AN ALTERNATIVE METHOD TO ASTM D86 MEANS MORE OPTIONS FOR DISTILLATION OF GASOLINE AT ATMOSPHERIC PRESSURE

Distillation of crude oil to separate hydrocarbon components so they can be processed into higher value products is one of the first steps of the refining process. This process, which takes place in atmospheric crude towers, has not changed significantly in nearly 70 years.

What has changed is the instrumentation technologies and software capabilities that optimise the distillation process. Crude oil is highly complex, with 1000 identifiable components with boiling temperatures that range from 20°C for butane and propane to over 550°C for heavy residuals, like lubricating oil or asphalt. This makes understanding the distillation characteristics very important in the processing of crude into mixtures of naphtha, kerosene, diesel, and other fuels.

For years, product quality was solely determined by boiling points specified in ASTM D86, which specified technologies that required an operator to manually extract between 100-300 mL of sample volume, insert the sample into a chamber, and commence a testing procedure that could take upwards of two hours.

To simplify the process, many refineries use a combination of technologies to efficiently measure and optimise the distillation process. The speed of technology enhancements is such that ASTM standards often cannot keep pace with proven innovations. A common solution for refineries to ensure product quality while optimising their process is to use a more efficient analyser requiring a smaller sample and delivering results in a faster cycle time that correlates with ASTM D86. An analyser that performs atmospheric distillation in compliance with ASTM D86 is then used at the end of the process to ensure compliance with the required method.

While this method works, it also adds a time-intensive step to the process and requires a refinery laboratory to use and maintain unnecessarily redundant equipment. Earlier in 2017, ASTM D4814 Standard Specification for Automotive Spark-Ignition Engine Fuel, listed ASTM D7345 Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (Micro Distillation Method) as an approved alternative method for distillation of gasoline.

This means that micro distillation analysers are now an approved method for determining distillation characteristics for gasoline. In addition to gasoline, micro distillation has also been approved for jet fuel with ASTM D1655 Standard Specification for Aviation Turbine Fuels and diesel, with ASTM D975 Standard Specification for Diesel Fuel Oils.

The approval of alternative methods of distillation measurement offers a tremendous opportunity to incorporate efficiencies into the distillation process for gasoline, diesel, and jet fuel applications. In a traditionally slow-to-change industry like refining, operators and stakeholders need proof and quantified data to be sure that new technologies like micro distillation analysers offer true physical distillation that correlates with conventional distillation analysers before they will allow the micro distillation method to be adopted into the process.

Because ASTM D7345 was recently approved as an alternative to D86 for gasoline, refiners are asking just how good is this newly accepted alternative. Houston-based PAC conducted a series of tests that showed how well micro distillation analysers correlate with analysers that are in compliance with D86.

Comparing Three Unique Distillation Analysers

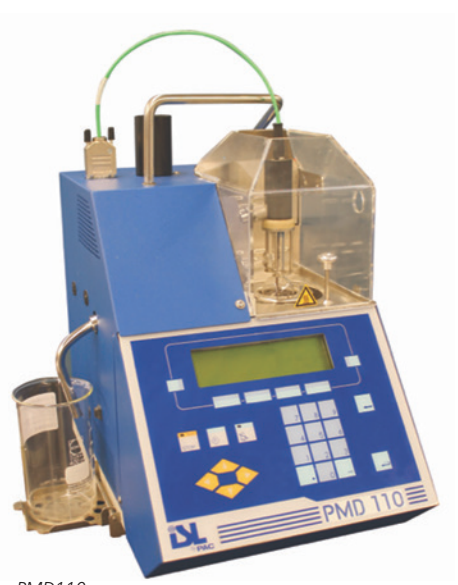
Working with a large, global customer who owns refineries worldwide, PAC conducted a series of tests between its three unique distillation analysers:

- **OptiDist** – An automated atmospheric distillation analyser, OptiDist offers a 35-minute cycle time, with full compliance with all atmospheric distillation methods, including ASTM D86. It is designed to accommodate multi-methods and non-standard capabilities, and can be adapted for multiple applications. As a highly user-friendly instrument, it is possible to install the flask in seconds using just one hand. Testing initiation occurs at the push of a button. OptiDist is field-proven to deliver up to two times better precision for all common distillation samples.

