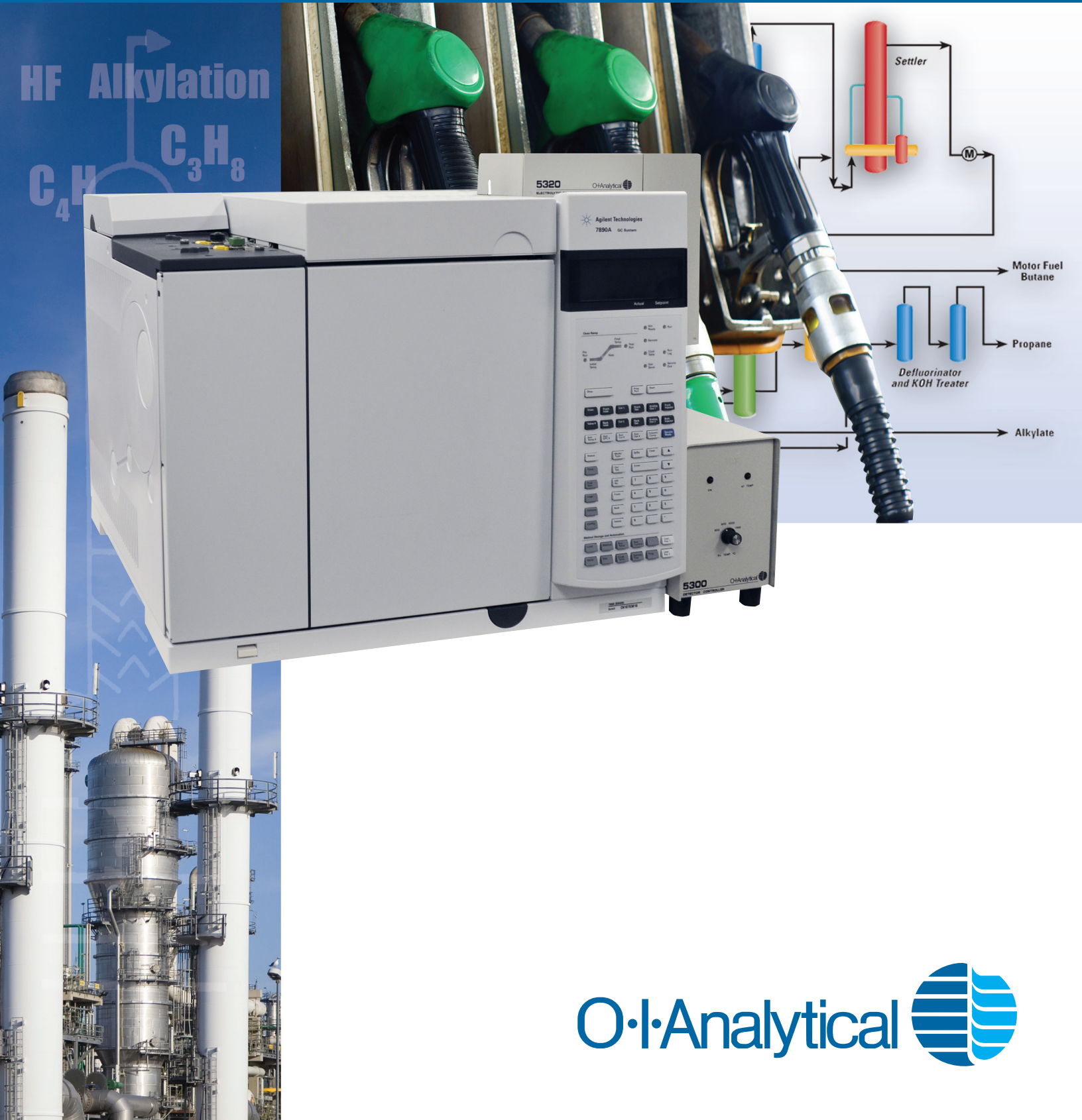


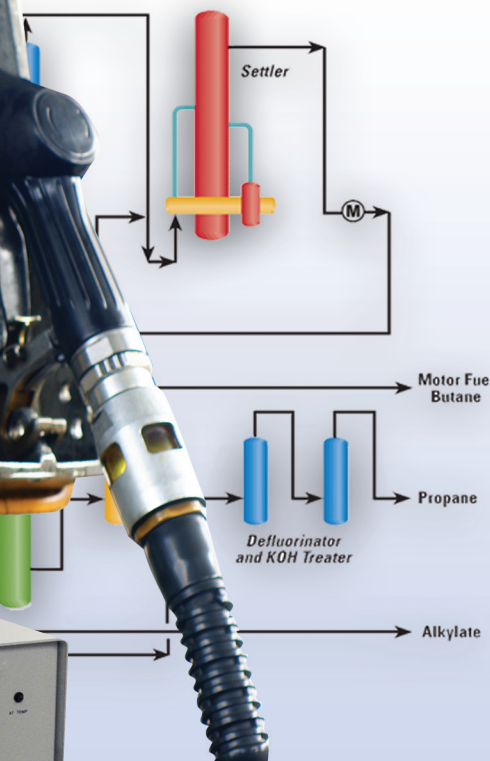
FBA 5320

Laboratory Fluorinated By-products Analyzer

Detection of Fluorinated Contaminants in Hydrocarbons



HF Alkylation
 C_4H_{10}
 C_3H_8



Selective Detection of Fluoride Compounds



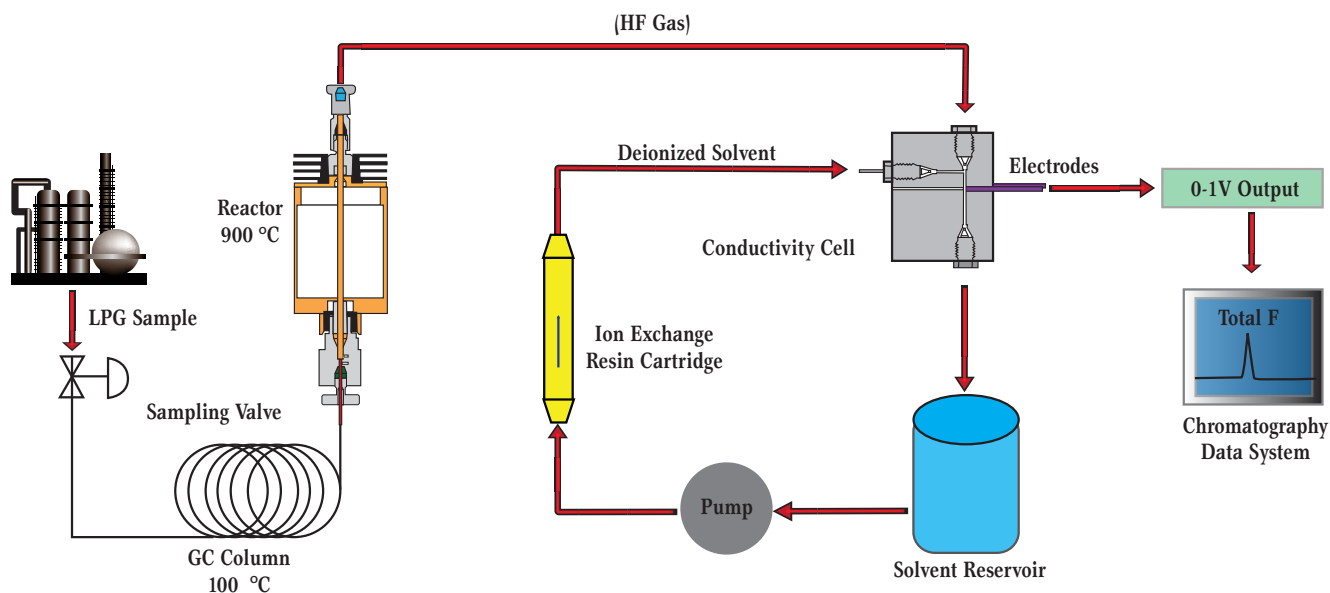
FBA 5320 Fluorinated By-products Analyzer

The OI Analytical FBA 5320 is a laboratory fluorinated by-products analyzer (FBA) designed to quantify total fluorinated contaminants in samples from liquid propane or liquid butane process streams. The analyzer is based on an Agilent 7890 gas chromatograph (GC) equipped with an automated liquid sampling valve for sample introduction, a packed-inlet injection port, a stainless steel column, and 5320 Electrolytic Conductivity Detector (ELCD) configured for fluoride detection. The FBA 5320 accurately detects total fluoride concentrations in the low parts-per-million (ppm) range.

