

Application Note

BENKE Rapid Distillation Process Analyzer rapiDist-4

Atmospheric Distillation Process Control with Advanced Distillation Process Analyzer Technology



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Crude oil processing in the atmospheric distillation tower is the first and most fundamental step in the petroleum refining process. The primary purpose is to separate crude oil into distillation cuts (distillation fractions) for further processing in the refinery. Understanding the fundamentals of the distillation process is critical to operate this refinery crude unit as economic and efficient as possible. Here the separation performance is measured by a gap-overlap comparison or by product property specifications, both usually based on the ASTM D86 distillation boiling points at 5% and 95% recovered volumes.

However, the ASTM D86 distillation boiling point measurement requires sample amounts of 100 mL that result in cycle times of about 45 – 50 minutes, which is nowadays often too slow for fast process control. To overcome this problem BARTEC BENKE developed with the rapiDist-4 analyzer a technical solution through miniaturization of core components. With this

distillation process analyzer it is now possible to achieve cycle times of e.g. 7-10 minutes for diesel without sacrifice measurement performance, while at the same time keep high closeness to the ASTM D86 procedure. With these features, it is the perfect choice for fast process control of atmospheric distillation columns.

Industry leading distillation analyzer technology

The rapiDist-4 analyzer uses an advanced optical imaging measurement technology that combines highly precise volume measurement with unrivaled robustness. The optical imaging device detects continuously, in real-time, the volume of distillate during the distillation process through detection of the meniscus in the receiver cuvette from 0% to FBP. The IBP is determined separately through an additional sensor in the receiver cuvette. This ensures the highest reliability and precision in measuring the IBP. The sample volume, dosed prior to each run, is measured in the dosing cuvette using the same optical imaging technique.

The result and resolution of volume measurement fully correlates with the requirements of ASTM D86. Another advantage of this measuring principle is the detection of the complete meniscus in the cuvette which, for the calculation of volumes, ensures precise, reliable and quality data even

in the presence of particles, drops and bubbles.

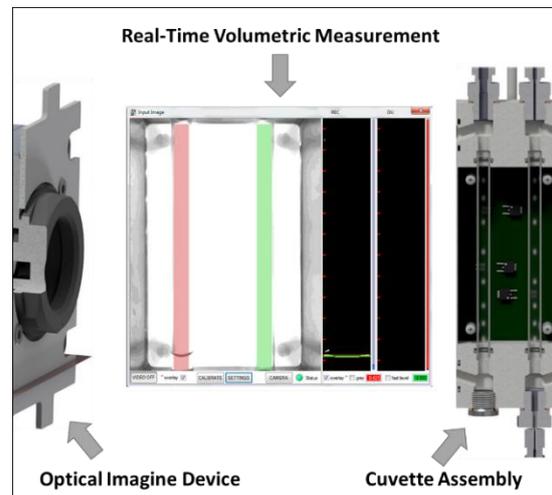


Figure 1: Real-time volumetric measurement of the recovered distillate.

Outstanding correlation with ASTM D86

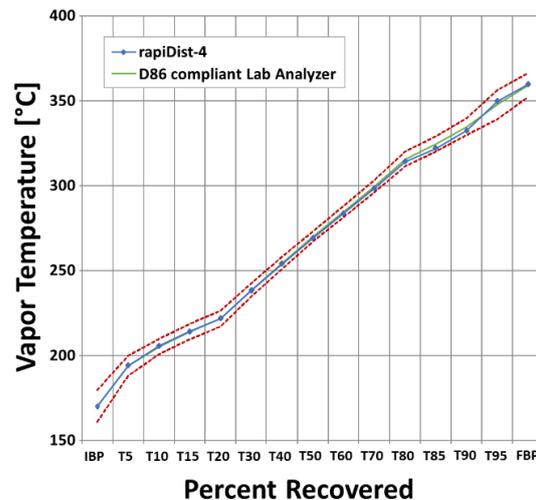
The rapiDist-4 analyzer provides real distillation measurement with true volume measurement resulting in outstanding correlation with the ASTM D86. Unlike other distillation process analyzers on the market, the IBP and FBP are directly measured by the rapiDist-4 and avoid the need for uncertain

extrapolations. Furthermore, there is no need for any timely and cumbersome recalibration when changing crude oil feedstock or changing sample composition regardless of product type: gasoline, naphtha, jet fuel, fuel oil, diesel fuel, petroleum products and other liquid hydrocarbons. This ensures perfect results

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from the first analysis even when samples are of unknown composition. The core distillation components of the rapiDist-4, i.e. dosing unit, vaporizer, condenser and receiver, are state-of-the-art components and are according to the design specifications set out by ASTM D86.

