Application Note

On-Line NIR Analysis for Blending

Introduction

Gasoline and Diesel blending is a refinery operation that blends different component streams into various grades of final product. The main purpose of a product blending is to allocate the available blending components in such a way, as to ensure all product demands and specifications are met at the least cost and to produce products which maximize overall profit.

Gasoline, by-product of petroleum, contains carbon and hydrogen. This factor allows the fuel to burn freely and to create extensive heat energy. The octane number in gasoline is a measure of its ability to burn evenly and resists spontaneous combustion. A knock in a gasoline engine is caused by gases burning too rapidly.

Diesel fuel comes from the residue of the crude oil after the more volatile fuels, such as gasoline and kerosene are removed during the petroleum refining process. As with gasoline, the efficiency of a diesel fuel varies with the type of engine. The refining and blending process can produce a suitable diesel fuel for almost any engine operating conditions. Using a contaminated fuel or an improper grade of fuel can cause hard starting, incomplete combustion, a smoky exhaust, or cause an engine to knock. Cleanliness of diesel fuel is important because fuel containing more than a trace of foreign substances can cause fuel pump and injector problems to develop.

Diesel fuel properties that are measured include Cetane number (analogous to octane number for the gasoline engine); Flash point (relates to fire hazard in storage); Low temperature properties, including cloud point, pour point and Sulfur content.

Process Analyzer

The WetSpec200 is an online, multi-channel wet process analysis system. It enables non-contact, real-time monitoring and closed-loop control of chemical composition in wet process applications. The WetSpec200 is ideal for monitoring petroleum and petrochemical products. Based on novel algorithm, the WetSpec200 measures the absorption spectrum in the near infrared (NIR) fast and accurately without labor and material waste. The system's versatile software models enable soft-switch between different chemistries.

The Main Analyzer is located in the Control Room, protected from the process environment. The Main Analyzer connects, via telecommunications fiber optics, to the Field Units, which are installed up to 3 km (2 miles) away, close to the process. Up to 8 Field Units can be connected to one Main Analyzer.

Features & Benefits

"All in One" - multiple streams, multiple properties analysis by a single central system housed in the central equipment room

- **Up to 3000 meters** distance between analyzer and measuring cell enables placement of the analyzer in a convenient location by using **standard communication fiber optic** cable.
- One analyzer can monitor **up to 8 measuring cells** with different chemistries.
- Short measurement time and **low operational costs**.
- **Online**, real-time measurement of chemical concentration of liquids for advanced process control purposes.
- Automatic fine tuning of calibration Model.
- Powerful Communication System.

Properties measured with the NIR analyzer

Gasoline: RON, MON, RVP, distillation properties, D(15)/D(20), MTBE %, Oxygenates %, Benzene %, Olefines %, Total Aromatics %.

Diesel: Cetane, distillation properties, Freeze pt., Cloud pt., Pour pt., Flash pt., D(15)/D(20).

Examples of Measured Results

Gasoline:

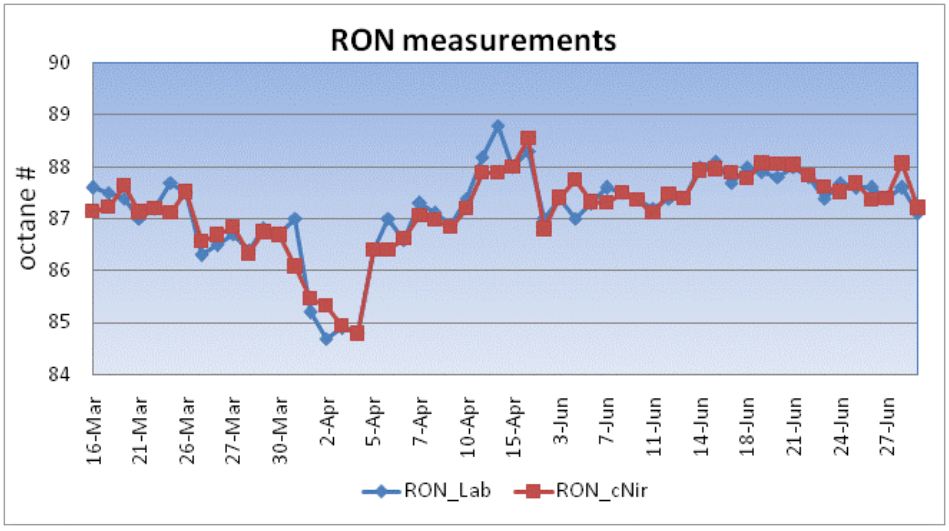


Figure 1: RON measurements of blending stream

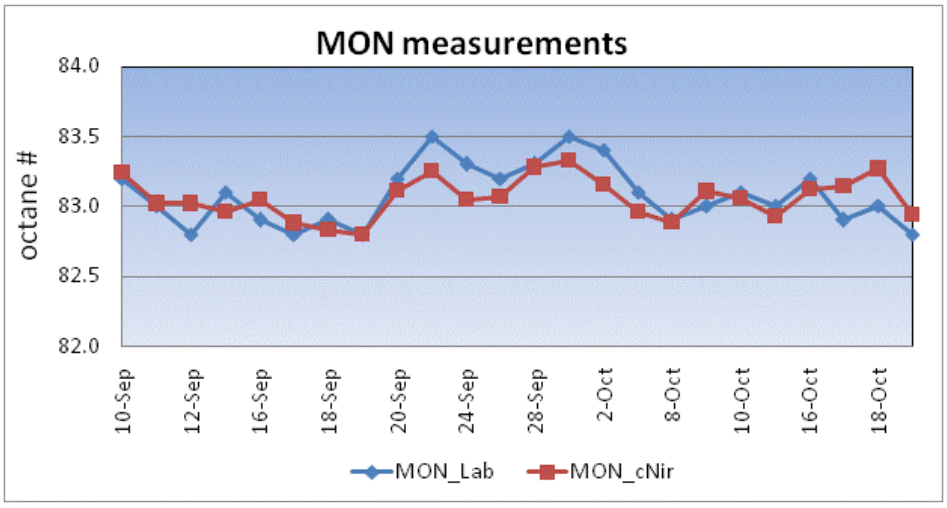


Figure 2: MON measurements of blending stream

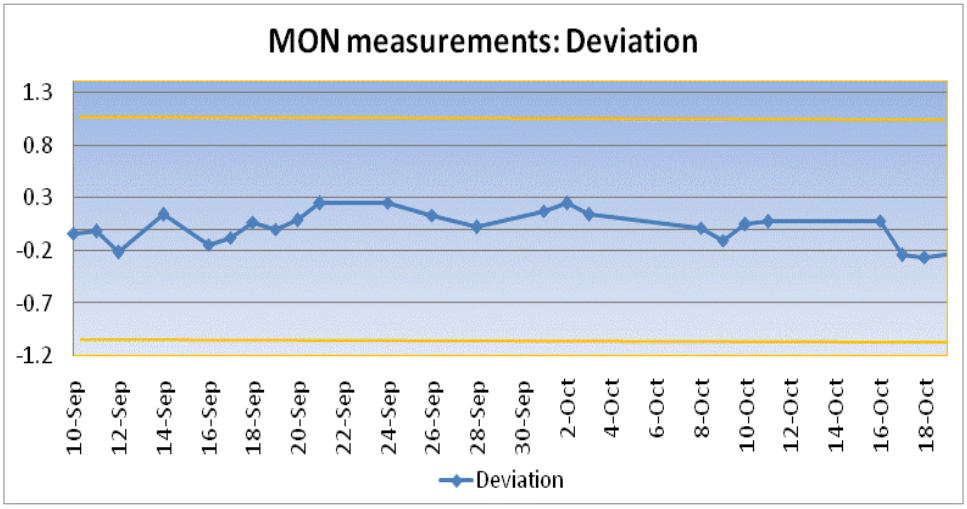


Figure 3: Deviation on MON measurements of blending stream (ASTM)

