ElvaX Sulfur in Oil analyzer

Introduction

ElvaX Sulfur in Oil was designed especially for analysis of petrochemicals for sulfur content in wide concentration range from 1 ppm to 5%. Many international standards describes analysis method for sulfur in fuel and oil. ElvaX Sulfur in Oil analyzer fully complies requirements of ASTM D4294, ISO 20487, IP 496.

Due to low detection limits (down to ppm level) and minimal required sample preparation ElvaX Sulfur in Oil analyzer is an ideal tool for petrochemical analysis.

Application

Sulfur in automotive fuel. Sulfur forms damaging sulfates in vehicle exhaust and pollute the atmosphere by sulfur oxides. Furthermore sulfur reduces fuel stability and effects on engine performance.
Maximum permissible level of sulfur in fuel decreases from year to year. 2003/17/EC (or EURO VI) directive requires a maximum amount of sulfur in fuel of 10 ppm.
Measurement of so low sulfur concentration is a simple task for ElvaX Sulfur in Oil analyzer.

Instrumentation

ElvaX Sulfur in Oil analyzer is a benchtop energy-dispersive x-ray fluorescence spectrometer. It equipped with 40 kV Silver anode tube and large area Fast Silicon Drift Detector (FSDD), which provides excellent energy resolution, low detection limits and high productivity.

Silver anode x-ray tube prevents line overlaps with chlorine and sulfur and performs lower chlorine detection limit compared to rhodium or palladium anode tubes.

ElvaX software has a user-friendly interface and requires minimal operator training.

Method

Petrochemical products analysis doesn't require any sample preparation without weighing or volumetric measurements. Liquid samples are poured into the sample cells and assembled with a thin Ultralyne © film.

Several oil standards were used to calibrate spectrometer for sulfur.

Calibration was made for several concentration ranges: 0 to 100 ppm, 100 to 1000 ppm, 0.1 to 1.5% and 1 to 5%.

Measurement time was 180 seconds. Anode voltage in main mode was 7 kV without primary beam filter.

Results

1. Calibration curves.

   Figures 1-4 shows the correlation curves sulfur in oil for various concentration ranges. This data was approximated with linear function. R^2 is the coefficient of determination which shows how closely lab and XRF results correlate to each other. An ideal correlation would have an R^2 value of 1.

   Obtained results indicate a good correlation between certified and measured concentration values.
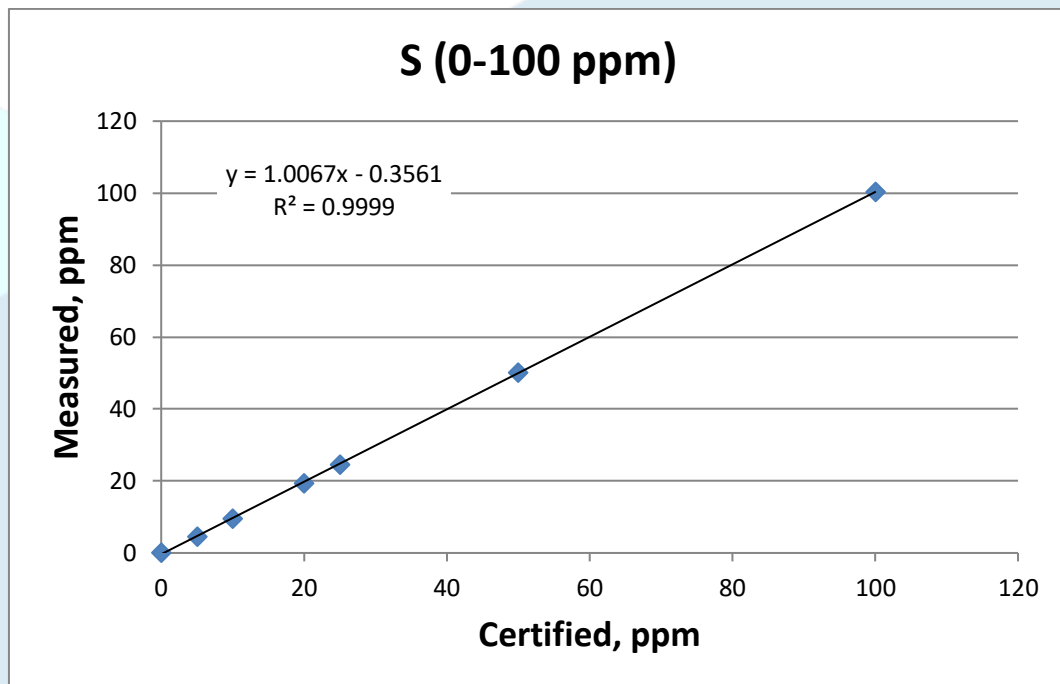

