Efficient determination of crude oil quality – with METTLER TOLEDO instruments

The petrochemical industry is facing depleting oil resources, higher exploration and production costs. Crude oil products are constantly tested for quality and environmental purposes. Challenges include keeping production downtime to an absolute minimum at the same time as increasing production yield and reducing costs. METTLER TOLEDO offers a wide range of solutions for such ambitious endeavors.

Continuous monitoring of crude oil quality

The exploration and production of crude oil is a high-tech process involving many risks. Pipeline corrosion or blockage, due to chemical reactions, occurs easily due to the oil’s high acid content as well as through chemical reaction between formation and production water. Therefore, an oil production shutdown is extremely costly and clearly must be avoided. Typical crude oil characteristics, such as chloride content, total acid number and water content, are constantly monitored within the laboratory in order to enhance oil yield and suppress costs. More simple analysis is often carried out off-shore in a small oil rig based laboratory. Therefore, instruments need to be portable, rugged and easy to use. Analytical tests done in laboratories on the mainland are more comprehensive and include sulphur content and density measurement, two parameters that greatly influence the price that refineries pay for the oil. Testing is implemented according to standard norms and all results need to be available quickly.

Clever solutions from METTLER TOLEDO

Laboratory instruments play an important role within the petrochemical industry. Through offering a wide range of solutions, METTLER TOLEDO instruments are compatible for various laboratory environments. METTLER TOLEDO provides compact and portable instruments suitable for offshore situations as well as a comprehensive selection of innovative products with greater functionality for critical laboratory tests. All METTLER TOLEDO instruments are reliably accurate, robust and easy to use in order to assist the petrochemical industry’s analytical testing quality and laboratory efficiency.

METTLER TOLEDO solutions support the petrochemical industry in upstream as well as downstream processes and therefore increasing productivity within your laboratory.

METTLER TOLEDO sales and support specialists are highly trained and competent in finding petrochemical solutions.

Contact METTLER TOLEDO now and allow them support your business!
Changing Standards

Diesel fuel carries very strict limits on aromatic hydrocarbons since these promote the formation of black soot and the soot is an environmental hazard. ASTM method D5186 has been adapted to measure aromatics in fuel with SFC, since it provides a rapid and efficient method for refiners to monitor the aromatic content. In California, the Air Resources Board (CARB) specifies use of this method.

Proven instrumentation

To meet the diesel specifications, METTLER TOLEDO’s partner AC Analytical Controls developed the AC Aromatics Analyzer, based on the original Berger SFC developed by Dr. Terry Berger. The system incorporates the proven packed column METTLER-TOLEDO Berger SFC. The Berger SFC modules include a single fluid control system that allows independent control of pressure and flow, and a thermal control
Environmental regulations control the amount of particulate emission generated by diesel combustion. With aromatics in diesel fuels promoting particulate combustion, it is essential to accurately measure the aromatic content in diesel fuels. Gasoline-range olefinic hydrocarbons have been demonstrated to contribute to photochemical reactions in the atmosphere, which result in the formation of photochemical smog in susceptible urban areas.

METTLER TOLEDO’s partner AC Analytical Controls has developed a combined aromatics/olefins analyzer that determines both aromatics in diesel fuels and olefins in gasoline using the proved packed column Berger SFC technology from METTLER TOLEDO. The cost effective design allows refiners to combine two applications into one METTLER TOLEDO Berger Supercritical Fluid Chromatography (SFC) system, which reduces the amount of investment required for fuel analysis.

module optimized for packed columns, which also allows for the mounting of a flame ionization detector. The user-interface software automates the analysis, and reduces operator involvement.

**Aromatics in diesel fuel**

The METTLER TOLEDO AC Aromatics (ASTM D 5186) Analyzer, based on METTLER TOLEDO’s Berger SFC technology, detects:

- Saturates
- Mono-ring aromatics
- Polynuclear-ring aromatics (di- and polyring aromatics)

in diesel fuels, aviation turbine fuels and diesel blending stocks.

**Olefins in gasoline**

Since January 1, 2002, the Californian Air Resources Board (CARB) has specified test method ASTM D 6550 to measure total olefins in gasoline, which also incorporates the SFC technology. Olefins boost the octane number of gasoline, but tend to be reactive and toxic. This necessitates an appropriate analytical test method for determination of total olefins to be used both by regulators and producers.

The AC Olefins (ASTM D 6550) Analyzer, based on METTLER TOLEDO’s SFC technology, separates and quantifies olefins in gasoline, and completely separates the olefinic fraction of the fuel from saturates, aromatics and oxygenates. Everything is easily automated, no sample preparations are required and analysis time is a comparatively short 10 minutes.

➢ www.mt.com/berger
METTLER TOLEDO

XP analytical balance: Security at its best

In the Petrochemical Industry, precise weighing is the backbone of many processes. Oil samples are highly viscous and therefore problematic or even dangerous to work with. Nevertheless, accurate and efficient sampling is the key for higher yield which is why the new METTLER TOLEDO XP analytical balance offers the best solution: It makes the weighing process faster and safer.

