# Get comparable ASTM/EN data for biodiesel blend while saving time and money

By Sandra Rintoul, Wilks Enterprise Inc.

If you need to verify how much biodiesel is in a diesel fuel, sending a sample off to a laboratory can take several days to get an answer. This can add unnecessary delays if a truck has just been loaded for a delivery, but must wait for the lab result.

The best solution is to have an on-site test where the fuel is loaded or delivered. The two most widely used analytical methods for measuring the amount of biodiesel in diesel fuel are ASTM D7371 and EN 14078. Both specify a relatively expensive FTIR (Fourier Transform Infrared) spectrometer for the analysis. But for those individuals needing a quick biodiesel blend check at a loading rack, off a truck or at a fuel station that matches the ASTM of EN methods, there is another option.

Filter-based infrared analyzers are simplified instruments that use the same infrared (IR) technology as an FTIR spectrometer and as called for in the ASTM and EN methods. The difference is that an FTIR spectrometer can do a multitude of analyses, while the filter-based analyzer uses a filter to select one particular measurement, in this case percent biodiesel. Reducing the complexity not only lowers the price, but also makes operation easier for non-technical personnel who can test fuel on-site and get a result in less than a minute. Simplification also makes for a more rugged, portable system that can be operated in a harsher environment, such as a loading rack.




*Figure 1. Portable infrared analyzers can provide quick, on-site results for biofuel tests.*

To measure biodiesel, infrared light passes through the fuel blend and the amount of light absorbed at a specific IR frequency by the biodiesel is detected. The IR absorbance increases and decreases with biodiesel concentration, so it can be correlated to a percent biodiesel value. The FTIR spectrometer and the filter-based analyzers both measure biodiesel at the same frequency, 1745cm-1. Unlike the FTIR, the filter-based analyzers have no moving parts, making them more compact and portable.

The real test is how each type of analyzer performs with the ASTM and EN methods. The data in Table 1 compares a single wavelength analyzer (InfraCal Biodiesel Blend Analyzer) and a spectral range (InfraSpec VFA-IR Spectrometer) filter-based analyzer to FTIR spectrometers following the ASTM D7371 and EN 14078 methods. In Table 2, the same samples were tested by three different laboratories performing D7371 with an FTIR compared to a filter-based infrared spectrometer. Both examples show that the filter analyzers perform as well as the laboratory methods. Table 2 shows that even laboratories are subject to operator and/or calibration offsets that can lead to differences on the same samples between laboratories. It should be noted that for D7371, the reproducibility for a B20 sample is 1.7 percent and EN 14078 states it would exceed 1.4 percent in only one case in 20.

For ease of operation, the filter-based analyzers use an exposed ATR (attenuated total reflection) sample plate, as called for in ASTM D7371. The exposed ATR sample plate allows for easy introduction and cleaning of the sample, as well as the extended measurement range up to 100 percent without the need for sample dilution. For the operator, all it takes to make a measurement is to place the sample on the sample plate, select "run" and the result is displayed within a minute. The plate is cleaned and the analyzer is ready for the next sample.

| Sample ID | EN 14078 FTIR | ASTM D7371 FTIR | InfraCal Biodiesel Blend Analyzer | InfraSpec VFA-IR Spectrometer |
|---|---|---|---|---|
| 105-003 | 0.2 | 0 | 0.2 | 0.22 |
| 1.0 STD | 1.1 | 1.15 | 1.3 | 1.4 |
| 5.02 STD | 5 | 4.99 | 5 | 5.12 |
| 30.0 STD | 30.2 | 30.07 | 30 | 30.11 |
| 50.0 STD | 50 | 50.06 | 50.4 | 50.6 |

*Table 1 – Infrared filter-based analyzers compared to EN and ASTM blend measurement methods.*

| % FAME in Diesel | ASTM D7371 lab 1 | ASTM D7371 lab 2 | ASTM D7371 lab 3 | InfraSpec VFA-IR Spectrometer |
|---|---|---|---|---|
| 2.0 | 1.1 | 1.8 | 2.2 | 2.4 |
| 4.0 | 3.0, 2.8 | 3.5, 3.7 | 4.0, 4.0 | 4.4, 4.3 |
| 10.0 | 8.4 | 9.2 | 9.7 | 10.1 |
| 20.0 | 17.3 | 19.8 | 18.0 | 19.5 |

*Table 2 – Three laboratories and Infrared filter-based spectrometer testing the same samples.*

The EN 14078 method uses a transmission cell that is filled with the biodiesel/diesel mix. One disadvantage with the transmission cell sampling method is that all samples require dilution with cyclohexane. This adds an awkward step to the analysis, as well as an added chance for operator error in the dilution process. The cell also is difficult to clean, which adds the risk of leaving residual fuel in the cell that could lead to errors in subsequent samples.

As higher percentages of biofuels enter the supply chain, knowing the biodiesel/diesel blend becomes more important for regulators, distributors, blenders, pipeline operators and end-users. Portable infrared analyzers such as the one shown in Figure 1 can provide an on-site blend ratio measurement in less than a minute. A quick and easy analytical check reduces delay for both fuel transporters and regulators, saving both time and money for the biofuels industry as it continues to grow.

*Sandra Rintoul is president of Wilks Enterprise Inc., www.WilksIR.com. You may contact her by e-mailing bpteditorial@woodwardbizmedia.com.*


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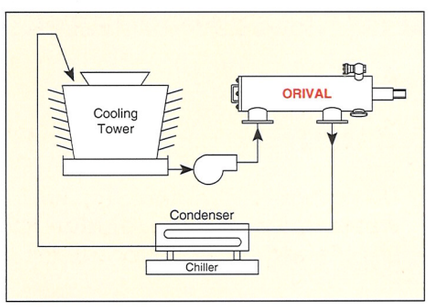

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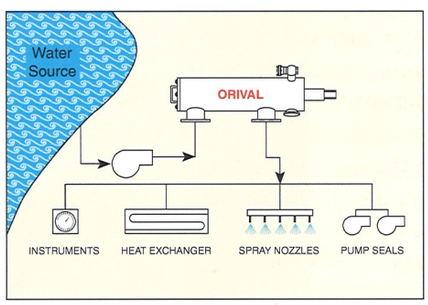

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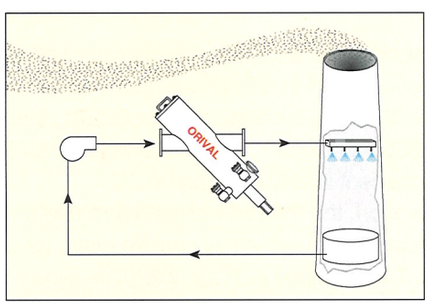

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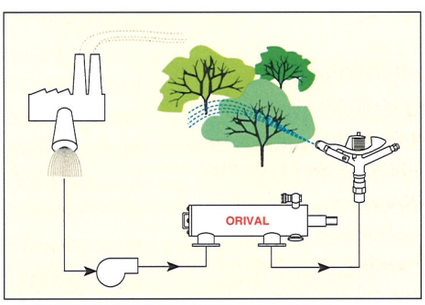

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