

Monitoring Sulfur and Nitrogen in Diesel and Naphtha Products



FEATURES

- A highly robust design results in little to no downtime and requires minimal maintenance—which is generally dictated by internal quality requirements, not instrument service issues
- Fast analysis time of 1-5 minutes, real-time results, and integration with the plant DCS translates into a fast response time to irregularities in the product stream
- Real-time access to data reduces the number of required trips to the field
- Correlation to ASTM D4629, D5453, and D6667 means lab accuracy without the time lag of sending samples to a laboratory

APPLICATION

Diesel and Naphtha Hydrotreating Process

CHALLENGE

Diesel and Naphtha Hydrotreating Plants (DHT and NHT respectively) use hydrogen to remove the sulfur from diesel or naphtha fractions from refinery streams. When they receive the refined product, sulfur levels are normally around 1000 ppm of sulfur. As part of their process, the DHT and NHT units must remove the sulfur down to ≤ 10 ppm using a catalyst. Catalysts have a typical lifespan of 4-5 years.

It is not uncommon to have instruments from different manufacturers in the laboratory and the process. Unfortunately, the instruments often follow different methods, making determining reproducibility a challenge. A difference in reproducibility of 3-4 ppm between lab results and process results means the process needs to be adjusted to achieve 6 ppm. It's possible to remove sulfur to 6 ppm, but to do so means the DHT or NHT plant must adjust their entire process, which costs more. It also negatively effects the lifespan of the expensive catalyst. As such, operators of DHT and NHT plants want to keep sulfur levels as close to 10 ppm as possible. Therefore, they need to achieve tight correlation between lab and process results, and the best way to do this is to have systems from the same manufacturer using the same method in both the laboratory and process environments.

SOLUTION

The NSure elemental analyzer is ideal for accurate determination of nitrogen and sulfur in liquid streams at viscosities up to 10 cP at 100°C. Instead of the contamination-prone inject-and-hold method, NSure uses Antek's patented Pyro-chemiluminescence detection process. With Pyro-chemiluminescence detection, the sample does not need to be vaporized in a holding cell. Instead, a 2-5 μL sample is injected directly into the furnace.

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Another option designed specifically for high-viscosity applications is NSure’s heated valve kit, which helps to reduce the viscosity of the fluid prior to the measurement process. The temperature and the size of the sample loop, which is internal to the valve, can be adjusted as needed to optimize the analysis.



NSure Correlates with Antek Laboratory Analyzers (9000, MultiTek, & ElemeNTS)
 PAC’s Antek instruments are installed in thousands of laboratories around the world. While all the Antek lab instruments are still considered current and fully supported products, most customers are choosing to install the NSure in new installations. Because NSure is the next-generation system using the same method as other Antek instruments, the results are tightly correlated when one type of system is in the lab and the other is in the process.

Results

Recently, a test was conducted over an eight-hour period to determine accurate sulfur measurement in a 0-1 ppm range. The sample used was sulfur, with a liquid toluene solvent, at a 0.9 ppm concentration. The test demonstrated very tight correlation between lab and process tests, as show in Chart 1. Another test was conducted where multiple samples of varying concentration were analyzed on both the lab and process analyzers. The results in Chart 2 demonstrate that the reproducibility is well within ASTM D5453 limits.

Analyzer Stream Information	
Model	Nsure
Range (ppm)	0 - 1
Stream	1
Injection Time (mins)	3

Test Sample Data	
Solvent	Toluene
Solvent Phase	Liquid
Sample Type	Sulfur
Sample Concentration (ppm)	0.9

Statistical Test Data	
Mean (ppm)	0.65
Standard Deviation	0.01
Minimum (ppm)	0.60
Maximum (ppm)	0.69
% Relative Standard Deviation	2.07
% Full Scale	1.34
Test Run Time (hours)	8.0

Chart 1: Eight-hour repeatability test

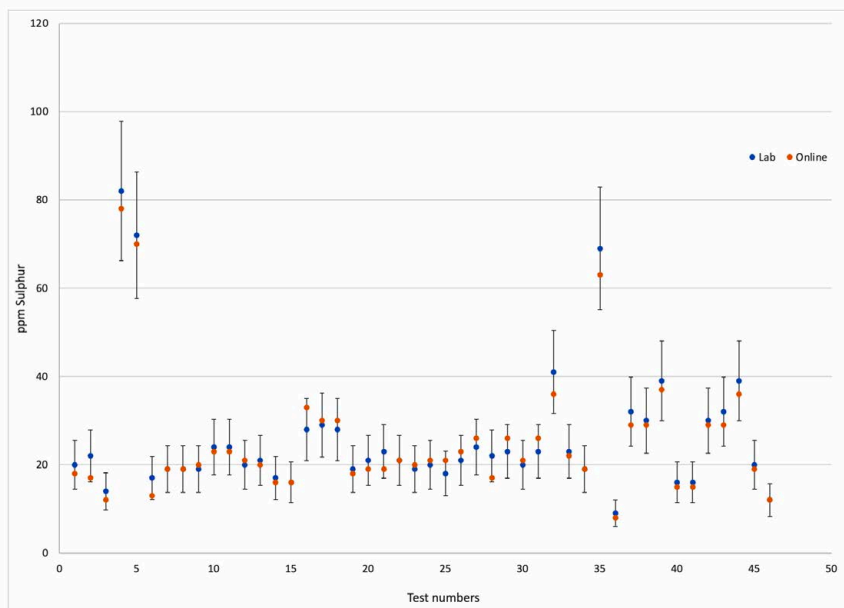


Chart 2: Multiple samples of varying concentration were analyzed on lab and process analyzers, demonstrating that the reproducibility is well within ASTM D5453 limits.

CONCLUSION

By using proven, laboratory-proven technology to qualify products, the NSure helps meet or exceed regulatory standards in the process environment, while operating close to specification limits to maximize profitability.