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EDXRF1942 - Metals in Crude & Residual Oil per ASTM D8252



Scope

The analysis of nickel (Ni), vanadium (V), and iron (Fe) in crude and residual oil per ASTM D8252 is demonstrated. The measurement also includes the analysis of sulfur (S) complying with ASTM D4294.

Background

The quality and grade of crude oil, in part, depends on the metal content as well as the sulfur content. Nickel and vanadium are critical metals, as well as iron in some crudes and residual oils, and the metal content is especially important in the quality of bunker fuels.

ASTM D8252 addresses the need to measure low levels of nickel and vanadium in crude to meet the new NYMEX/CME specifications for light sweet crude oil futures contracts concerning maximum allowable levels the Ni and V.

To meet the needs of the industry, Rigaku offers the [NEX QC+](#), a simple, versatile, and portable benchtop EDXRF analyzer for the analysis of sulfur in crude, residual oil, and marine fuels.

Units

1 ppm = 1 mg/kg

Calibration

Empirical calibrations were built using a suite of 12 commercially available calibration standards. A summary of the empirical calibrations is shown here.

Element	Concentration range
Ni	3 – 50 ppm
V	3 – 50 ppm
Fe	3 – 50 ppm
S	0.100 – 5.000 mass%

Repeatability

To demonstrate repeatability, samples were measured in a static position for ten repeat analyses with typical results shown below.

Sample: Std 10				
Element	Standard value	Average value	Std. dev	% Relative dev
Ni ppm	51	50.4	1.1	2.2
V ppm	5.0	5.67	0.37	7.4
Fe ppm	10.0	10.5	0.7	7.0
S mass%	4.501	4.564	0.022	0.5

Sample: Std 12				
Element	Standard value	Average value	Std. dev	% Relative dev
Ni ppm	30	29.7	0.8	2.7
V ppm	50	49.0	0.5	1.0
Fe ppm	5.0	4.54	0.48	9.6
S mass%	0.250	0.252	0.002	0.8

Sample: Std 3				
Element	Standard value	Average value	Std. dev	% Relative dev
Ni ppm	5	5.66	0.36	7.2
V ppm	30	31.0	0.4	1.3
Fe ppm	40	40.1	0.8	2.0
S mass%	1.000	1.003	0.002	0.2

ASTM D8252-19

In ASTM, little r is called repeatability and represents the precision of the measurement. Little r is 2.77 times the 1 σ standard deviation precision of repeat measurements. Comparison of NEX QC+ instrument r to the method r of D5282 shows NEX QC+ complies with the ASTM method for the measurement of Ni and V in crude and residual oil.

Units: mg/kg (ppm)					
Element	Standard value	Average value	Std. dev	Instrument r	D8252-19 r
Ni	5.0	5.66	0.36	1.0	1.1
V	5.0	5.67	0.37	1.0	1.0

Conclusion

The performance shown here demonstrates the ability of the NEX QC+ for the measurement of metals in crude and residual oil as per ASTM D8252 and sulfur in compliance with D4294. The simple user interface and low maintenance requirements of the NEX QC+ allows operators of all skill levels to use and maintain the equipment.

Related products



NEX QC Series

Combines quality, affordability, and performance for a wide range of applications