

MONITORING TRACE AMOUNTS OF DIESEL IN JET FUEL BY UV ABSORBANCE

The application

Diesel and jet fuel are often in use at the same location. There is a real danger in using diesel where jet fuel is required, or in trace amounts of diesel contaminating the jet fuel, since the same vessels and pipelines are used for both types of fuel. An analyzer that can automatically detect either trace amounts of diesel in jet fuel or determine if a sample is that of jet fuel or diesel is required. This analysis is extremely important on aircraft carriers where the planes require jet fuel; however, there is also a wide use of diesel for forklifts, trucks, and other heavy equipment. It should be noted that the source of jet fuel

The analysis

Jet fuel and diesel show distinct UV absorbance spectral features, which were used to recognize the fuel type in a sample. Also, as will be shown, contamination of one in the other were readily detected.

The OMA-300, a UV-VIS diode array process analyzer, was applied to this application, measuring a complete UV-VIS absorbance spectrum of a sample and performing an instantaneous analysis to give the diesel and jet fuel contents of a sample.

Absorbance spectra

Figure 1 shows the absorbance spectra of diesel and jet fuel--the differences can be easily seen. Figure 2 shows the diesel concentration readings for both the gravimetric and absorbance method.

Calibration

For standards, samples of jet fuel contaminated in a controlled manner with 0-3% diesel were prepared. A multi regression evaluation method was applied to the data where the absorbance levels for a wavelength range, rather than a single wavelength, are used. The evaluation results are summarized in Figure 2; a plot of mixture concentration vs. OMA-measured concentration is shown.

It was found that a linear calibration model gives an excellent fit. This is due to the high performance capabilities of the spectrophotometer. By utilizing a

Figure 1: absorbance spectra of jet fuel and diesel

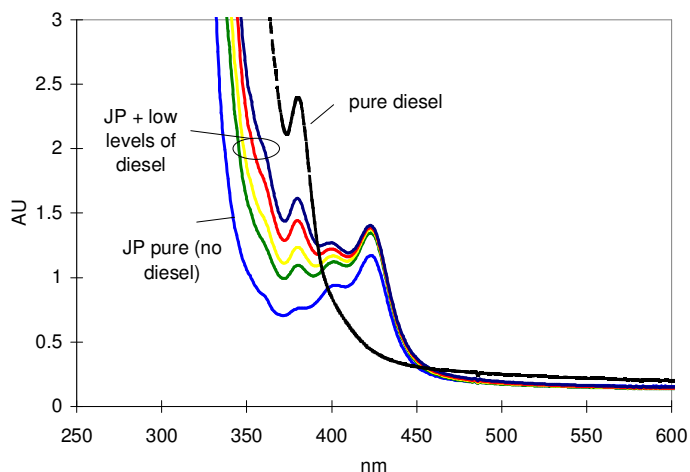
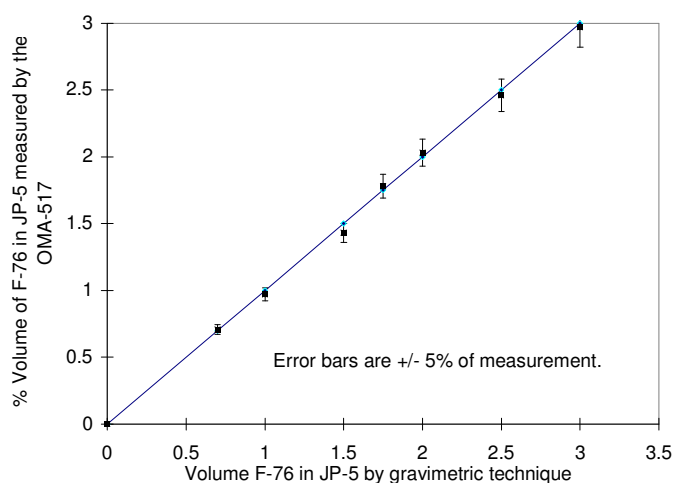


Figure 2: % Volume of F-76* in JP-5 *Gravimetric vs the OMA-300 results



*JP -5 : jet fuel

*F-76 : diesel

spectrophotometer with very low stray light (such as the OMA-300), the linearity even at such high absorbance levels is maintained.

