

Process Raman solution

Measuring and controlling SAF feedstock transformation with Raman

What is Raman spectroscopy?

Raman spectroscopy is an optical analysis technique that measures the vibrational properties of molecules. Raman has revolutionized process analysis with its high-resolution compositional data, linear response to concentration, non-destructive nature, ability to measure samples in real-time, and no need for a sampling system or carrier gasses.

Fueling the future

Raman spectroscopy plays a pivotal role in the production of sustainable aviation fuel (SAF) by providing valuable insights into the composition and quality of biofuels derived from renewable sources. By analyzing the vibrational spectra of key molecular components, Raman spectroscopy helps ensure that the resulting SAF meets stringent quality standards. It also aids in process optimization and quality control throughout the entire SAF production cycle, contributing to the sustainable and eco-friendly transformation of the aviation industry.

Benefits of Raman spectroscopy

1

Rich compositional information

2

Quantitative and linear response

3

Non-destructive

4

No sample preparation

5

Measures all sample types:

- Solid/powder/slurry
- Liquid/gas
- Heterogeneous samples

6

Fast measurements times—
milliseconds to seconds,
not minutes



MarqMetrix All-In-One Process Raman Analyzer.

Monitoring the SAF production process

A leading sustainable aviation fuel company based in the United States has harnessed the capabilities of multiple Thermo Scientific™ MarqMetrix™ All-In-One Process Raman Analyzers and High-Throughput Process (HTP) BallProbes to monitor the conversion of sugar into fuel. The application requires the measurement of both liquid and gas phases to ensure that multiple process points are controlled, from feedstock to final jet fuel product quality assurance. The primary objective of the customer is to determine the correct distribution of carbon compounds (including aromatics and nonaromatics) throughout the transformation process while ensuring the quality of the end product in an efficient manner.

Requirements

- Inline measurement of multiple process points along with both liquid and gas phase measurement
- Precise measurement of the distribution of carbon number (aromatics and nonaromatics)
- Real-time jet fuel properties measurement such as API, distillation points, flash point, and freeze point

Results

The customer is using multiple MarqMetrix All-In-One analyzers to monitor the transformation of sugar feedstocks into fuel. To accomplish this, the following steps were taken:

1. Liquid phase:

During the initial stage of the process, the customer employs the MarqMetrix All-In-One analyzers in conjunction with an HTP BallProbe to monitor the concentration of sugars such as glucose, sucrose, fructose, and maltose within a liquid mixture. The probe's large sapphire lens enables faster acquisition times when monitoring the individual sugar components within the mixture, which is not a clean sample due to suspended solids and relatively dark color.

2. Gas phase:

For the transformation phase, a FlowCell and MarqMetrix All-In-One analyzer is utilized to control the hydrogenation and deoxygenation reactions. Additionally, the FlowCell continuously monitors the correct carbon number distribution in real-time.

3. Final product quality control (second liquid phase):

In the final step, the customer employs another HTP BallProbe for the final liquid phase in tandem with the MarqMetrix All-In-One analyzer to regulate the purification of individual hydrocarbons and the blending process for the final jet fuel product. The probe delivers a better signal-to-noise ratio, which is ideal for the prediction of low concentration components. This setup allows for the real-time measurement of essential jet fuel properties, including API, distillation points, flash point, and freeze point.

This meticulous control ensures that the customer can efficiently and promptly produce and release products that meet the certified chemical and quality standards in the market.