



Petrochemical Refinery Analysis

A power of a
collaborative expertise



A seamless operation needs uninterrupted support

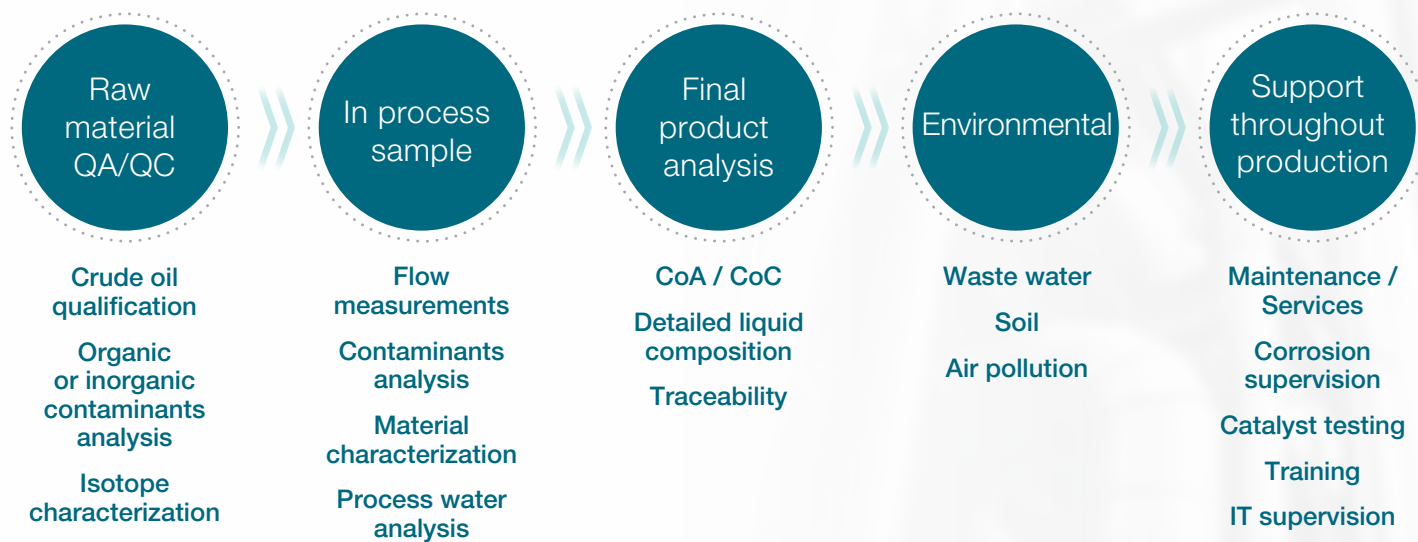
Turning crude oil and raw natural gas into feedstocks, petrochemicals and resulting final products is a challenge at every level. In a competitive global industry, refineries are facing tremendous economic pressure—made worse by uncertain raw material supplies and environmental concerns.

All that pressure and complexity makes its way to the lab. The workload keeps increasing, and everyone is expected to “do more with less.” To ensure quality and manufacturing efficiency, analysis is required at every step of the process, usually in accordance with standardized methods from organizations such as ASTM, IP, UOP, ISO and GPA. And to ensure compliance and conformity, all the work must be done within a rigorous, auditable data management environment.

A value-added ally at every step of your process

With today's broadest portfolio of technology solutions for the petrochemical, oil and gas industry, backed by an experienced, dedicated industry support team, Thermo Fisher Scientific can help you meet the analytical challenges you're facing today and help you get prepared for tomorrow.

