Fit For Biofuels and Blends

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As the content of biofuels within Gasoline and Diesel is on the rise, manufacturers of analytical instrumentation are driving to meet the standards for analyzing biofuels. Biofuels used for combustion engines are Biodiesel and Bioethanol. Here we want to list some of the instruments amenable to ensure regulatory specifications and new standards evolving around the new applications.

Biodiesel:

ASTM D6751-07a is the Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels in the USA. With the Grabner Instruments IROX-Diesel it is possible to determine the concentration of Biodiesel according to D6751-07a in diesel fuel from 0 to 40 volume percent using FT-IR spectroscopy. The measurement method is under evaluation within the ASTM committee and will become a standard method within the near future (New Standard Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) in Diesel Fuel Oil Using Mid Infrared Spectroscopy). The actual draft is available within the ASTM (WK10753).

For the determination of total Biodiesel the IROX uses a sophisticated mathematical model to separate overlapping peaks (see Fig. 1). In addition to Grabner Instruments own method the IROX allows the determination of FAME content according to the standard EN 14078.

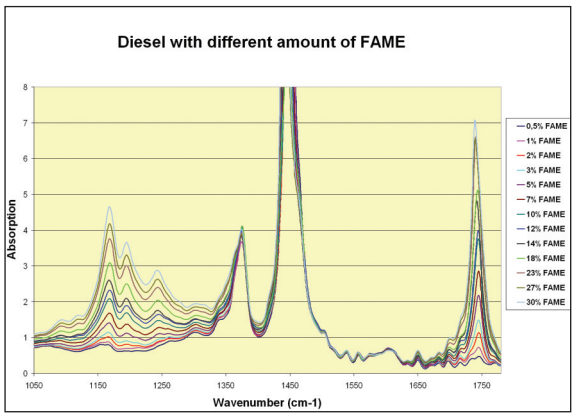

Fig. 1: Spectrum of different concentrations of FAME in Biodiesel: Strong peak at 1745 cm-1, weak peak at 1195 cm-1

While the vapor pressure of Biodiesel blends is not significantly influenced, even by small amounts of free alcohols, the flash point of Biodiesel drops dramatically from 120°C down to 60°C with only some tenth of weight percent of free methanol (see Fig. 2). With a new standard method currently worked on for available instruments the flash point of pure Biodiesel can be controlled.

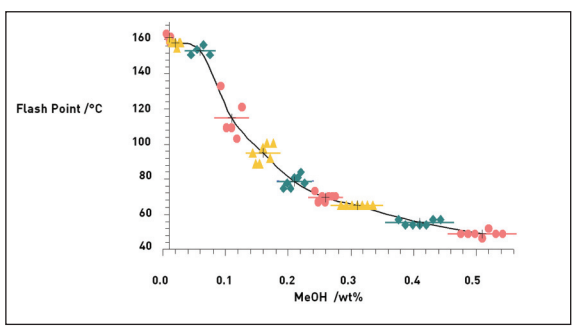

Fig. 2: Flashpoint of Diesel containing small amounts of MeOH.

Distillation is a common quality check for fuel distillates. Biodiesel tends pushing up the distillation curve towards higher boiling points especially in the T50 region (see Fig. 3). This can be verified with the new MiniDIS in a fast, D86 compliant, true atmospheric distillation.

The MiniVis VIS445, a viscometer applying the rolling ball principle allows automatically monitoring the viscosity of fuels and its temperature dependence in a wide range. Viscosity measurements will always complement routine quality checks of fuels.

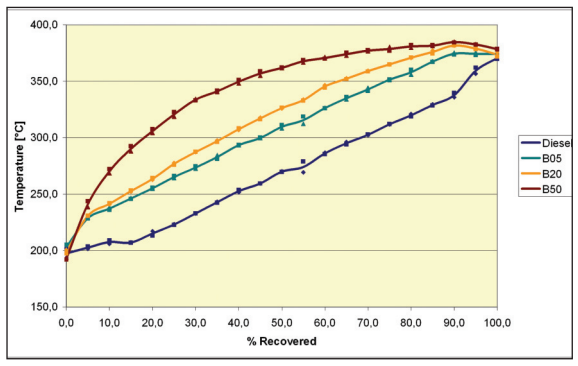

Fig. 3: Distillation curves of Biodiesel blends.

Bioethanol:

For Bioethanol in gasoline the following standards apply: ASTM D4806-06c is the Standard Specification for Denatured Fuel Ethanol for blending with Gasoline for Use as Automotive Spark-Ignition Engine Fuel. ASTM D5798 is the Standard Specification for Fuel Ethanol for Automotive Spark-Ignition Engines. D 5798 covers standards E75 to E85.