- **PMD110** – A micro distillation analyser with a 10-minute cycle time, PMD110 fully complies with ASTM D7345 and correlates with ASTM D86, ASTM D1160, ISO 3405, and IP 123. Its compact, portable design makes it ideal for field use. With true physical distillation in 10 minutes, it can accurately determine the boiling range characteristics of any commercially available petroleum product from a 10 mL sample. PMD110 requires no pre-testing or programming, and delivers exceptionally fast results and validation using user-defined criteria and automatic pass/fail notification.

- **MicroDist** – An online micro distillation analyser, MicroDist operates in compliance with ASTM D7345, with a 10-minute cycle time and the ability to automatically pull samples from the pipeline. It also fully correlates with ASTM D86, ISO 3405, IP 123, and Cetane Index in accordance to ASTM D4737 and ASTM D976 (procedures A & B). MicroDist delivers test results with less variability, which allows tighter control and maximum upgrade from low- to high-value products. With full automation of initial heat, distillation rate, and final heat regulation, MicroDist offers robust and reliable process control.

OptiDust



PMD110

MicroDust

Test Details

During the testing period, five unique gasoline samples were run through each of the distillation analysers, demonstrating high levels of correlation between the two micro distillation analysers, MicroDist and PMD110, using the ASTM D7345 method, and the laboratory distillation analyser, OptiDist, which uses the ASTM D86 method.

Results

The test results demonstrated excellent correlation between ASTM D86 and ASTM D7345, as shown in the charts.

Conclusion

Analysers using both the ASTM D86 and ASTM D7345 methods have been shown to deliver reliable, highly correlated results. The best choice of analyser largely depends on the requirements of the refinery.

Laboratory distillation analysers using the D86 method, like OptiDist, are ideal for laboratory analysis when full compliance with all atmospheric distillation methods is required. The versatility of OptiDist makes it easy to adapt the instrument to many different applications. Micro distillation analysers like PMD110 and MicroDist are ideal for field analysis, especially for gasoline, diesel, and jet fuel applications. Now that ASTM specification for diesel (D975), jet fuel (D1655), and, most recently, gasoline (D4814), allow for analysis by alternate method D7345, the PMD110 and MicroDist can be used to release products to specification without the need for additional laboratory testing.

For additional information about monitoring the distillation of petroleum products and liquid fuels at atmospheric pressure, visit our website at www.paclp.com.

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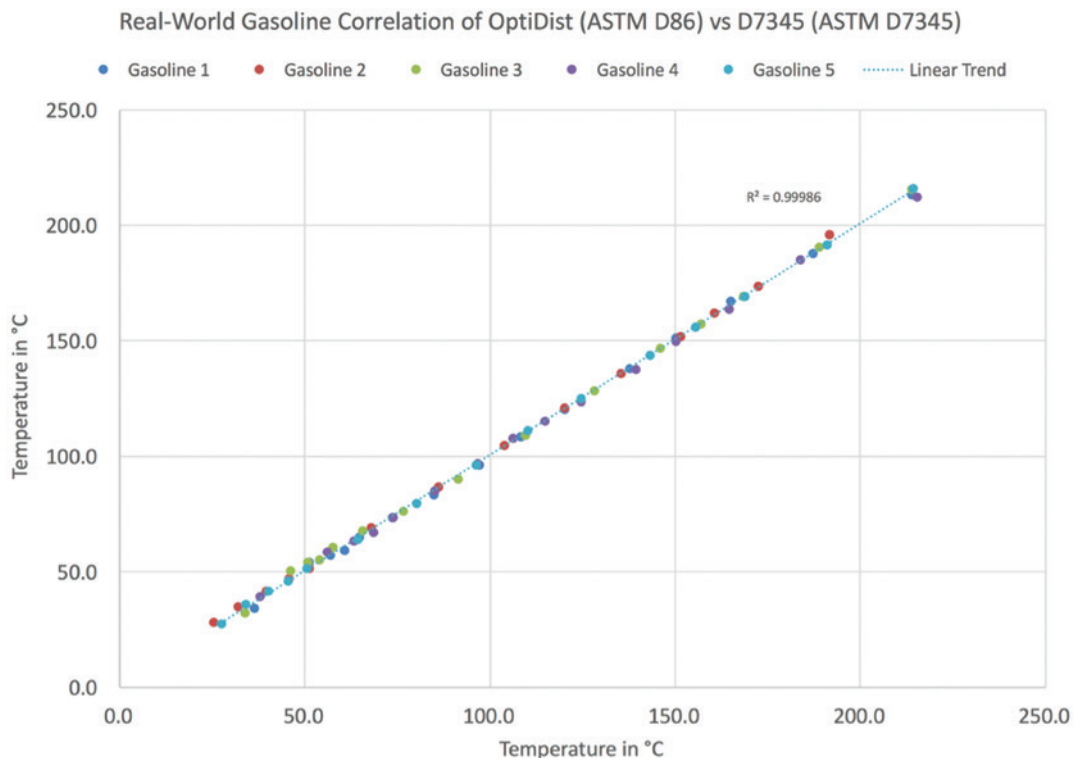