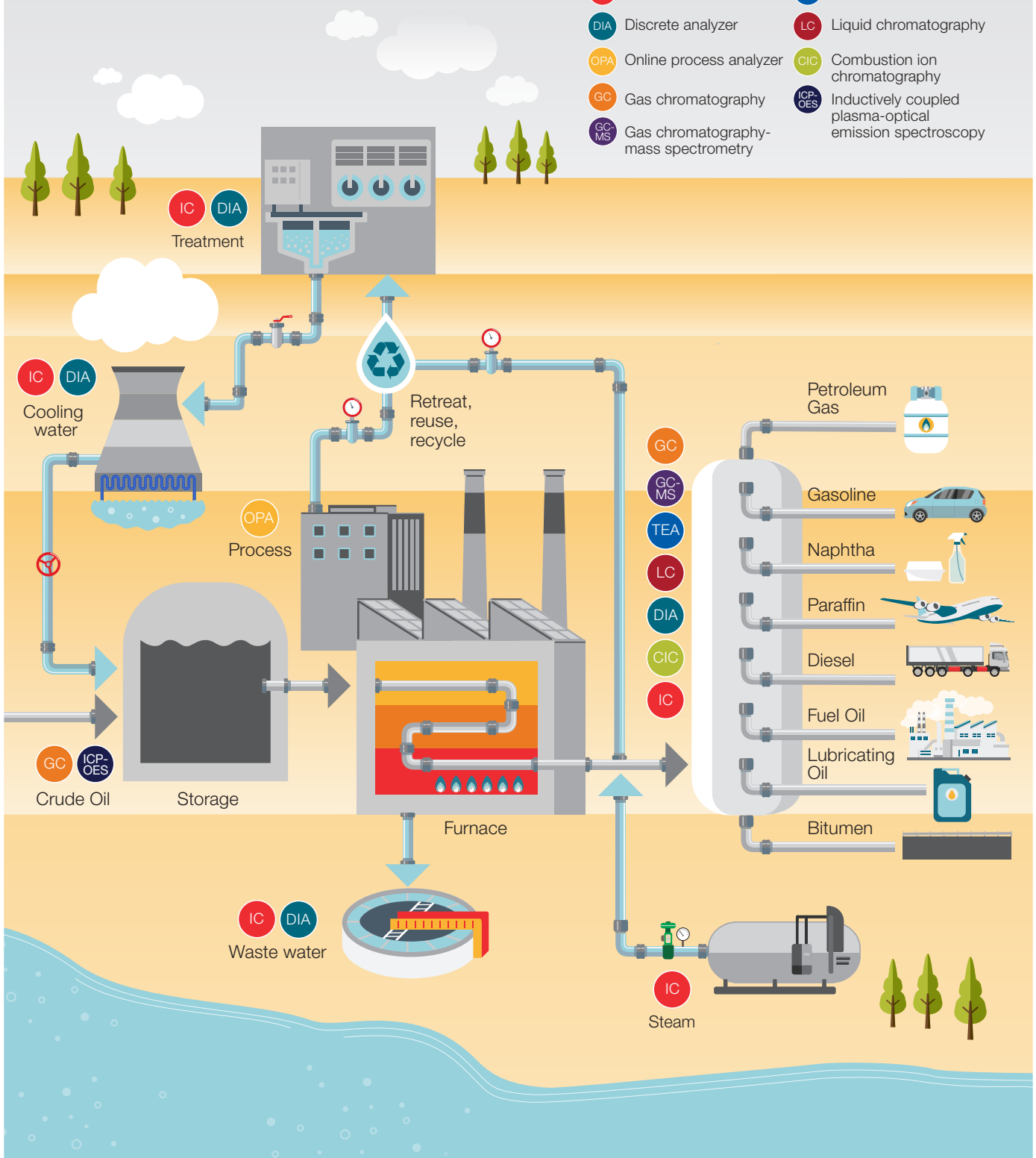
HERE'S WHERE WE FIT IN:



In the following pages and application charts, we offer a closer look at some of the ways Thermo Fisher Scientific can assist with solutions that enable you to become more efficient, more productive, and more profitable. Each application chart provides links to detailed product information, technical data and industry-specific application notes.

Thermo Fisher Scientific delivers industry-leading, compliance-ready analytical solutions for all areas of refinery operations.

- IC Ion chromatography
- TEA Thermal elemental analyzer
- DIA Discrete analyzer
- LC Liquid chromatography
- OPA Online process analyzer
- CIC Combustion ion chromatography
- GC Gas chromatography
- GC-MS Gas chromatography-mass spectrometry
- ICP-OES Inductively coupled plasma-optical emission spectroscopy



Raw material QA/QC

Detecting and identifying organic and inorganic impurities in raw materials is necessary not only to optimize process methods, but also to help guard against downtime and major unexpected maintenance. Crude oil or natural gas composition may vary depending on geography, extraction methods and other variables. For example, crude may be classified as “sweet” or “sour” according to its sulfur content, and this will have a significant impact on transportation methods and downstream processing.