Figure 1. Correlation curve for sulfur in oil from 0 to 100 ppm concentration range.
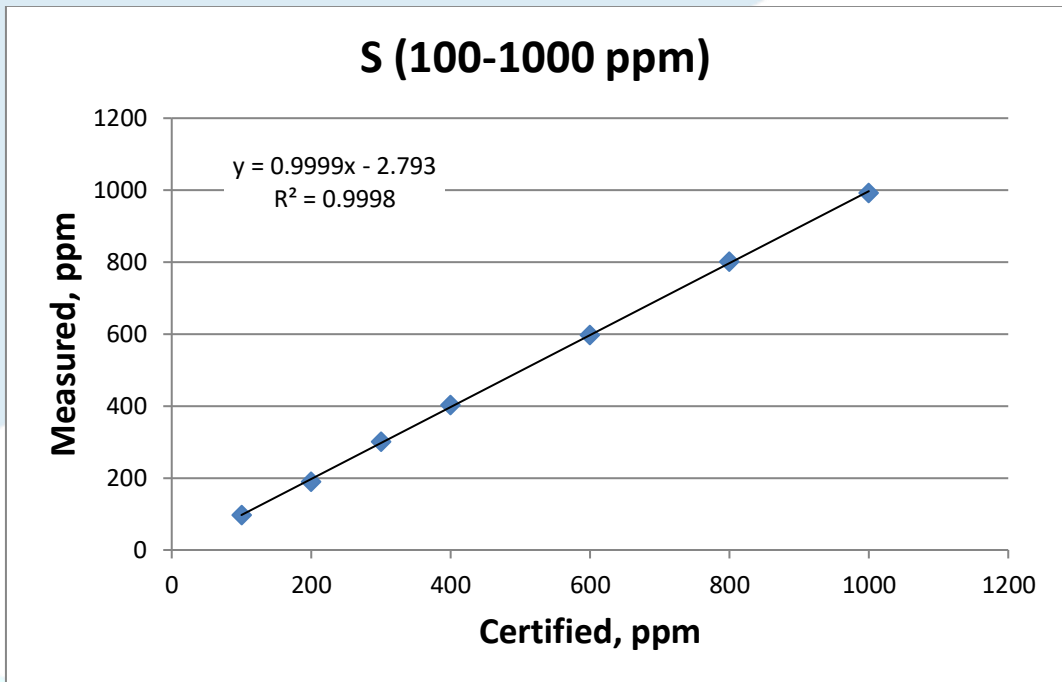
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Figure 2. Correlation curve for sulfur in oil from 100 to 1000 ppm concentration range.
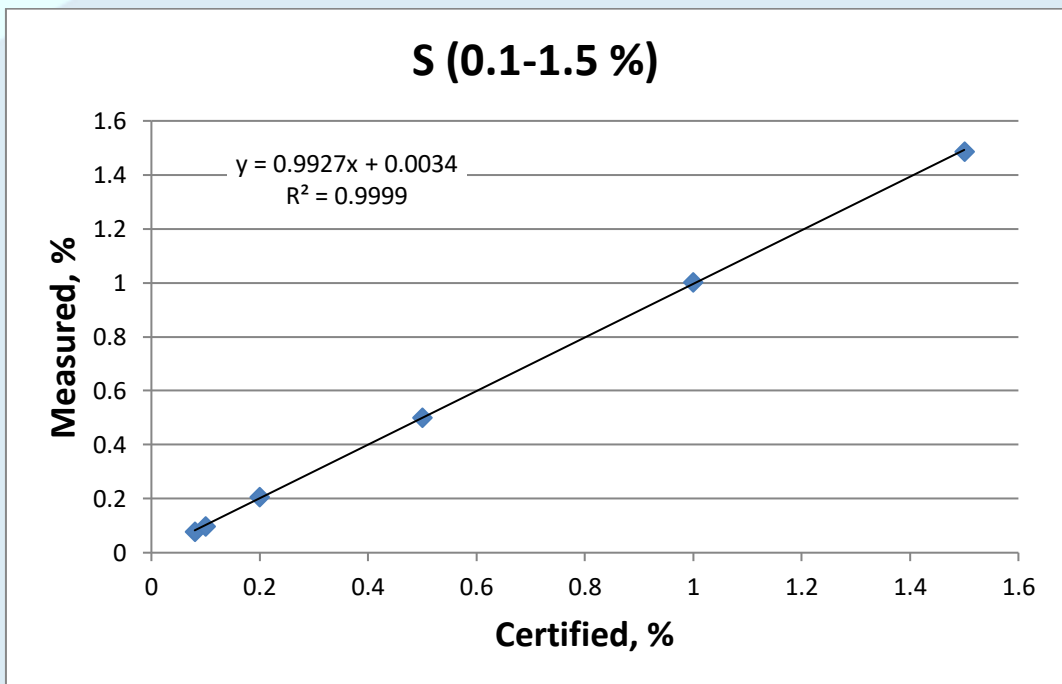

