

BIOFUELS ANALYZERS



SIMPLE ANALYTICAL SOLUTIONS...

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- Biodiesel in diesel
- Ethanol in gasoline
- Water in feedstock
- FFA'S in feedstock
- Total glycerides as glycerine
- Water in methanol or ethanol

The biofuels marketplace is a rapidly growing industry and so is the need for measurement techniques to ensure product quality. Product quality begins at the production facility and extends to the final burn in the engine. Wilks Enterprise, Inc. has two portable, easy-to use mid-infrared (mid-IR) analyzers for use by producers, distributors, fleet managers, or regulators for various biofuels measurements to help ensure product quality.

FOR BIODIESEL PRODUCERS

The InfraSpec VFA-IR Spectrometer provides measurements for quality control and process monitoring in the production of biodiesel. These include:

- Water in incoming biodiesel feedstock
- Free fatty acids (FFA) in feed stock
- Total glycerides as glycerine during transesterification
- Percent water in methanol or ethanol



FEEDSTOCK

Knowing the amount of Free Fatty Acids (FFA) and water in the incoming feedstock helps the producer to adjust the amount of alcohol and catalyst for a complete reaction. FFA in oil react with the alkaline catalyst to form soap and can cause a reduction in yield. Water deactivates the catalyst. Water can be extracted from the biodiesel with acetonitrile and measured by mid-infrared in the 6 micron region. Measuring FFA involves adding a weak base to form a salt whose carbonyl absorption band is shifted away from that of the biodiesel ester. Each measurement takes under five minutes and does not require a skilled technician.

PRODUCTION

Most producers use the transesterification process to convert feedstock oil into biodiesel. To determine when the reaction is complete, a sample must be taken from the reactor and the mass percent of bound glycerin is measured. The ASTM standard D 6751 specifies that the residual total glycerin must be below 0.240 mass percent. If greater than 0.240 mass percent, the reaction is allowed to continue possibly with the addition of more reactant or catalyst. Sampling with a gas chromatograph takes approximately 45 minutes. The InfraSpec VFA-IR Spectrometer gives the result in less than five minutes. The InfraSpec Spectrometer can give pass/fail determinations and reduce analysis time by about 40 minutes. The decreased analysis time can increase reactor throughput—up to 20 percent.



FOR TERMINAL MANAGERS, DISTRIBUTORS, REGULATORS

BIODIESEL AND ETHANOL BLEND RATIO

As more mandates for a minimum of ethanol in gasoline and biodiesel in diesel come into effect, a large number of major oil companies are blending higher percentages of biofuels at their terminals. Although manufacturers of in-line blending systems claim indisputable accuracy, a quick analytical measurement method to assess the blend ratio gives real data to a claimed assumption. This can be a valuable asset for terminal managers, fuel distributors, engine manufacturers, fleet operators, and regulatory agencies. The InfraCal Blend Analyzers and the InfraSpec VFA-IR Spectrometers are rugged, compact, portable and easy-to-use for non-technical personnel. In less than a minute, the user gets a direct readout in percent biodiesel or ethanol on-site at a terminal, distribution center or laboratory.



The InfraCal Analyzer and InfraSpec VFA-IR Spectrometer are compact, fixed-filter mid-infrared analyzers with no moving parts and an insignificant optical air path. They weigh less than 5 pounds and can be operated from a battery pack or a cigarette lighter adapter cable. This makes them portable, sturdy and operable in a range of ambient conditions typically found in field environments.

INFRACAL BIODIESEL BLEND & ETHANOL BLEND ANALYZERS

- **Single Wavelength Analyzer**—dedicated single analysis
- **Fast** — results in less one minute
- **Portable** — 6.5 x 6.5 x 5 inches (16.5 x 16.5 x 12.7 cm), can be battery operated
- **Affordable** — less costly than most other measurement techniques
- **Lightweight** — less than 5 lbs
- **Easy to use** — no knowledge of infrared analytical techniques needed
- **Direct readout** in desired units
- **Data Transfer** - RS-232 connections or printer



The **InfraCal Analyzer** is a low-cost, single wavelength analyzer with filters preset for a particular measurement -- either biodiesel in diesel or ethanol in gasoline. Biodiesel has a characteristic infrared absorption band at $5.73 \mu\text{m}$ (1745 cm^{-1}). Ethanol's infrared absorbance is at $9.6 \mu\text{m}$ (1045 cm^{-1}). As the biodiesel or ethanol percentage increases, the infrared absorbance increases. An internal calibration table in the InfraCal Analyzer converts infrared absorbance to a digital readout in percent. A fuel sample is placed directly on the exposed ATR sample window and after 10 seconds the percent biodiesel or percent ethanol is displayed. The fuel is easily cleaned off the window using a solvent and a wipe and the analyzer is ready for the next sample. An RS 232 interface is available for data transmission to a PC. The InfraCal Blend Analyzers are ideal where a single, repetitive analysis is needed.