Always correctly leveled – for accurate results

The leveling check is often the first step within the daily balance operation in a quality control laboratory before analyzing lubricant samples. If the balance is not leveled correctly, accuracy of the weighing results can not be guaranteed. On this account METTLER TOLEDO developed the new feature «Level Control» for the XP analytical balance for exactly this purpose. This time saving and more accurate system sets the balance level under a sensor eye which omits and acoustic signal as soon as the balance falls out of level whilst a simultaneous message appears on the display. The display then gives comprehensive instructions on how to relevel the balance. Many Standard Operating Procedures (SOP) of petrochemical companies stipulate a balance level check as part of the daily work routine which really does mean that METTLER TOLEDO can provide welcome relief for petrochemical companies, whilst also saving time and money.

«SmartGrid» and «ErgoClips» speed up your weighing procedures

Oil companies are constantly striving for ever faster guaranteed weighing results, which is why METTLER TOLEDO developed the revolutionary SmartGrid, a uniquely shaped weighing pan. It minimizes the effects of turbulence, stabilizes much faster and at the same time provides accurate weighing results more quickly. As specifically shaped tare containers are required for different tasks, SmartGrid offers Clip-ins, called «ErgoClips», which enable efficient sample handling. Thanks to «ErgoClips», any type of tare container can be placed firmly on the weighing pan and consequently making the weighing-in of your samples far easier and avoiding spillage. In combination with «SmartGrid», «ErgoClips» simplify specific weighing operations and set new records in weighing efficiency.

Hands-free operation

When weighing-in lubricant oils or other chemicals, gloves are often worn to protect the user from hazardous spillage. Thanks to two optical sensors on the terminal called «SmartSens», weighing can be carried out without having to touch the balance at all, thus saving time and reducing the risk of instrument contamination. With the freely placeable optical sensor «ErgoSens» up to 4 operations can be done literally hands-free. Consecutive weighing procedure, for example «Zeroing – Taring the balance – opening & closing the door – Printout» can be completed without actually touching the balance. One can concentrate 100% on sample handling and the risk of spillage is reduced to the bare minimum!

In addition, the draft shield can be completely dismantled, making cleaning the balance especially easy. All parts are resistant to acids and chemicals and can be cleaned in the dish washer.

www.mt.com/xp-analytical
METTLER TOLEDO titration and RAININ pipettes: Taking the strain out of bromine number determinations

Bromine number determination is an important test in refineries and petrochemical plants. It helps to control refinery processes and allows the assessment of aliphatic mono olefins quality. METTLER TOLEDO titrators and RAININ pipettes offer some unique features to facilitate the life of laboratory personnel in the petroleum industry. Better bromine number productivity, reduced cost and improved results are the benefits of joining forces with METTLER TOLEDO.

An important measure for refineries and petrochemical plants
The bromine number is a useful measure of unsaturation in petroleum samples and allows the estimation of olefin content in petroleum distillates. It is therefore a standard test procedure carried out in large numbers by refineries around the world.

This test also serves to determine purity and to identify commercially available aliphatic mono olefins, making it an important parameter in the quality control of petrochemicals. The bromine number is determined by titration with bromide/bromate titrant at reduced temperature. The endpoint is indicated voltametrically when an excess of bromine is present in the solution.

METTLER TOLEDO DL58: Facilitating the task
The METTLER TOLEDO DL58 is ideally suited for bromine number determination in a large variety of samples. Its robust design meets the harsh conditions in refinery and petrochemical process labs thereby reducing maintenance cost. The user interface is self explanatory allowing process staff to execute the tests, which reduces cost for shift lab personnel. Through LabX PC software automatic LIMS integration is simple, reducing manual data processing and eliminating transcription errors. The unique temperature control function ensures that each bromine number determination takes place at the ideal temperature range of 0 to 5 °C, which greatly increases result accuracy.

Rainin Pipettes: Accurate sample measuring
A different sample size has to be added to the titration beaker by means of a pipette depending on the expected bromine number of a substance. This is done by means of a pipette. The use of a Rainin pipette is highly recommended as it allows one handed operation, simple volume change and protects the operator from repetitive strain injury thanks to its LTS™ pipetting force reduction feature.

METTLER TOLEDO solutions: improving bromine number determinations
Thanks to its unique competencies in laboratory equipment METTLER TOLEDO can help to facilitate bromine number determinations. Increased productivity, reduced operating cost, healthier operators and improved accuracy are just some of the benefits petrochemical companies experience through teaming up with METTLER TOLEDO.

► www.mt.com/rainin
► www.mt.com/titration
Refinery labs face a multitude of analytical challenges on a daily basis and this, along with the ever increasing pressure to speed up, reduce cost and run more samples, makes evaluating state-of-the-art instrumentation solutions a crucial, yet daunting task for lab managers. METTLER TOLEDO’s interactive refinery Internet guide makes it easier to understand the overall offering for refineries and assists with investment justifications and lab improvement programs.