Figure 3. Correlation curve for sulfur in oil from 0.1 to 1.5 % concentration range.
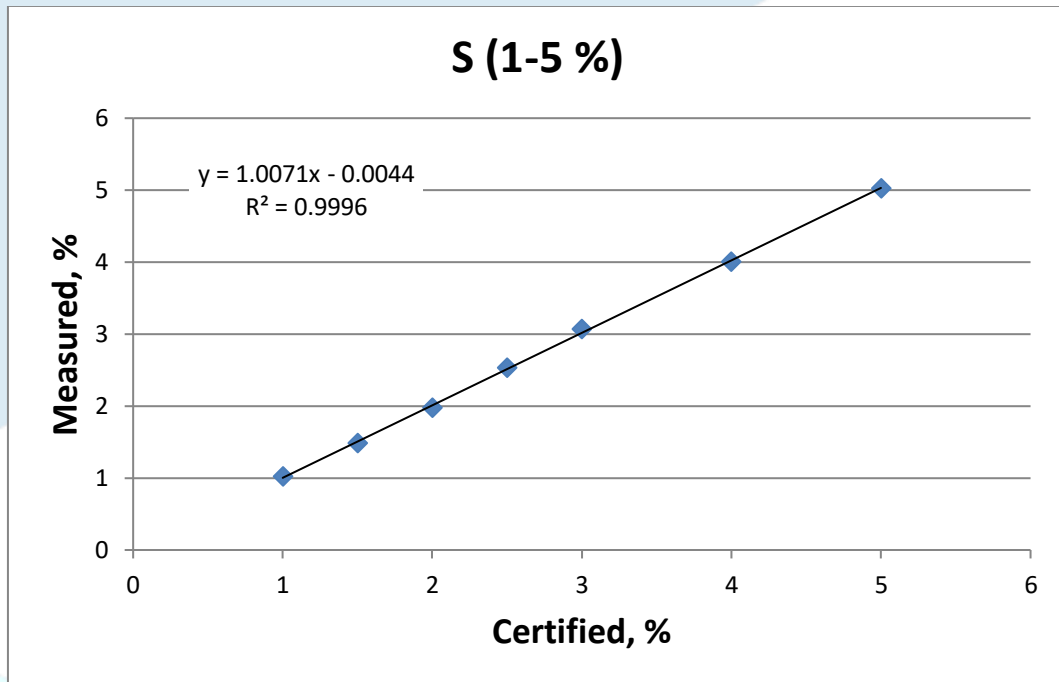
Figure 4. Correlation curve for sulfur in oil from 1 to 5 % concentration range.

2. Detection limit.
   Detection limit was obtained as 3 sigma and it is **1.6 ppm** for 10 minutes measurement time.

3. Repeatability.
   Another important parameter of XRF device is the repeatability of the analysis. The sample of oil containing around 10 ppm of sulfur was measured 10 times over a period of time. An average, standard deviation (Std Dev) and relative standard deviation (RSD) for sulfur content was calculated from this data. Results are given in

   Table 1.

measure #	S, ppm
1	9.3
2	8.9
3	8.7
4	9.6
5	10.7
6	9.4
7	11.1

4

8	9.7
9	8.7
10	9.7
Average	**9.6**
Std Dev	**0.6**
% RSD	**6.25**

Table 1. Repeatability test for oil sample containing around 10 ppm of sulfur.

Conclusions

Obtained results indicate a good correlation between certified and measured concentration values for sulfur in wide concentration range (from 1 ppm to 5%).

ElvaX Sulfur in Oil analyzer covers stringent international test methods, such as ASTM D4294, ISO 20487, IP 496.

Detection limit for sulfur reaches 1.6 ppm.

Due to excellent precision, high performance, ease of use and cost-effectiveness ElvaX Sulfur in Oil analyzer became a perfect instrument for sulfur in petroleum products analysis from ppm to % concentration range.

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