Grabner Instruments' IROX 2000 can determine the concentration of ethanol in gasoline fuel up to 20 volume percent, improving continuously. The second derivative of the peaks at 1091cm-1 and 1050cm-1 are used for the calculation (see Fig. 4). The use of the second derivative ensures the elimination of offsets and drifts in the IR spectrum of the ethanol blended gasoline. With dilutions, which factors can be automatically accounted for by the instrument it is possible to assess higher concentration ranges.

It is known that ethanol blending affects the vapour pressure behaviour of gasoline. While actually the vapour pressure of pure ethanol is much lower than that of gasoline, molecular effects are increasing the vapour pressure of the gasoline in blends up to about 8% (see Fig. 5). Therefore, vapour pressure needs to be thoroughly checked and reported for ethanol blended gasoline.

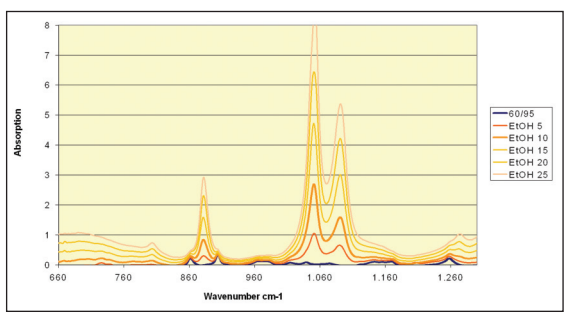

Fig. 4: IR-Spectrum of Ethanol in Gasoline.

Grabner Instruments is specialized in vapour pressure testing and almost 50% of such fuels around the world are tested with the MiniVAP VPS. The ASTM method D6378 is especially suitable as no air saturation and chilling is required, that interfere with the above mentioned molecular effects.

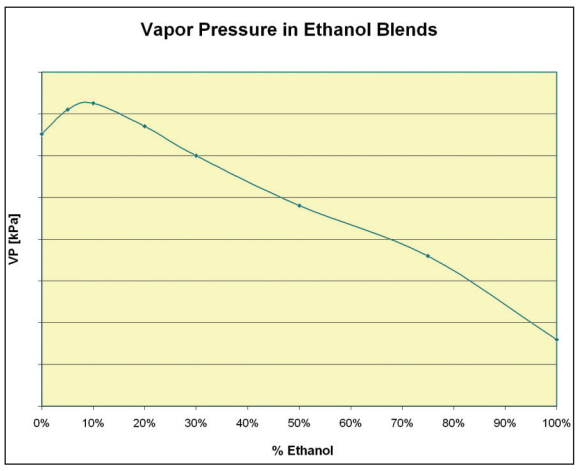

Fig. 5: Vapor Pressure of Gasoline-Ethanol Blends

Distillation curves of ethanol blended fuels tend to show a plateau around the azeotropic boiling point of 78°C. The plateau extends to the point where all of the azeotropic mixture, consisting mostly ethanol is distilled over. It is virtually consistent with the alcohol content. Then the distillation curve increases sharply towards the end boiling point of gasoline determined by its heavier components (see Fig. 6). The MiniDIS from Grabner Instruments allows for a good resolution of this distillation behaviour. The small sample volume together with the electronic circuits, the instrument achieves the required, very flexible heat rate adjustment.

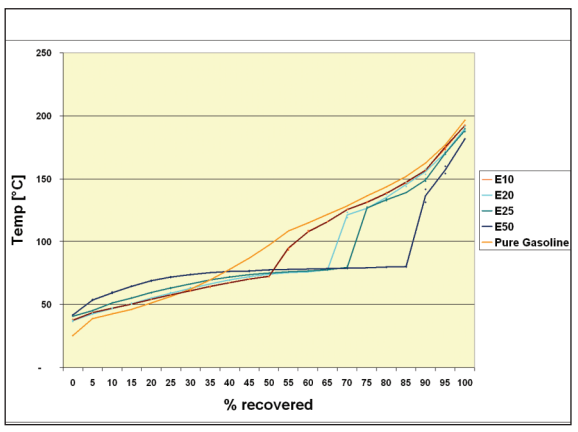

Fig. 6: Distillation curve of Gasoline-Ethanol blends

Analytical instrumentation Outlook:

As for the instrumentation market we expect a shift in the analytical instruments market. With the world wide strive for more environmentally friendly fuels and mandates to blend biofuels into regular petro fuels, there is an ever increasing demand for checking both, the quality of the biofuel subjected to blending and also the blends, especially, monitoring the concentration. Companies in this business are now starting to adapt and extend their standard instruments for such new applications. Specific new standards are worked out and will soon be released to the market. We have only given an overview of our instruments which is an excerpt of the total market. For further information on analytical instrumentation turn to our website at www.grabner-instruments.com.