Regulatory requirements for oil and gas testing

Carbon number	1	2	3	4	5	6	10	16	20	30	44	60	80	120	
Boiling point	-200	-100	-0	100	200	300	400	500	600	700	800				
GPA 2286			natural gas												
GPA 2177			natural gas liquid												
GPA 2186			natural gas liquid												
GPA 2261			natural gas												
ASTM D3710			gasoline												
ASTM D7096			gasoline + ethanol												
ASTM D5399			solvents												
ASTM D2887			petroleum fractions												
ASTM D5442			petroleum wax												
ASTM D7213			medium petroleum distillates												
ASTM D6417			medium petroleum distillates												
ASTM D6352			medium and heavy petroleum distillates												
ASTM D5307		crude petroleum													
ASTM D7500			medium and heavy petroleum distillates												
ASTM D7169		crude oil and residues													
DIN 51581-2			medium petroleum distillates												
DIN 51435			medium and heavy petroleum distillates												
IP 406			petroleum products												
IP 480			middle distillates and lubricating base oils												
IP 507			vacuum distillates and residues												
IP 545		crude oil													
EN 15199-1			middle distillates and lubricating base oils												
EN 15199-2			vacuum distillates and residues												
EN 15199-3		crude oil													
ISO 3924			petroleum fractions												
UOP 1001-14			F and Cl in FPG												
ASTM D7359			F, Cl S in aromatic HC												
ASTM D5987			F in coal and coke												
UOP 991-13			F, Cl, Br in liquid organics												
ASTM D5600			metals in coke												
ASTM D5185			metals in lube oils												
ASTM D7691			metal in crude oils												
ASTM D5662			oxygen in gasoline and methanol												
ASTM D5291			C,H, N in petroleum products and oils												
ASTM D5373			C, H, N in coal and coke												
ASTM D5622			oxygen in gasoline and methanol												

■ Natural Gas and Natural Gas Liquid Analyzers ■ GC, GC-MS ■ CIC ■ ICP-OES ■ OEA

Application

CRUDE OIL QUALIFICATION

Analyze your crude oil purity and potential impurities

Technique

- ICP-OES
- GC/GC-MS
- LC

Thermo Scientific Solution

- iCAP™ PRO Series ICP-OES
- TRACE™ 1600 Series Gas Chromatograph
- Vanquish™ UHPLC system

INORGANIC CONTAMINANTS ANALYSIS

Trace your raw materials and critical inorganic contaminants to protect further processes (from % to ppb)

- GC/GC-MS
- Combustion IC
- Trace Elemental Analysis

- TRACE™ 1600 Series Gas Chromatograph
- Dionex™ Integrion™ HPIC™ system
- Dionex™ Aquion™ IC system
- Dionex™ ICS-6000 HPIC™ system
- AnalyteGuru Blog TEA which instrument is best for you

ORGANIC CONTAMINANTS ANALYSIS

Trace your raw materials and critical organic contaminants to protect further processes (from % to ppb)

- GC-MS
- Organic Elemental Analysis

- TRACE™ 1600 Series Gas Chromatograph
- FlashSmart™ Elemental Analyzer
- Gallery™ Discrete Analyzer
- Gallery™ Plus Discrete Analyzer

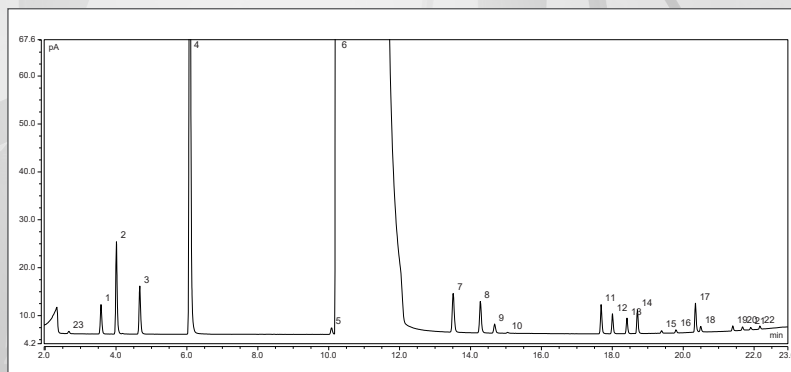
ISOTOPE CHARACTERIZATION

Assure reliable and safe supply of your product

- ICP-OES
- GC-IRMS

- iCAP™ PRO Series ICP-OES
- Isotope Ratio Mass Spectrometry

The oil and gas industry relies on a wide variety of standard methods from many regulatory agencies to ensure product quality and safety, as well as compliance with environmental requirements. Thermo Fisher Scientific can help with all of them.