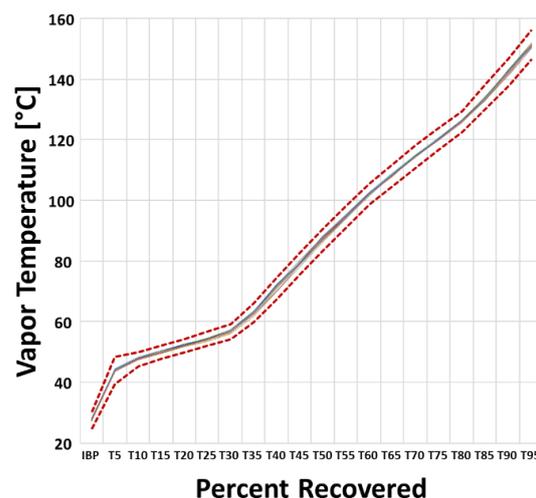
Figure 2: Outstanding correlation between the boiling curves of the rapiDist-4 analyzer and an ASTM D86 compliant laboratory analyzer measured for a diesel sample. Reproducibility limits according to ASTM D86 are marked as dotted lines.



Outstanding repeatability of boiling curves

To show the outstanding repeatability (r) of the rapiDist-4 analyzer evaluation runs were performed. For each sample type a minimum of 20 boiling curve replicates were measured and the obtained results were found to be all within the repeatability limits according to ASTM D86.

Figure 3: Overlay of 20 boiling curve replicates for a gasoline E5 sample measured with the rapiDist-4 analyzer. Repeatability limits according to ASTM D86 are marked as dotted lines.



A new level of system up time

Like all Bartec Benke process analyzers, the rapiDist-4 analyzer is designed to provide unmatched reliability and longevity. This is achieved by using only the highest quality components combined with high quality manufacturing under strict quality control. Thanks to the contactless volume measurement without moving parts, the analyzer provides industry leading robustness

and system uptime. A fully automated preventive de-coking procedure for flask regeneration significantly reduces required manual maintenance efforts compared to other D86 correlative analysis technologies. Finally, the analyzer is always on and ready to run as no recalibration is required when changing sample composition.

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A perfect alternative to Simulated Distillation Online GC

When comparing gas chromatographs (GC) solutions with distillation process analyzers like the rapiDist-4, one has to understand the differences in the analysis technology. The rapiDist-4 is capable of directly measuring the 5%, 95%, IBP and FBP with highest precision, as required by the ASTM D86. GC solutions merely extrapolate the IBP and FBP, while the 5% is in the steep section of the GC calibration curve, thus makes this important process parameter more uncertain. To handle changing input composition, especially in

blending processes, gas chromatographs require frequent and tedious recalibrations with laboratory samples, which adds another error source to the analysis. On the other hand, the rapiDist-4 does not require any recalibration or measurement correction using correlative equations. Overall, the rapiDist-4 analyzer shows significant advantages over GC solutions which makes Bartec Benke's advanced distillation process analyzer technology clearly the desirable solution.

Increased profits with advanced technology

Because of the large volumes produced in refineries, even small increments in the profit margin will help improving profitability. Therefore, the precise measurement of the IBP and FBP as well as the 5% and 95% recovered volumes with the rapiDist-4 analyzer significantly helps refiners to achieve these goals. Here the rapiDist-4 analyzer with its fast real distillation curve measurements prevents

product giveaway by improved control of distillation towers based on precise cutpoints determination.

With its minimal maintenance requirement combined with low running cost the rapiDist-4 shows in addition an unsurpassed low cost of ownership for a maximum return of investment.