



Application Note AN-PAN-1026

Analysis of hydrogen sulfide and mercaptans derived from crude oil

Online determination according to ASTM D3227 and UOP163

Sulfur compounds in petroleum products not only have an unpleasant odor, but they are also environmentally damaging and promote corrosion. Desulfurization can occur at many points within a refinery – from the crude feedstock to the distillate streams. While lighter impurities (including mercaptans and sulfides) can be removed via hydrotreating, heavier sulfur compounds can be removed with hydrocracking after the hydrotreating process.

This Process Application Note details the online analysis of hydrogen sulfide and mercaptans by potentiometric titration. Many areas within the refinery can benefit from the implementation of a Metrohm Process Analytics **2045TI Ex proof Process Analyzer** with a customized sample preconditioning system to ensure the catalysts in the reactors are not exhausted and to limit corrosion in the distillation unit. The analyzer fulfills EU Directives 94/9/EC (ATEX95) and is certified for Zone 1 and Zone 2 areas.

Process Analyzer (Figure 2) with a customized sample preconditioning system could be implemented in many areas within a refinery to ensure that catalysts in the reactors are not exhausted and to limit corrosion

further on in the distillation unit. The analyzer fulfills EU Directives 94/9/EC (ATEX95) and is certified for Zone 1 and Zone 2 areas.



Figure 2. The 2045TI Ex proof Process Analyzer is certified for Zone 1 and Zone 2 areas.

APPLICATION

The mercaptan and H₂S content in crude oil is determined by a two-endpoint argentometric titration based on ASTM D3227 and UOP163.

Endpoint 1 corresponds to H₂S and endpoint 2 to the mercaptans.

REMARKS

Other online applications are available for the petrochemical industry such as: salt in crude oil, ammonia, phenol, bromide index, saponification

value, halogens, acidity, and many more in different areas of a refinery (e.g., water in crude desalting).

Table 1. Oil refinery measurement parameters

Parameters	Untreated crude oil	Treated crude oil
Mercaptans	100–500 mg/L	0–50 mg/L
H ₂ S	0–100 mg/L	0–1 mg/L

CONCLUSION

Crude oil contains several percent by weight of sulfur compounds. They not only have an unpleasant smell, but they are also environmentally harmful and corrosive which is why they must be largely removed during refining. The 2045TI Ex proof Analyzer with a flexible sample pretreatment system is the ideal

solution for a very wide selection of petrochemical refinery applications. This process analyzer fulfills EU Directive 94/9/EC (ATEX95) and is certified for Zones 1 and 2. The 2045TI Ex proof Analyzer monitors mercaptan and H₂S content in crude oil in accordance with ASTM D3227 and UOP163.

RELATED APPLICATION NOTES

[AN-PAN-1001 Online analysis of hydrogen sulfide and ammonia in sour water stripper](#)

[AN-PAN-1014 Online determination of salt in crude oil by automated process analysis](#)

[AN-PAN-1037 Online thermometric titration of acid number \(AN\) in oils \(ASTM D8045\)](#)

[AN-PAN-1047 Inline monitoring of water content in naphtha fractions by NIRS](#)

[AN-PAN-1052 Online process monitoring of octane number during catalytic reforming by NIRS following ASTM D2699 and ASTM D2700](#)

BENEFITS FOR TITRATION IN PROCESS

- Protection of company assets with built-in alarms at specified warning limits to prevent corrosion
- Safer working environment for employees (e.g., no exposure of operator to dangerous and explosive environments)
- Guarantee compliance with environmental standards



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CONFIGURATION



ADI 2045TI Ex proof Analyzer

The ADI 2045TI Ex proof Process Analyzer is used in hazardous environments where explosion proof protection is a critical safety requirement. The analyzer fulfills EU Directives 94/9/EC (ATEX95) and is certified for Zone-1 and Zone-2 areas. The analyzer design combines a purge/pressurization system with intrinsic safety electronic devices. The air purging phase and permanent overpressure prevents any potentially explosive atmosphere in the ambient air from entering the analyzer enclosure. The analyzer smart design avoids the need for purging large analyzer shelters and can be located at the production line in the hazardous zone.

Titration, Karl Fischer titration, photometry, measurements with ion selective electrodes, and direct measurements are all possible with this Ex-p version.