A multitude of analytical challenges for refinery laboratories

Refinery laboratories carry out a multitude of tasks and analyze thousands of samples over the course of a year. METTLER TOLEDO offers numerous solutions that are the backbone of refinery quality control. Whether it is crude oil analysis for API gravity, sulphur, chloride or moisture content, quality control of petroleum distillates by acid or bromine number determinations, lubricants performance estimation by base number testing or simply the environmental evaluation of refinery waters, METTLER TOLEDO offers state-of-the-art solutions and extensive support.

Faster, cheaper, more comprehensive

Refinery labs are currently expected to provide answers faster, constantly decrease lab operating costs and perform increasingly more analyses with the same complement of staff. It is therefore mandatory to keep up to date with technological developments and replace outdated instrumentation with the best solution available. It also goes without saying, that all methods used in a refinery lab must comply strictly with industry standards such as ASTM, UOP or IP. The Internet plays an ever increasing role in helping laboratories to stay in tune with the fast developing market place.

Interactive refinery guide

In order to facilitate the life of lab managers, METTLER TOLEDO has developed an interactive guide for refinery customers (www.mt.com/refinery-lab). This guide details the refinery process including all various product streams, summarizes the respective standard procedures to be obeyed for each product stream and presents METTLER TOLEDO solutions for each analysis. In order to assist lab managers with the CAPEX justification, feature benefits of the solutions are explained, so that the value of updating a piece of kit can be clearly communicated to senior management.

The wonders of the cyber world make solution evaluation not only easier, but also a much more enjoyable task. A visit to www.mt.com/refinery-lab could be the beginning of a substantial improvement program with valuable benefits for refinery labs around the world.

www.mt.com/refinery-lab
METTLER TOLEDO’s Thermal Analysis in the Petrochemical Industry – Part 1

An important test in the petrochemical industry concerns the measurement of the oxidation stability of oils. The determination of the oxidation induction time (OIT) is a rapid method for assessing the stability of petroleum products.

High pressure differential scanning calorimetry (HP DSC) is the thermal technique most frequently used to characterize the stability of petroleum products. Part I of this topic focuses on isothermal method conditions based on the ASTM D6186 standard. The examples highlight how detailed information can be obtained to predict the behavior of oils under actual operating conditions and how stabilizers can be developed to improve performance.

**Oxidation stability of oils according to ASTM D6186**

Measurement of the oxidation stability of oils allows their behavior to be predicted under actual operating conditions, for example in motor vehicle engines. In the test procedure according to ASTM D6186, the sample of oil is held isothermally at 180 °C under increased oxygen pressure until oxidation begins. The onset of exothermic oxidation (intersection of the baseline with the inflectional tangent) is called the oxidation induction time (OIT).

The diagram shows OIT measurements of two different motor oils, one mineral the other synthetic. The mineral oil oxidizes after about 35 minutes. The synthetic oil is stable at the same temperature during the 120-minute period prescribed by the ASTM standard. The inserted diagram on the right displays the measurement curve of the synthetic oil and shows that it takes much longer to oxidize than the mineral oil, namely 237 minutes.

www.mt.com/TA
METTLER TOLEDO’s goal is to constantly improve laboratory solutions and consequently fulfill customer needs on the highest level by offering effective technologies and state-of-the-art applicative solutions. We are your partner for efficiency, integration and quality across all your laboratory processes. Our balances meet a diversity of needs and our analytical instruments assure consistently reliable results on composition or properties of liquids and substances.

**METTLER TOLEDO density measurement systems:**
The determination of tanker vessel density profiles is not an unproblematic undertaking as oil is sticky and highly viscous. With the METTLER TOLEDO Density meter’s automatic error recognition and the efficient cleaning concept, delays are prevented and productivity is increased on a daily basis.

www.mt.com/density

**METTLER TOLEDO coulometric Karl Fischer Titrators:**
The METTLER TOLEDO coulometric Karl Fischer Titrators for water content determination save analysis and cleaning time, providing a fast analytical response when it really matters. This is crucial when a tanker is waiting to be unloaded.

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**METTLER TOLEDO XP precision balance:**
Chemical resistance against any kind of sample spillage makes our new Excellence Plus precision balances robust. Weighing-in of sticky or oily samples has never been easier with increased productivity.

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**Lasentec® & React IR™ Tools**
In-Process tools for the Petrochemical industry allowing real-time measuring, understanding and control. Continuous Phase analysis via in-situ mid-infrared spectroscopy. Measurement in opaque/black process fluids from asphalts to micronized coal to water in crude oil.

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A Small Scale Production System for the production of high value compounds and intermediates. With the SSPS, METTLER TOLEDO provides a powerful tool supporting all necessities of Kilo Lab Production assuring accurate, safe and reliable process control.

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**Lasentec® & React IR™ Tools**
In-Process tools for the Petrochemical industry allowing real-time measuring, understanding and control. Continuous Phase analysis via in-situ mid-infrared spectroscopy. Measurement in opaque/black process fluids from asphalts to micronized coal to water in crude oil.

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