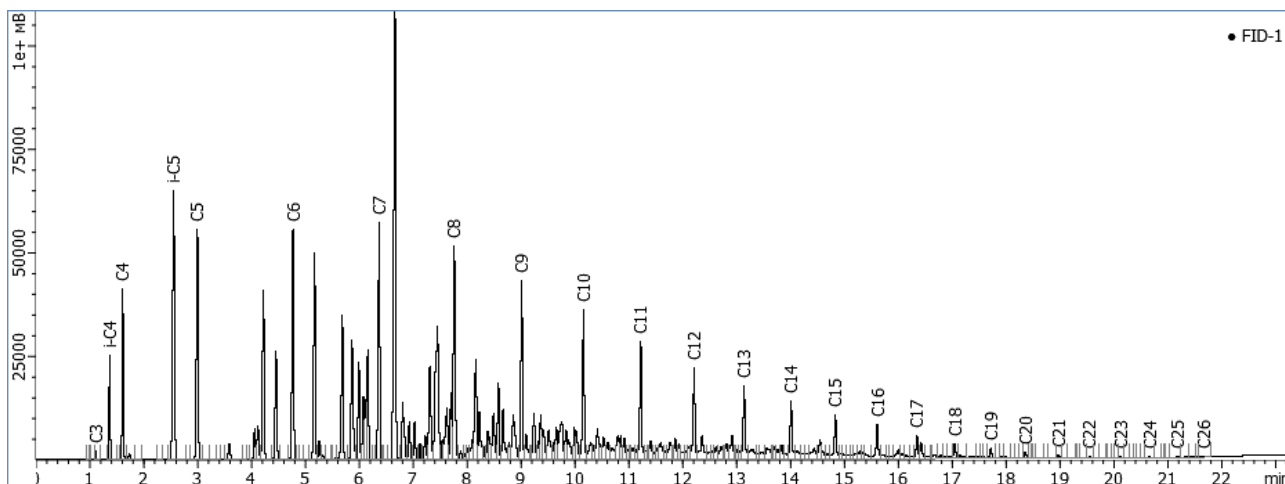

Signal TCD 2 – Chromatogram eluting O2, N2, CH4, CO (CO not displayed).

Signal FID 1 – Chromatogram eluting hydrocarbons C3 - C12.

Chromatograph (B) Liquid sample analysis

Signal FID 1 – Degassing condensate sample.

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