



Measurement of Sulfur and Chlorine in Petroleum Products  
using Monochromatic, Polarized EDXRF Analysis



- The MESA-7220 now features an 8-tray turntable. Programmable to run samples in different calibration curves during measurement testing.
- The new turntable has a quiet and robust stepper motor with faster rotation between sampling.
- Simultaneous analysis of sulfur and chlorine
- ASTM 7220 Pooled Limit of Quantitation (PLOQ) of 3 ppm sulfur in a wide variety of fuel types
- Compact, field-proven EDXRF technology
- Integrated electronics and computer
- Vacuum based system, no purge gases required
- Also available in a single-holder configuration

Superior to other X-ray technologies

# MESA-7220

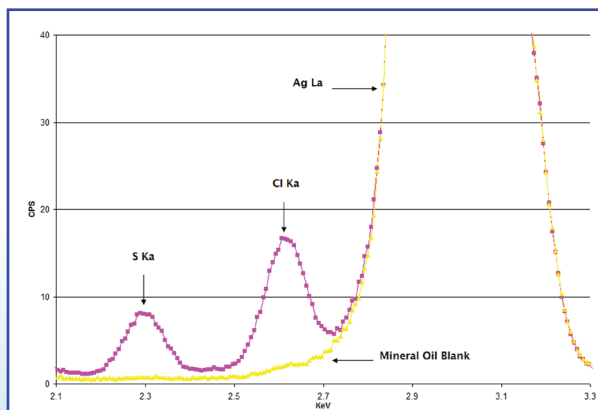
## Multi-Element Analyzer Using EDXRF Technology

The MESA-7220 delivers the latest innovation in field measurement of sulfur and chlorine in petroleum-based products.

The MESA-7220 is based on the latest advances in Energy Dispersive X-ray Fluorescence (EDXRF) technology. It utilizes a proprietary X-ray optical technology and produces a polarized, monochromatic X-ray source. This approach is critical for a user to achieve an ultra low noise background for the best limits of detection for sulfur and chlorine. This provides excellent performance at high concentration (multiple wt.% levels), simultaneous multi-element analysis and applicability over a wide range of sample types, and excellent low ppm capabilities.

The versatile MESA-7220 can be used in a wide range of applications for sulfur and chlorine in the range of 1 ppm - wt. % levels. It automatically corrects for interferences coming from matrix differences or interfering elements. The MESA-7220 performance is well established, as it is compliant with ASTM and ISO International Sulfur Determination Norms:

ASTM D7220	EN ISO 8754
ASTM D4294	EN ISO 13032
ASTM D4929-C	EN ISO 20847
IP 532	



This spectrum illustrates the separation of sulfur and chlorine using the MESA-7220.



### Key Features

- Simultaneous elemental analysis.
- One calibration – for multiple petroleum matrices over a wide dynamic range.
- Dynamic Analysis Range:  
Sulfur: 0.7 mg/kg – 10.0 wt%  
Chlorine: 0.6 mg/kg – 10.0 wt%
- Various sample types including liquids, solids, pastes, powders, films, and pellets.
- No purge or combustion gases required.
- Correction for oxygen interference that can effect sulfur results significantly in other analyzers.
- User defined measurement times (90 - 600 seconds.)
- Single digit ppm repeatability achieved on low level samples.
- Multiple Calibration Curve capability with easy storage and retrieval for matrix matching.
- Rugged, user serviceable Kapton Windows.
- Multiple external outputs: Printer, serial I/O, USB (2) and network (RJ-45), (2) USB ports, side and back. PS2 connects, ports for mouse and keyboard, ethernet connections.)
- Accurately measures sulfur and chlorine in the presence of moisture.

# Designed for Easy Operation

The MESA-7220 is a compact and lightweight analyzer that can readily measure sulfur and chlorine content in petroleum products down to ppm levels in just 3 minutes.

The optical path is under vacuum, so no helium or nitrogen purges are required.

The instrumentation requires only a stable source of electrical power (100/250 VAC). No other utilities or gases are required for this nondestructive and non-combustion based monochromatic, polarized EDXRF technique.

The apparatus features a large, responsive touch screen display that is easy to use. Sample analysis is performed with minimum input.

Sample preparation and handling are made easy by the use of Mylar® film covered disposable plastic sample cups. This allows the instrument to be used by trained laboratory technicians, not scientists.

A powerful on-board computer enables a full line-up of data handling, printing, and processing features. These greatly aid in the implementation of data transfer to assure compliance with good laboratory practice requirements.

To ensure operator safety, the instrument has an automatic control that reduces the power to the X-Ray tube anytime the sample compartment is opened.