Illustration 1: PAC measured five different gasoline samples at temperatures ranging from 25°C to 220°C. At every stage of the testing process, the results demonstrated excellent correlation between the online micro distillation analyser, MicroDist, to the laboratory distillation analyser, OptiDist. (R squared of 0.9999).

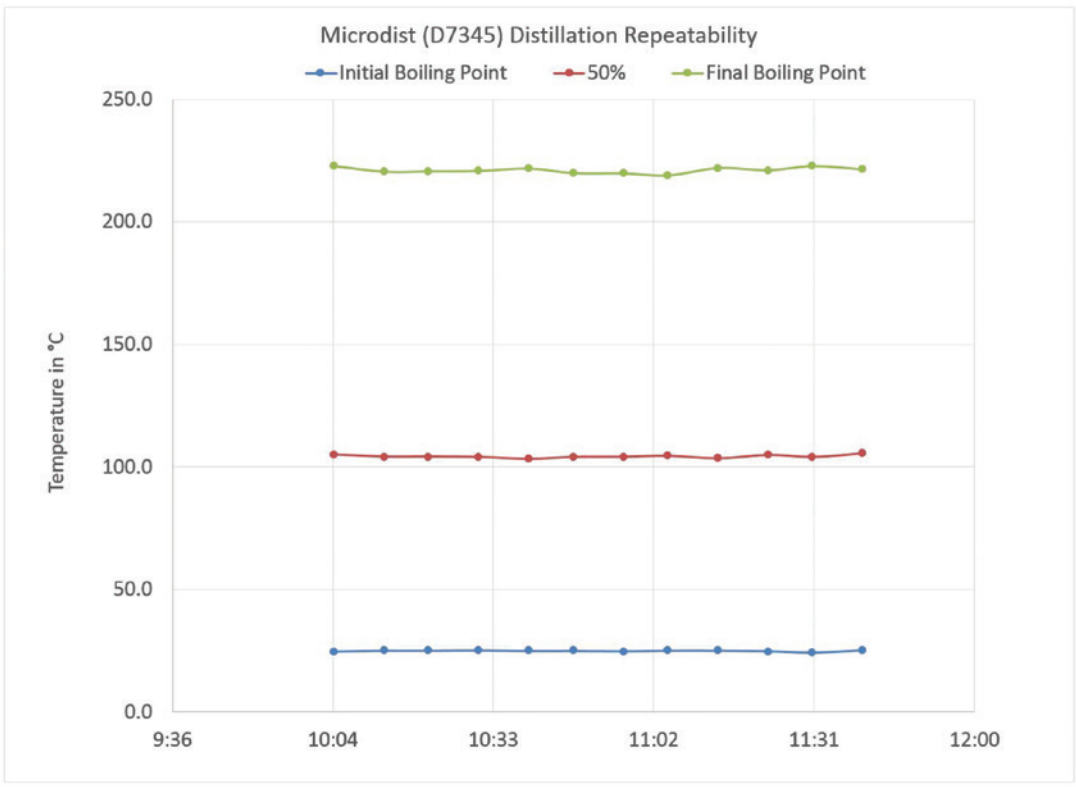

Illustration 2: The tests also showed a very high repeatability of micro distillation analysers for a typical gasoline sample. PAC's micro distillation analysers, MicroDist and PMD110, have a very fast cycle time, and can measure sample to sample within 10 minutes.