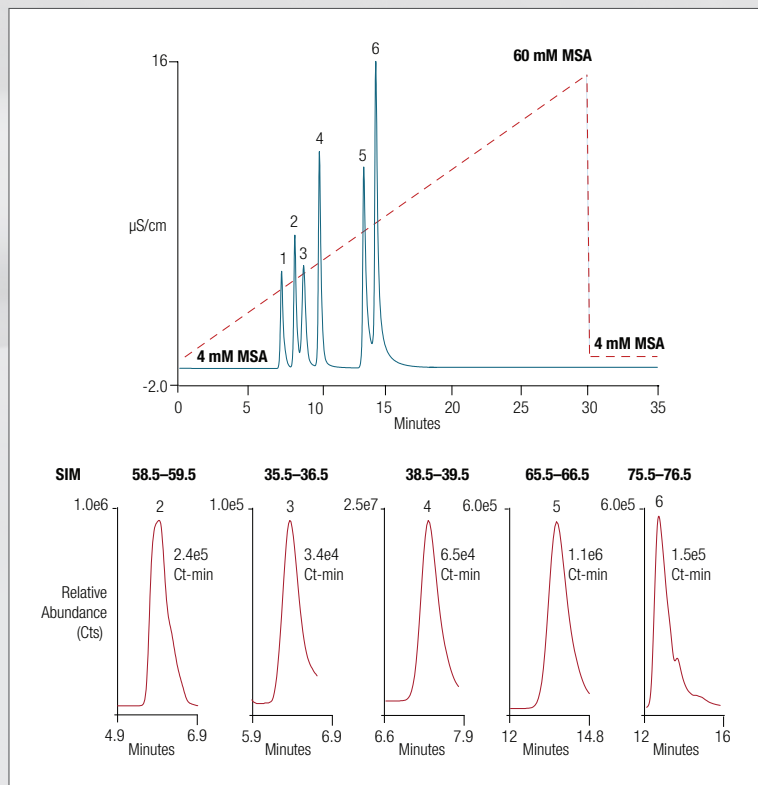
High purity, polymer grade Propylene analysis with a GC-FID including backflush of precolumn to detector

In-process sampling

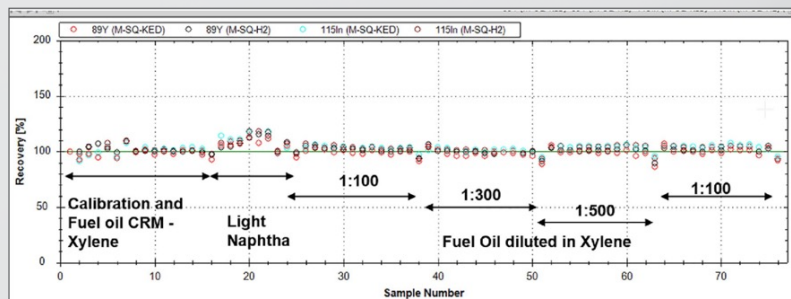
Advanced automation and controls throughout the manufacturing process improve product quality and plant efficiency, as well as process safety and reliability. They contribute to profitability, while also reducing emissions. At each unit operation, precise, accurate flow monitoring, detailed characterization of process materials, and analysis of critical contaminants helps engineers optimize and stabilize processes and increase uptime.

Thermo Fisher Scientific instrumentation and software supports all refinery operations, including:

- Distillation
- Adsorption/desorption
- Reformer
- Stripping
- Coking
- Cracking
- Scrubbing



Rapid, accurate IC-MS determination of cations and anions in a scrubbing solution.



Analytical testing of trace elements in refinery products using a robust ICP-MS approach.