On-line monitoring

This application was automated to run continuously and evaluate samples for fuel content.

Conclusion

The contamination of diesel fuel in jet fuel can be measured by the OMA-300, a diode array UV-VIS spectrophotometer. The required range of 0-2.5% with an accuracy level of +/-5% of the measurement was readily achieved. The absorbance spectrum of jet fuel is source dependent. A pure sample of jet fuel was used to zero the spectrometer whenever the fuel source had been changed.

Figure 3: absorbance spectra of jet fuels samples coming from a various ships

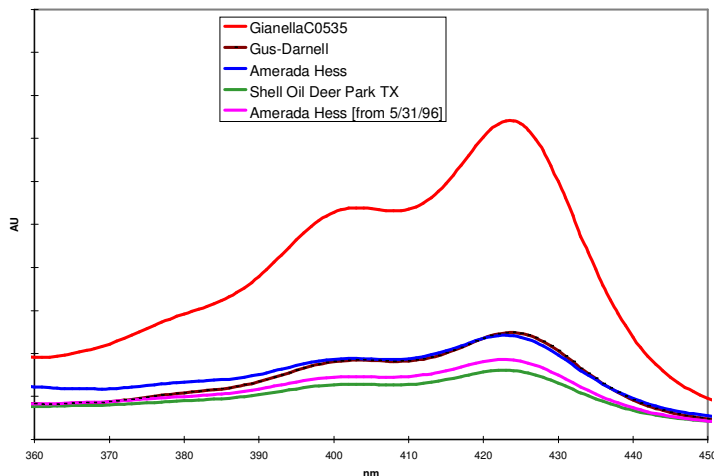


Figure 4: absorbance spectra of JP-5 jet fuel Amerada Hess line with controlled amounts of diesel contamination

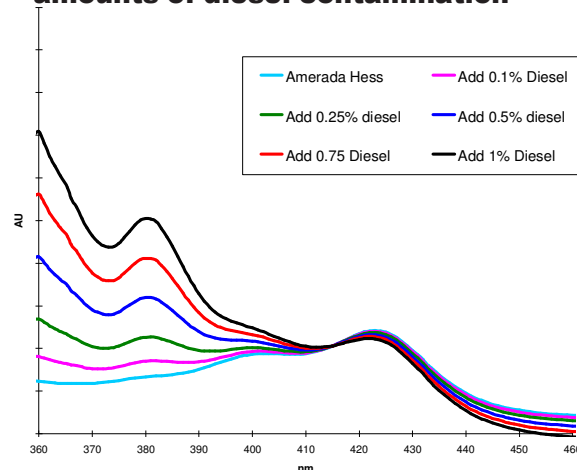
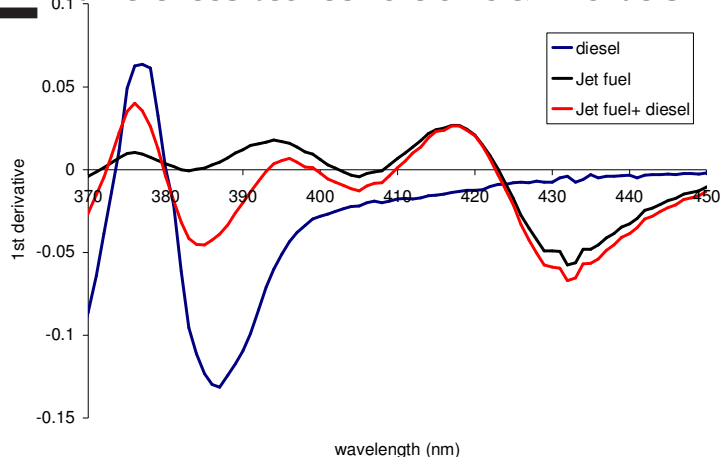


Figure 5: The first derivative of the absorbance spectra enhances the structural differences between the JP-5 & F-76 fuels



For information about Dyed Aviation Gasoline detection method, see the OMA-300-CM product brief.



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Product Brief - OMA-300 517-60300
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