Optimum X-Ray tube performance is monitored by an integrated, self testing scheme that is initiated each time a sample analysis is started.



## Easy to use Software

- Multitasking dual functioning screen
- An intuitive touch screen based, user interface.
- Creation of an unlimited number of calibration curves.
- Password protected for supervisor setup only.
- Spectral display of final analysis.
- On screen diagnostics for all operating parameters.
- Unlimited data storage.
- Critical calibration curve information and plot displayed.
- Easy to view results and all statistical information.

# Features and Benefits

## *The Technology*

The MESA-7220 features a unique, patented design with a close-coupled, doubly curved HOPG X-ray optic. It simultaneously polarizes, focuses, and mono-chromates the X-ray beam. This yields the ideal X-ray source for measuring chlorine and sulfur. This technique creates an environment with ultra-low background radiation similar to other optics-based X-ray analyzers. It has the added advantage that it retains the EDXRF benefit of allowing for simultaneous analysis of sulfur and chlorine.

## *New! Eight Tray Turntable*

The MESA-7220 now features an eight tray turntable. This new feature can be programmed to run samples in different calibration curves during measurement testing. The turntable has a quiet and very robust stepper motor which has a much faster rotation between sampling compared to the older DC Gear Motors.

## *Field Rugged*

The MESA-7220 was developed from a rugged line of ship based marine fuel and oil analyzers. It is ideally designed to meet the challenges of demanding environments such as pipelines, terminals and refineries.

## *User-Friendly Design*

The MESA-7220 seamlessly analyzes sulfur and chlorine levels from single digit ppm to wt. % levels. The unique polarized, monochromatic excitation technology automatically corrects for oxygen content that effects the accuracy of other X-ray analyzers. From the high resolution integrated display, to the intuitive user interface, the operator will recognize this is a product built with the needs of the user in mind.

## *Proven Applications*

The MESA-7220 will easily measure ppm levels of chlorine in the presence of wt. % levels of sulfur delivering answers for both elements in one analysis. This eliminates the need for two independent test procedures, or worse yet, two analyzers. This unique technology corrects for the high oxygen levels in biofuel samples.

## *Outstanding Global Service*

Every MESA comes with the global service and customer applications support you expect from HORIBA products. U.S. locations are listed below for reference.



9755 Research Dr.  
Irvine, California 92618  
800-446-7422

554 Anderson Dr., Unit A  
Romeoville, Illinois 60446  
815-372-9076

5390 Bay Oaks Drive  
Pasadena, Texas 77505  
281-482-4334

20 Knightsbridge Road  
Piscataway, New Jersey 08854  
732-494-8660

# A Fast and Accurate Method for the Determination of Sulfur in Real World Petroleum Applications

## Sulfur Measurement in Fuel Products

With U.S. Federal and international regulations becoming increasingly stringent, the need to determine the sulfur content of petroleum oils and fuels is a critical issue. In crude oil, sulfur can be present in concentrations up to 5% by weight. The distillation of fuel products from these crude oils will produce products containing varying concentrations of sulfur. Hazardous air pollution is caused by sulfur oxides coming from the burning of sulfur containing fuels. In addition, there are harmful effects on engines, when they are being operated with fuels containing more sulfur than these permitted levels. It is, therefore, essential that sulfur concentrations be closely monitored and controlled in all petroleum products.

Energy Dispersive X-Ray Fluorescence (EDXRF) is a well established technique for the analysis of sulfur in petroleum products. The analysis requirements for these techniques are established through international standards such as ASTM 4294, ASTM 7220, and prEN ISO 13032.

To meet these tough requirements for the measurement of sulfur in automotive fuels and other petroleum products the MESA-7220 is becoming the method of choice. The table below demonstrates the analytical performance of the MESA-7220 for the determination of sulfur in several different product types.

A variety of contemporary petroleum products were analyzed in a 5 lab ruggedness study with the results illustrated on the right. Materials analyzed included:

- Ultra low sulfur diesel (ULSD) straight run gasoline and RFG
- Diesel
- Kerosene / Jet Fuel
- Biodiesel/Biodiesel Blends
- Transformer Oil/Hydraulic Oil
- Crude Oil
- No. 2 Home Heating Oil

The study results demonstrate excellent reproducibility for all materials tested.

## Equivalency

In order to determine how the MESA-7220 results would compare to established techniques, samples were analyzed by both the MESA-7220 and an ASTM D5453 instrument. The results on the right demonstrate that the MESA-7220 produced very comparable results.