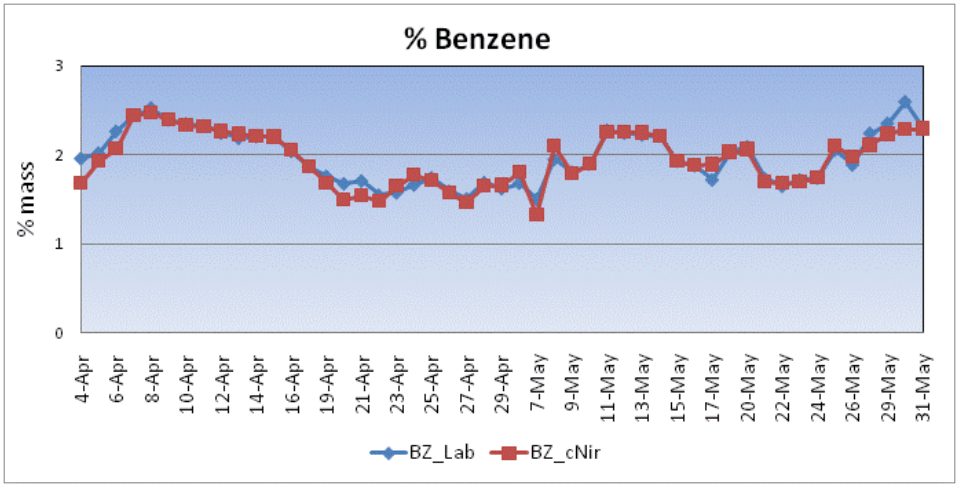


Figure 4: % mass of Benzene

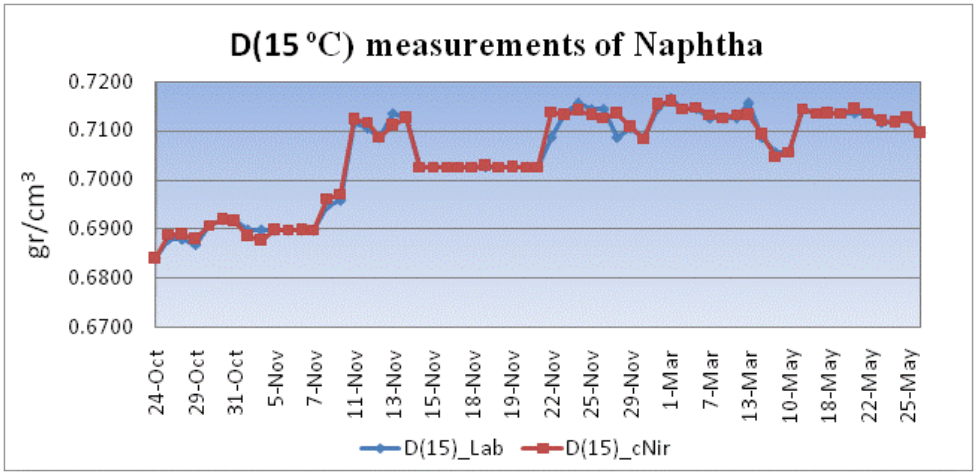


Figure 5: D (15 °C) measurements of Naphtha stream

Diesel:

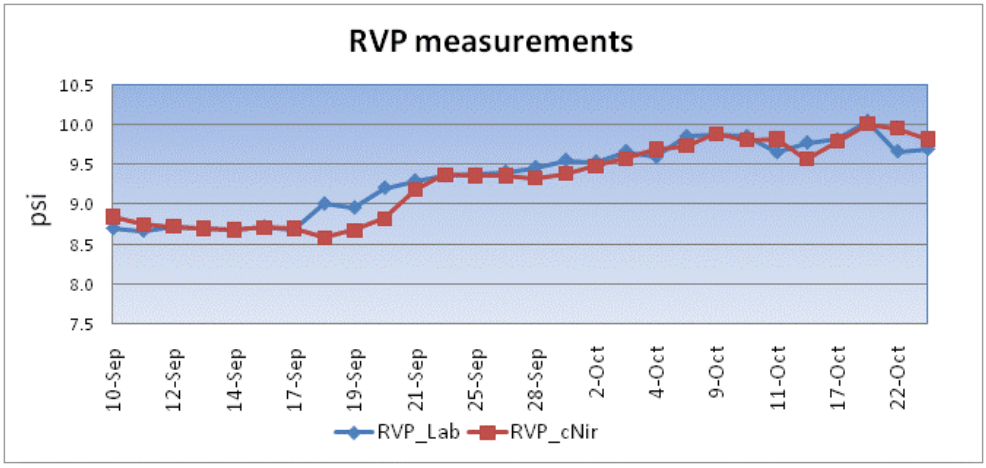


Figure 6: RVP measurements

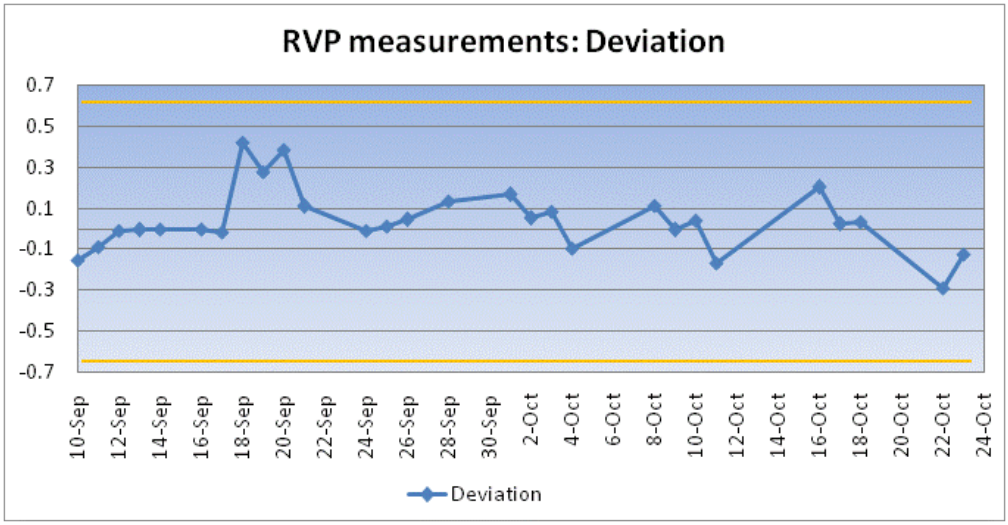


Figure 7: Deviation of RVP measurements (— ASTM)