Application

FLOW MEASUREMENT

Monitor your process with flowmeter and supervision systems

Technique

- Autoflex Flow Computer
- AutoEXEC
- AutoXP

Thermo Scientific Solution

- AutoFLEX Flow Computer
- AutoEXEC 32-Run Expandable Gas and Liquid Flow Computer
- AutoXP Gas and Liquid Flow Computer
- Flow Analysis | Thermo Fisher Scientific

CONTAMINANTS ANALYSIS

Analyze critical contaminants (from % to ppb) from your products during production

- ICP-OES
- DIA
- AAS
- ICP-MS

- iCAP™ PRO Series ICP-OES
- FlashSmart™ Elemental Analyzer
- Gallery™ Discrete Analyzer
- Gallery™ Plus Discrete Analyzer
- Atomic Absorption Spectroscopy
- Element™ Series HR-ICP-MS

PROCESS WATER ANALYSIS

Analyze the purity of your process water to protect your production equipment

- HPIC
- Solvent Extractor
- GC
- DIA

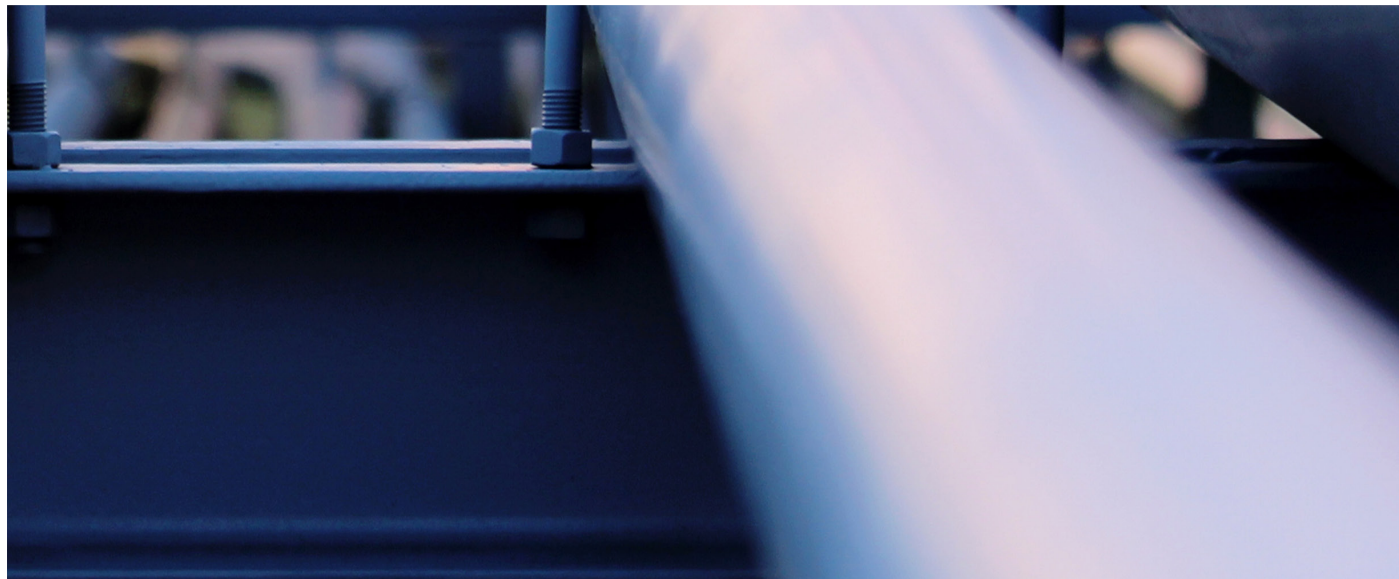
- Dionex™ Integriion™ HPIC™ system
- Dionex™ ASE™ 350 Accelerated Solvent Extraction System
- TRACE™ 1600 Series Gas Chromatograph

MATERIAL CHARACTERIZATION

Avoid unexpected downtime and continue to meet your material identification and verification needs

- X-Ray Fluorescence
- X-Ray Diffraction

- Everest™ Diamond ATR Accessory for the Nicolet™ Summit Spectrometer
- ARL™ QUANT'X EDXRF Spectrometer
- ARL™ OPTIM'X WDXRF Spectrometer
- ARL™ PERFORM'X WDXRF Spectrometer
- ARL™ EQUINOX 100 X-ray Diffractometer



Final product analysis

Detailed analysis of liquid or gas components verifies the actual composition of refinery products. Accurate and precise analysis of product streams is essential not only for quality assurance, but also to provide proof of conformity to meet contractual obligations. A robust data management system must be in place to comply with industrial and local certifications and to ensure traceability in the event of a regulatory audit.