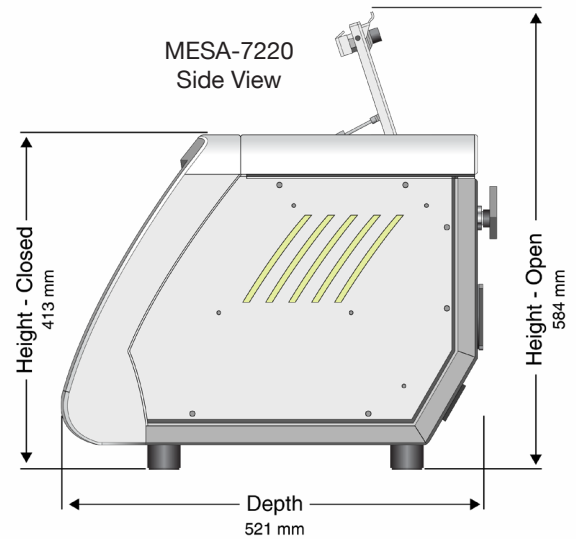
Sample Type	LAB 1	LAB 2	LAB 3	LAB 4	LAB 5
Diesel Low S	5	6	6	6	6
B-11 (Diesel)	9	10	8	8	12
Gasoline E10	35	35	35	36	37
Diesel Low S	3	4	3	3	5
B20 (Diesel)	5	7	6	6	9
Transformer Oil	34	33	32	31	34
Kerosene	234	233	236	237	240
Jet A	446	441	440	435	449
HFO	941	938	936	921	953
Jet B5	433	429	429	425	437
Hydraulic Fluid	508	508	500	498	510

Sample Type	ASTM D5453	MESA-7220
Gasoline	39.2	35
Diesel	7.3	8.8
Kerosene	226	231
E85	6.4	5.0
RFG	33.1	34
Jet A	437	437
ULSD	7.9	8.0
Transformer Oil	38	35
B100	1.5	2.2
Crude Sweet	3600*	3603
Crude Sour	1.03%*	1.23%

\*Data was collected using ASTM D4294 Methodology.

# Specifications

Instrument Dimension	Inch	mm
Width	12.75	324
Depth	20.50	521
Height (Closed)	16.25	413
Height (Open)	23.00	584
Feet (Side to Side)	10.75	273
Feet (Front-to-back)	13.00	330



<b>X-Ray Tube</b>	Pelletier-cooled, Ag anode X-ray tube; 0-12.5kV; 0-2mA	
<b>Polarizing Mono-chromater</b>	Closed-coupled, doubly curved HOPG crystal reflects Ag Ka radiation for optimal excitation of S and Cl.	
<b>Si drift Detector</b>	Stable peak positions and spectral resolution (<150 eV) up to an input count rate of 200 kcps.	
<b>Dynamic Range</b>	1.0 mg/kg - 10% (wt/wt) - (1 ppm - 100,000 ppm). The sample chamber is under vacuum to enhance sensitivity.	
<b>Vacuum Chamber Window</b>	User replaceable 7.5 mm Kapton window. The detector is also protected by a replaceable safety window between it and the sample cup window.	
<b>Sample volume</b>	5 mL	
<b>Included Accessories and Options</b>	<ul style="list-style-type: none"> <li>• Printer</li> <li>• Keyboard and mouse</li> </ul>	
<b>Software</b>	<ul style="list-style-type: none"> <li>• Create unlimited number of calibrations.</li> <li>• On screen diagnostics of all operating parameters.</li> </ul>	<ul style="list-style-type: none"> <li>• An intuitive touch screen based, user interface.</li> <li>• Ability to easily add new functionality.</li> </ul>
<b>Operating Requirements</b>	<ul style="list-style-type: none"> <li>• Nominal input voltage: 120-240 V +/- 10%AC, 50/60Hz, 125W</li> </ul>	<ul style="list-style-type: none"> <li>• Ambient operation temperature: -25° C to 40° C</li> <li>• Relative humidity at 25° C (77°F): 0 to 95%</li> </ul>
<b>Computer</b>	<ul style="list-style-type: none"> <li>• Simple, touch screen interface with a sealed, field-hardened 8.4" screen (800 x 600 px)</li> <li>• Password protected, keyboard driven interface for supervisor setup.</li> <li>• Direct web customer support capability.</li> </ul>	<ul style="list-style-type: none"> <li>• Powerful Pentium processor, embedded Windows OS</li> <li>• 480 GB hard drive and 500 MB of RAM.</li> <li>• Multiple USB port connectivity for a mouse and keyboard.</li> </ul>
<b>Weight</b>	<ul style="list-style-type: none"> <li>• 21kg (45 lbs.)</li> </ul>	



Please read the operation manual before using any of these products to ensure safe and proper operation.

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