INFRASPEC VFA-IR SPECTROMETER



- **Spectral Range Analyzer**—multiple component analysis
- **Fast** — results in less one minute
- **Portable** — 6.5 x 4.25 x 2.6 inches (16.5 x 11 x 4 cm), can be battery operated
- **Affordable** — less costly than most other measurement techniques
- **Lightweight** — less than 4 lbs
- **Easy to use** — simplified PC interface
- **Direct readout** in desired units
- **Data Transfer** - USB or RS-232 connections or printer

The **InfraSpec VFA-IR Spectrometer** is a spectral range analyzer capable of monitoring more than one component with a single analyzer. Analyses include: ethanol in gasoline, biodiesel in diesel, water in ethanol or methanol, total glycerides and FFA or water in the incoming biodiesel feedstock. It utilizes a patented design consisting of an Attenuated Total Reflection (ATR) sample plate with an electronically modulated source on one end. At the other end of the ATR window is a linear variable filter (LVF) covering a wavelength range of $5.4\text{-}10.8 \mu\text{m}$ ($1850\text{-}925 \text{ cm}^{-1}$) combined with a 128 pixel detector array. The result is an infrared analyzer that, unlike an FTIR spectrometer, has no moving parts and an insignificant optical air path. This makes for a portable, rugged analyzer suitable for use in a field environment. The InfraSpec VFA-IR Spectrometer has a simplified PC interface for non-technically trained personnel as well as complete spectral information that is stored and can be transmitted to laboratory technicians for review if necessary. Measurements can be done on-site at a manufacturing facility as well as in the laboratory.

MEASUREMENT SPECIFICATIONS

	Range	InfraCal Blend Analyzer Instrument repeatability	InfraSpec VFA-IR Spectrometer Instrument repeatability
Ethanol in Gasoline	0.5-20%	+/-0.20	+/-0.20
Ethanol in Gasoline	65-98%	+/- 1% of concentration	+/- 1% of concentration
Biodiesel in Diesel	0-30%	+/-0.20	+/-0.20
Biodiesel in Diesel	30-100%	+/- 1% of concentration	+/- 1% of concentration
Water in Ethanol or methanol	0-10%	N/A	+/- 1% of concentration
Ethanol in Water	0-10+%	N/A	+/- 0.20
Total Glycerides as glycerine	0-1%	N/A	+/- 0.05
FFA in Feedstock	0-10%	N/A	+/- 0.33
FFA in Feedstock	0-50%	N/A	+/- 1.3
Water in Feedstock	0-2%	N/A	+/- 0.09
Methanol in Biodiesel	0-0.3%	N/A	+/- 0.08
Vegetable oil in Diesel	0-30%	N/A	+/- 1.3

INFRACAL FILTOMETER SPECIFICATIONS

INFRACAL ETHANOL BLEND ANALYZER	Model HATR-T2E, part number 405-2019
INFRACAL BIODIESEL BLEND ANALYZER	Model HATR-T2B, part number 405-2013
Dimensions	6.5 x 6.5 x 5 in. (165 x 165 x 127 mm)
Weight	4.5 lbs (2.0 kg)
Power Requirements	12V DC, 7.5 watts max
Power Supply	Universal AC/DC converter type, optional 12 volt battery
Operating Temperature Range	4°C - 45°C
Humidity	0 – 98% relative humidity (non-condensing)
Communications Port	RS 232
Analytical Wavelength	5.73µm (1745cm ⁻¹) or 9.6µm (1045cm ⁻¹)
ATR Crystal Material	Zinc Selenide

INFRASPEC VFA-IR SPECTROMETER SPECIFICATIONS

INFRASPEC VFA-IR SPECTROMETER	Model E: 405-2017-1013 Model ES: 405-2036-1013
Dimensions	6.0" x 6.5" x 2.75", 15.2 x 16.5 x 7 cm
Weight	3.5 lbs., 1.5 kg
P.C. Interface	RS 232, USB
Power Requirements	12V DC, 2.0 amps
Power Supply	Universal AC/DC converter type (supplied as standard)
Suggested Temperature Operating Range	15°C - 60°C
Humidity	0 – 98% relative humidity (non-condensing)
Detector Array	128 Pixel linear pyroelectric array
Array Responsivity	5.4-10 ⁵ V/W
Standard Spectral Range	5.4-10.8 µm (1850 – 925 cm ⁻¹)
ATR Crystal Material	Zinc Selenide
ATR Surface Size	50 x 16 mm
# of Reflections	12
Resolution	25 cm ⁻¹

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