Application

CERTIFICATE OF ANALYSIS / CERTIFICATE OF CONFORMITY

Deliver correct documentation to your customers

Technique

- FTIR
- UV Vis
- TEA
- AAS

Thermo Scientific Solution

- Everest™ Diamond ATR Accessory for the Nicolet™ Summit Spectrometer
- UV Vis and Visible Spectrometers
- TRACE™ Elemental Analysis
- FlashSmart™ Elemental Analyzer
- Atomic Absorption Spectroscopy

DETAILED LIQUID COMPOSITION

Provide a detailed analysis on your final liquid product

- HPLC
- ICP-OES
- HPIC™
- IC

- Vanquish™ UHPLC system
- iCAP™ PRO Series ICP-OES
- Dionex™ Integrion™ HPIC™ system
- Dionex™ Aquion™ IC system

DETAILED gASEous COMPOSITION

Provide a detailed analysis on your final gASEous product

- GC
- GC-MS

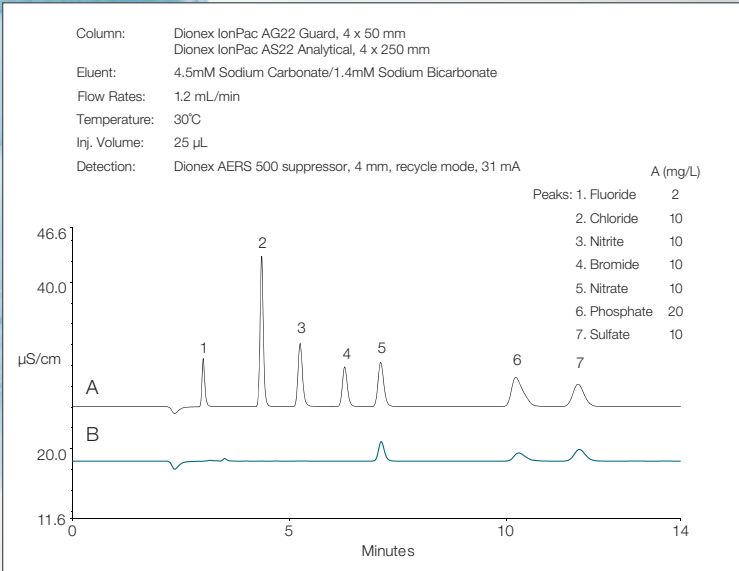
- Gas Chromatography
- TRACE™ 1600 series Gas Chromatograph
- Single- or triple-quadrupole GC-MS systems
- GC—Autosamplers

TRACEABILITY

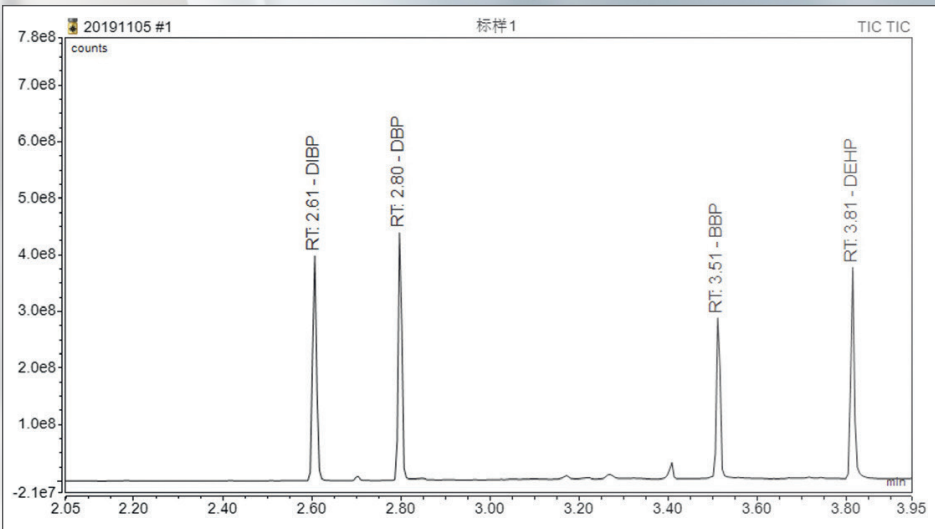
Remain in accordance with your quality management system and in compliance with regulation by using robust data management systems

- ISO17025 Compliance
- CDS
- LIMS

- Laboratory Management System
- LIMS Solution for Environmental Lab
- Chromeleon™ Chromatography Data System (CDS)
- SampleManager LIMS™, SDMS, ELN, and LES Software



Ion chromatography separation of (A) seven of (A) seven common anions and (B) a denatured ethanol sample using ASTM D-7328-17.



