

LAB-X5000



The LAB-X5000 benchtop analyzers present many advantages:

- | **Compact and robust:** ideally suited in a plant's on-site lab, or in a mobile testing lab
- | **Easy to use:** reliable results with minimum operator training
- | **Results in minutes:** fast incoming product acceptance/rejection, and consistent final product quality

LAB-X5000 for the rapid determination of sulfur in used cooking oil

INTRODUCTION

With the introduction of biofuel mandates in many countries to help reduce greenhouse gas emissions and progressively replace fossil fuels, the global market for road and marine biodiesel is expected to grow significantly in the next 10 years.

The main feedstocks for the production of biofuel are soybean and rapeseed. Because of the pressure this puts on agriculture, alternative sources are increasingly used, such as waste cooking oil from restaurants, hotels, and other large institutions with catering facilities.

Waste oil collection companies pick up the used cooking oil, and transport it to the processing plant where the oil is tested, cleaned (to remove impurities such as water and salt), and converted into biofuel. This in turn will be sold to refineries for the production of biodiesel blends.

It is important to analyse the oil on arrival at the plant to ensure it meets purchasing specifications: for example, if the sulfur level is above the agreed concentration (e.g. 50ppm), the oil is either rejected, or its selling price significantly decreases.

USED COOKING OIL ANALYSIS MADE EASY

With the Hitachi High-Tech LAB-X5000 EDXRF benchtop analyzer, the analysis of used cooking oil couldn't be easier. Once the LAB-X is calibrated, routine analysis is carried out by pouring the oil into a sample cup (see Sample Preparation), placing the cup in the instrument's analysis port and pressing a button to start the measurement. Preliminary results are displayed within seconds on the analyzer's large, industrial LCD touchscreen, showing the sulfur content. Pass/Fail messages can also be setup for fast incoming product acceptance/rejection decision, and clear assurance that the final product meets sulfur content specification.

The LAB-X5000 is calibrated by measuring a series of assayed

samples or reference oil standards. Setting-up samples (drift correction monitors) are measured at the time of the calibration, and again in the unlikely event that the analyzer drifts, so there is no need to source calibration standards again or re-measure them, saving both time and money.

The combination of a high-resolution detector and optimized calibration parameters ensure that you get results you can trust. Built-in atmospheric compensation delivers reliable analysis without the need for helium, minimizing the cost per analysis while retaining optimum measurement stability.

The analyzer includes several features that help protect against potential damage caused by sample spills or leaks, minimize downtime and prevent costly repairs: an easy-to-replace safety window is used under the sample cup to retain any accidental spill or leak, and the analyzer's turntable only places the sample above the X-ray tube and detector for the duration of the analysis, significantly reducing the risk of damage or contamination to critical components.

With up to 100,000 results stored on the analyzer itself, operators can view new and old results easily, print them on the optional integrated printer for a hard-copy record, download them on a USB memory device as a CSV file, and upload them to our ExTOPE Connect cloud service or a local server via Wi-Fi for real-time access to the data anytime, anywhere.

SAMPLE PREPARATION

The sample preparation involves heating the used cooking oil in an oven to ensure it is fluid, and then centrifuging it to separate the oil from water and other contaminants. Take a sample from the top one third of the centrifuged oil and pour into a sample cup fitted with Poly-M film. Place the cup in a safety window (also fitted with Poly-M film) in the LAB-X5000's analysis port, and press the Start button.

PERFORMANCE AND RESULTS

For this application, the LAB-X5000 was calibrated by measuring a series of mineral oil samples with known sulfur content to establish the relationship between the sulfur concentration and its X-ray signal. A matrix correction was applied to allow the analysis of a wide variety of oils.

Table 1 shows the typical calibration performance the LAB-X delivers for the determination of sulfur in oil.

The limits of detection (LOD) were calculated from the results of 10 repeat measurements of a base mineral oil sample and the precision from 10 repeats of samples containing different levels of sulfur. The analysis time was set to 300 seconds.



Sample introduction



Starting the analysis

A screenshot of the analyzer's results screen. At the top, it displays the date and time '07-10-2020 13:41' and the test name '0-150ppm S in oil'. Below this is a table with the following data:

Element	Concentration	Unit	Pass/Fail
S	134.0	mg/kg	Fail

At the bottom of the screen, there are icons for printing and a graph.

Results screen

Table 1: Typical calibration performance for the analysis of oil samples (air path)

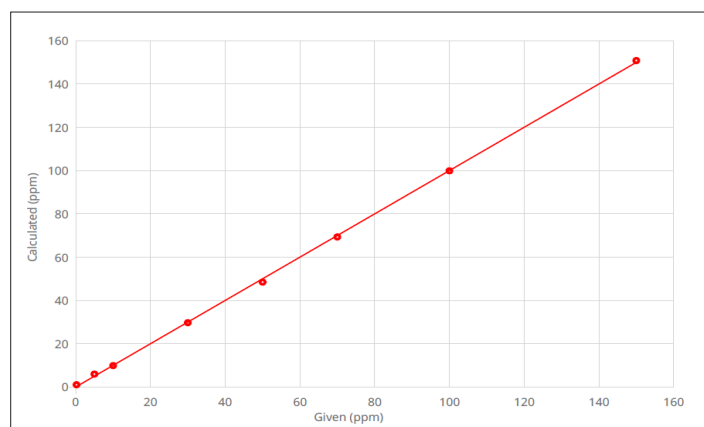
Analyte	Calibration range (mg/kg)	Standard error of calibration (mg/kg)	Guaranteed limit of detection (3σ) (mg/kg)	Limit of quantification (10σ) (mg/kg)	Precision (95% confidence) (mg/kg)
S	0 – 150	3	4	12	2.7 at 10
					2.2 at 50
					2.9 at 100

To obtain lower limits of detection (LOD) and quantification (LOQ), and increased precision, longer measurement times can be used (to halve the LOD and LOQ, you need to increase the measurement time by a factor of 4). Alternatively, you can use a Helium gas purge. This is required when measuring sulfur levels below 15 mg/kg (see performance in Helium in Table 2).

Table 2: Typical calibration performance for the analysis of oil samples (Helium path)

Analyte	Calibration range (mg/kg)	Standard error of calibration (mg/kg)	Guaranteed limit of detection (3σ) (mg/kg)	Limit of quantification (10σ) (mg/kg)	Precision (95% confidence) (mg/kg)
S	0 – 150	1	1.5	4	1.0 at 10
					1.2 at 50
					1.3 at 100

Graph 1: Calibration graph for Sulfur in oil (air path)



SUMMARY

Once calibrated, Hitachi High-Tech's LAB-X5000 provides cost-effective, rapid and accurate determination of sulfur in used cooking oil, enabling operators to make decisions fast on incoming products and ensure a consistent final product quality. The analyzer's ease of use and ruggedness make it an ideal quality control tool close to the production line or in the plant's laboratory, delivering results within minutes for maximum productivity.



ORDERING INFORMATION

The instrument configuration and accessories used to produce the data in this application note are included in the following packages:

- LAB-X5000 "Sulfur in oils and fuels" package (P/No. 10010087)
- LAB-X5000 "Low sulfur in oil (Helium)" package (P/No. 10024525) for sulfur content below 15 mg/kg

Visit www.hitachi-hightech.com/hha for more information.

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