



Application Notes AN N281

Quality Control of Petroleum products using FT-NIR Spectroscopy

Fluctuating prices on the one hand and demanding specifications due to environmental regulations and engine technology on the other hand require a continuous quality control of oil and petroleum products. In order to run production processes efficiently it is essential to monitor relevant quality parameters frequently. Analytical results must be available at short term to keep reaction times fast in closed loop control systems. The Fourier Transform Near Infrared spectroscopy (FT-NIR) is an ideally suited technique for the quality control of petroleum products.

Crude oil and refinery products represent a complex mix of the most diverse hydrocarbons. In the Near Infrared range, the molecular oscillations of C-H, C=O, N-H, O-H and S-H functional groups can be observed. The spectral information is related to the chemical composition (e.g. PIONA) as well as to the physical properties of fuel products like octane numbers, density, vapor pressure etc. All of these parameters can be reliably determined with modern FT-NIR spectrometers combined with Multivariate Data Analysis tools. As a single spectrum can be evaluated for multiple parameters, all relevant information is available within one sample acquisition. The easy-to-use software interface allows even less experienced users an intuitive set-up of the hardware as well as of the evaluation methods.

Advantages of FT-NIR

- FT-NIR is fast:
A sample is analyzed regarding multiple parameters within less than a minute. No sample preparation is needed.
- FT-NIR is sustainable:
No reagents or solvents are needed for the non-destructive analysis resulting in reduction of hazardous waste.
- FT-NIR is cost effective:
Beside the positive effects on analysis time and environment FT-NIR will enhance your process efficiency by reducing reaction times and increasing the quality of your products.

FT-NIR for on-line process control

FT-NIR can be used for quality control in the lab as well as for at-line or on-line process control. Real time on-line process control can be realized by installing process probes directly in the process streams – at a distance of hundreds of meters from the spectrometers. Thanks to the multiplexing capability multiple probes may be attached to a single spectrometer. Bruker process specialists will support you to find the best product configuration even for installations in hazardous or potentially explosive areas.

Products and Parameters

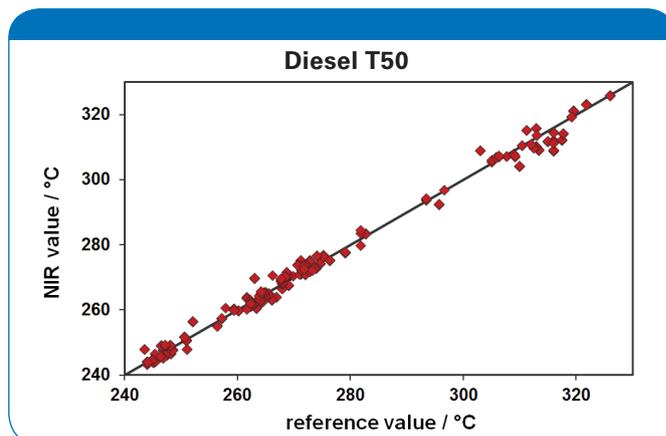
At refineries, NIR Spectroscopy is of practical value for quality control of intermediate and final petroleum products, such as:

- Reformate
- Isomate
- Naphtha
- Gasoline
- Diesel fuel
- Kerosene, etc.

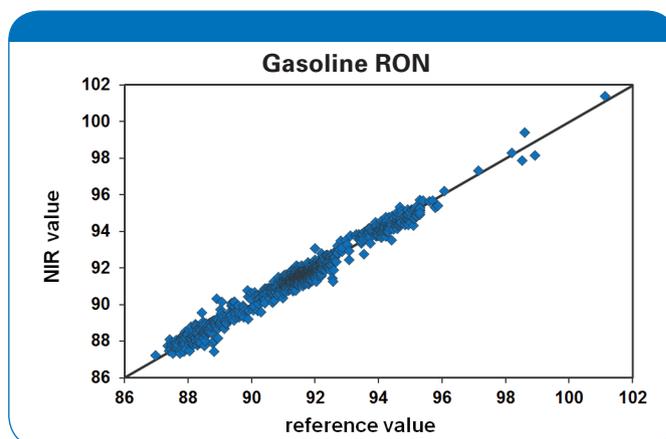
Near Infrared Spectroscopy is capable to determine a large number of parameters simultaneously within one measurement. Many of these parameters refer to time consuming, expensive and cumbersome reference methods like PIONA analyzers based on multi-dimensional GC, test engines for octane number evaluation or distillation apparatus.

Bruker offers ready to use calibration packages for Gasoline and Diesel covering the following parameters (selection depending on product):

- Density
- Reid Vapor Pressure
- Octane number (MON, RON)
- Cetane number, Cetane index
- Cloud point, pour point
- Components of PIONA
- MTBE, Oxygenate, Methanol, Ethanol
- Distillation profile (T5 – T95, E70 – E350)



Validation results of T50 in Diesel fuel over a range from 244°C to 326°C.



Validation results of RON in Gasoline over a range from 87 to 101.

FT-NIR Spectrometers: Bruker Optics offers various FT-NIR spectrometer models for lab, at-line and on-line applications:

TANGO



FT-NIR analyzer for routine use in the lab.

MPA II



Multi Purpose Analyzer for maximum flexibility.

MATRIX-F



Process monitoring with fiber optic probes or flow cells.

Accessories



Various types of probes or flow cells are available.

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