Total ion chromatogram (full scan, EI) of 0.5 mg of 1000 mg/kg standard PVC substrate.period



Environmental analysis is often driven by global and local regulations. It provides tangible proof to regulatory agencies that the plant is operating within prescribed environmental guidelines, and helps build the confidence of investors, employees and stakeholders by supporting the facility's "good neighbor" status within the community.

Application

AIR POLLUTION

Follow air quality regulation with reliable ambient air monitoring

Technique

- GC-MS
- IC
- Data Analysis

Thermo Scientific Solution

- TRACE™ 1600 Series Gas Chromatograph
- Single- or triple-quadrupole GC-MS systems
- Dionex™ Aquion™ IC system
- Technical Notes Air Analysis AIMS
- Chromeleon™ Chromatography Data System (CDS)

WASTE WATER

Remain compliant with waste water regulations utilizing cost-effective and simple analytical solutions

- IC
- Discrete industrial analysis
- LC-MS
- Software

- Dionex™ Integriion™ HPIC™ system
- Dionex™ Aquion™ IC system
- Gallery™ Discrete Analyzer
- Gallery™ Plus Discrete Analyzer
- DISC-IC Systems
- ARL QUANT'X EDXRF Spectrometer
- SampleManager LIMS™, SDMS, ELN, and LES Software

SOIL

Demonstrate robust, simple and effective analytical solutions for routine determination in soil samples

- ICP-OES
- GC-MS
- Spectroscopy
Elemental Isotope

- Soil Analysis
- TRACE™ 1600 Series Gas Chromatograph
- FlashSmart™ Elemental Analyzer
- iCAP™ 7600 ICP-OES Analyzer



Support throughout your operation

A collaboration with Thermo Fisher Scientific includes the services, support and tools you need to integrate and streamline analysis procedures and improve data management throughout your organization.



Application

MAINTENANCE & SERVICES

Increase your lab's productivity and efficiency with a customized, comprehensive suite of services

Technique

- Safety, Security and Detection
- Maintenance Contracts
- Consumables

Thermo Scientific Solution

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- Enterprise Services | Thermo Fisher Scientific
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CORROSION SUPERVISION

Develop a corrosion supervision routine with robust and uncomplicated equipment to avoid unexpected downtime

- IC
- PSM

- Dionex™ Integrion™ HPIC™ system
- Dionex™ Aquion™ IC system
- PSM-400MPX Particle Size Monitor

CATALYST TESTING

Ensure internal structure of the catalyst integrity supporting your uptime and productivity

- IC
- ICP-OES
- ICP-MS

- Dionex™ Integrion™ HPIC™ system
- Dionex™ Aquion™ IC system
- iCAP™ PRO Series ICP-OES
- Element™ Series HR-ICP-MS

TRAINING

Thermo Fisher Scientific specialists can support you at any time to ensure optimal equipment and software performance

- AnalyteGuru
- Regulation Requirements

- AnalyteGuru Communities
- Live and On-Demand Webinars
- Oil & Gas Application Notebook

IT SUPERVISION

Next-generation solutions accelerate scientific research and streamline manufacturing operations. Our full suite of lab informatic capabilities deliver the right solution to fit your unique needs

- LIMS
- Chromatography Data Systems

- Chemical Petrochemical LIMS
- SampleManager LIMS™, SDMS, ELN, and LES Software
- Chromeleon™ Chromatography Data System (CDS)

Our ongoing commitment to a long-term relationship

Wherever your lab fits into the refinery process, and whatever you need to meet your production targets and achieve your vision for growth, we're ready to help. Before the sale, after the sale, any time zone, anyplace in the world, our goal—and our promise—is to do whatever it takes to help you maximize efficiency and productivity, 24/7.

Don't see what you need?

We'll be happy to discuss your specific requirements. Our experienced technical support team will work with you to determine the product and configuration for your application, and answer any questions you may have. Whatever your business endeavor, process or vision for growth, Thermo Fisher has the products, resources, and support to help your lab close gaps, fine-tune workflows and pave the way for the future.



Learn more at thermofisher.com/petrochemical

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