Principle of Operation

The automated liquid sampling valve injects a 2- μ L aliquot of an LPG sample into the 1/16-inch O.D. x 55-foot long stainless steel column maintained at 100 °C inside the GC oven. Fluoride compounds eluting from the GC column enter the base of a high-temperature reactor installed in a GC detector port. The compounds are catalytically converted to ionizable HF gas inside the Nickel reaction tube. The gaseous reaction products

are carried into the detector cell where they are dissolved in a deionized solvent, increasing the electrolytic conductivity of the solution. The detector amplifies this instantaneous change in conductivity, producing a signal proportional to the mass of fluoride in the original sample. The signal is output to a chromatographic data handling system (supplied by the customer) to display and report the total fluoride concentration.

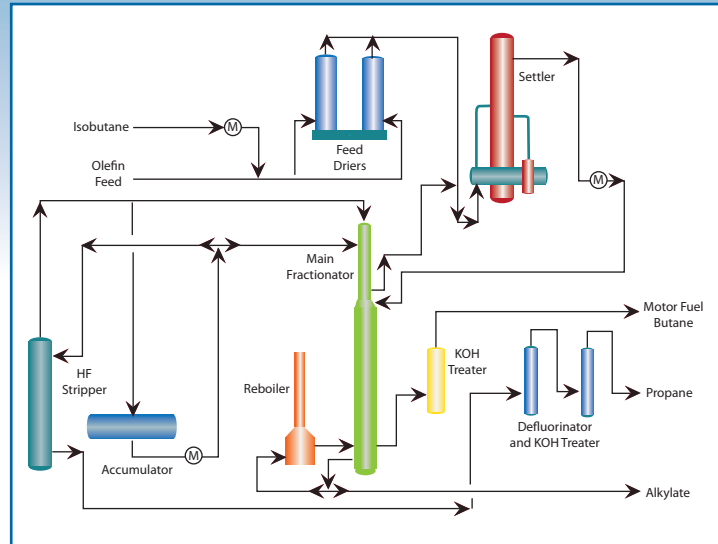


Total Fluoride Measurement in LPG Streams

HF Alkylation

The Hydrofluoric (HF) Alkylation process catalytically combines C3 - C5 olefins with isobutane to produce motor fuel alkylate.¹ There is an increasing demand for alkylate because of its properties as a low-sulfur, high-octane blending component for unleaded and reformulated gasoline. The products of this process, propane, butane, alkylate contain traces of HF and organofluoride by-product compounds.

Elevated levels of residual fluorinated by-products in process streams can cause serious problems in refinery operations including corrosion, catalyst poisoning, down-time, and lost production. The fluoride level in butane process streams can range from 100 - 400 ppm.² Fluorinated by-products are removed by catalytic decomposition of the organofluorides at 177- 220 °C to HF and olefins. The HF released in this process is removed by adsorption onto a bed of alumina forming aluminum fluoride.