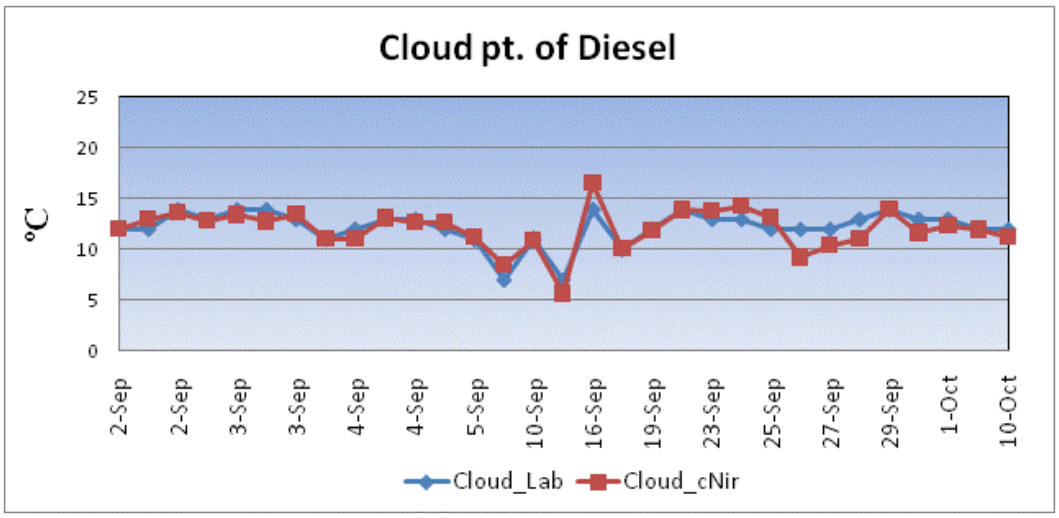


Figure 8: Cloud point measurements of Diesel

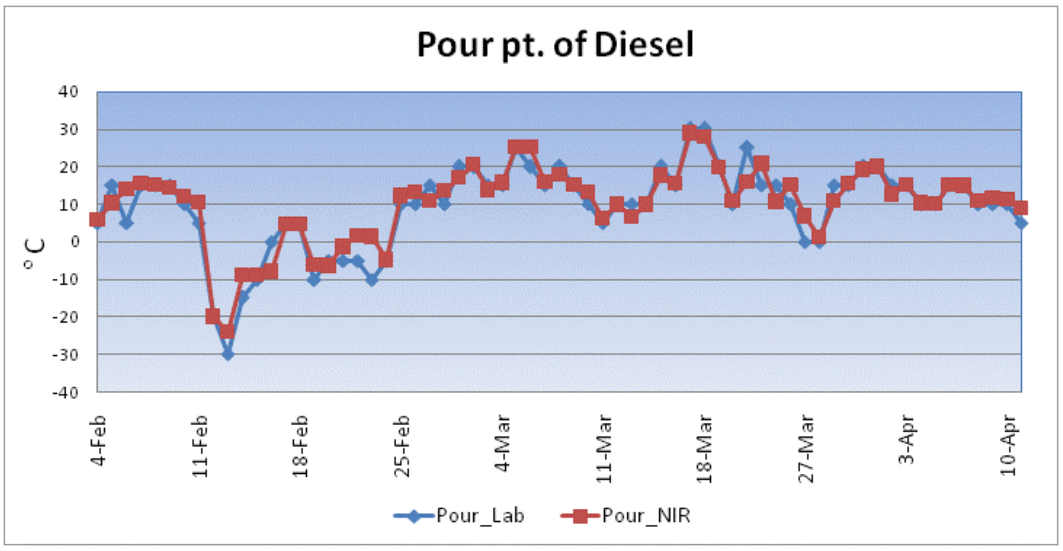
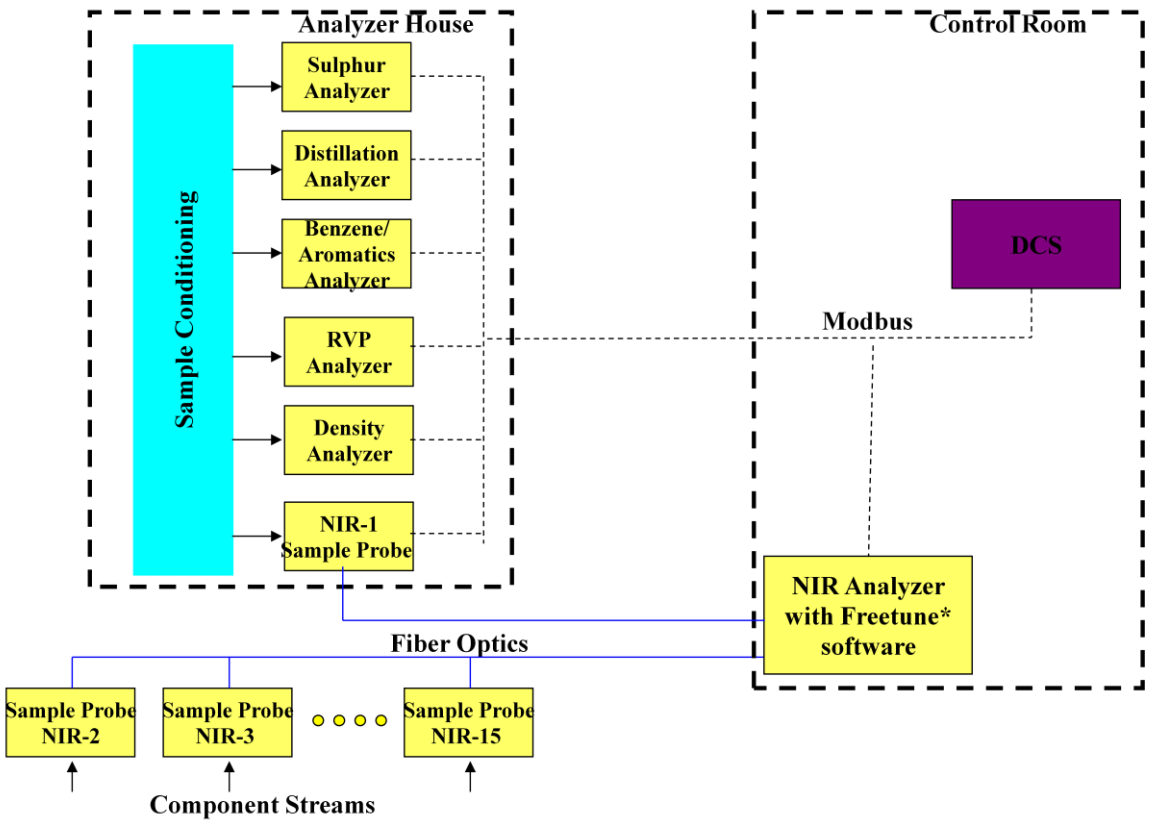


Figure 9: Pour point measurements of Diesel

Advanced Fusion Solutions

Purposed configuration in addition to NIR analyzer includes direct property analyzers that used in this configuration for higher accuracy, availability and performance validation. Our Freetune Software calibration program allows automatically adjusts the results measured by direct analyzers, in their periodic comparison with NIR analyzer measurements. This greatly eliminates the need for adjustments to models, ensures maximum accuracy and reliability of work and allows decreasing the expenditures spent on laboratory measurements. Such a configuration enables to certify the blended product on-line and can preserve high performance validation requirements.



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