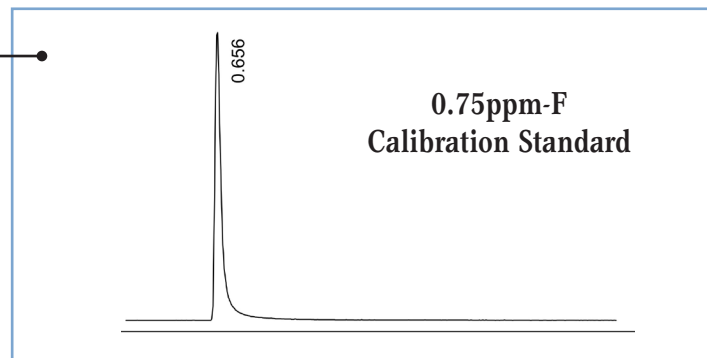


¹ Adsorbents for Motor Fuel Alkylation Process, www.uop.com

² Fluoride Removal in the HF Alkylation Process, www.engelhard.com

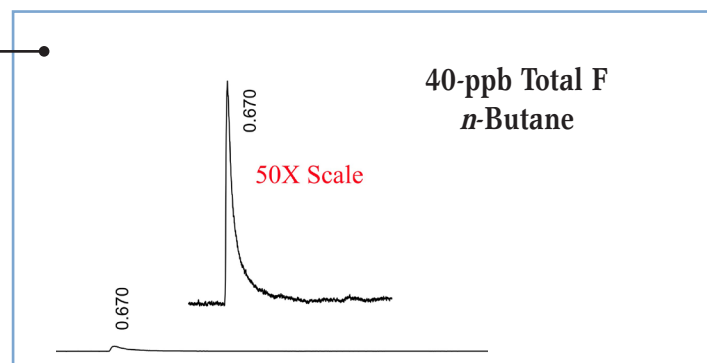
FBA 5320 Calibration

The FBA 5320 Laboratory Fluorinated By-products Analyzer is typically calibrated with a calibration gas mixture (e.g. 3-fluoropropane in *n*-Butane), or using a sample from a C4 process stream analyzed by the Wickbold Method (ASTM D 7284). The measurement range of the FBA 5320 is 0.02 to 100ppm-F.



Total Fluoride in *n*-Butane

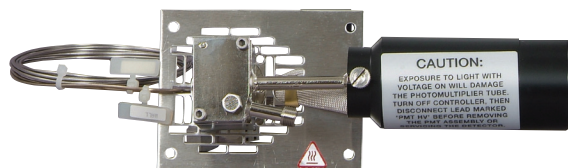
n-Butane sample with 40-ppb total fluoride run on the FBA 5320 Laboratory Fluorinated By-products Analyzer.



FBA 5320 Specifications

Operating Principle	Fluorinated compounds eluting from a GC column are catalytically reduced in a high temperature micro-reactor and converted to HF gas. The HF gas dissolves in a deionized solvent increasing the electrolytic conductivity of the mixture. The change in conductivity is directly proportional to the mass of fluoride in the sample.
Measurement Technique	Electrolytic Conductivity Detector (ELCD)
ELCD Reaction Gas	Hydrogen 100mL / minute
ELCD Reactor Temperature	Range: 800-1100 °C in 100 °C increments Operation: 900 °C (Stability: ± 1 °C)
ELCD Dynamic Range	5×10^5
FBA 5320 Range	0.02-100 + ppm
Selectivity for Fluoride	Fluoride / Hydrocarbon $> 10^6$ (Other halogens will respond)
Detector Output	0-1 V or 0-10 V full scale analog voltage
Gas Chromatograph (GC)	Agilent 7890 GC equipped with OI Analytical 5320 ELCD detector. Gases EPC flow controlled.
GC Dimensions	49cm H x 58.4cm W x 53.3cm D
GC Weight	50 kg (110.5 lbs.)
GC Column	54.8 feet long x 1/16 inch O.D. Stainless Steel
Carrier Gas	Helium 8 - 12 mL / minute
Liquid Sampling Valve	Air actuated
Sample Volume	2- μ L
ELCD Controller Dimensions	21cm H x 12.7cm W x 30.5cm D
ELCD Controller Weight	3.8 kg (8.4 lbs.)
Gas Requirements	Hydrogen, ultrahigh purity $> 99.999\%$ Helium, ultrahigh purity $> 99.999\%$
Power Requirements	90-260 VAC (+ 10%), 47-63 Hz, 200W (Surge-protected power supply required)

PFPD – Pulsed Flame Photometric Detector



The PFPD is widely used in laboratory and process gas chromatographs to analyze sulfur species and total sulfur levels in liquid-phase petrochemicals.

Publication 36580810



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