

## Versatile, Cost-Effective Solutions for Your Sulphur Analysis Needs – Introducing Petro-Pak™

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Introducing the Rigaku "Energy Suite" of total petro refinery solutions, designed to meet your every sulphur analysis and elemental characterisation need.

Hallmarks of Rigaku products are well-engineered instruments with high reliability and long-term stability. The easy-to-use and easy-to-learn, intuitive software interface controls elegantly designed, sophisticated underlying programs that seamlessly model complicated physical phenomena and deliver net intensity data that allows you to determine the most accurate and precise sulphur values for your materials.

This level of accuracy and precision allows for more stringent product control, which in turn translates into tighter cost control and increased profitability.

Rigaku is building solid partnerships with petroleum industry leaders to address the global challenges they face. At a time when demand for cleaner-burning fuels is peaking and quality of crude oil feedstock is tapering off, petroleum refiners are challenged daily to find cost-effective methods to implement greater efficiencies in dealing with these two conflicting demands. The Rigaku Petro-Pak Application's Suite is designed to help you meet these demands with reliable, accurate data that is validated and continually monitored, helping run refineries at optimum performance.

### Announcing the Petro-Pak™ Application Package

Designed to run on all Rigaku WDXRF instruments, Petro-Pak includes installation CD with optimised analytical settings and parameters, calibration data for specific ASTM and ISO methods, drift monitor standards and procedure to keep the method in specification, and Validation Certified Reference Materials to independently validate the calibration accuracy. The kit includes a starter set of cups and film, and a comprehensive manual that covers installation qualification, operation qualification and performance qualification modules. This information can fulfil the role of standard operating procedures in your laboratory.

ASTM and ISO compliant methods are the backbone of our Petro-Pak application package, which is designed to cover the whole range of products manufactured in today's modern refinery and lube oil manufacturing facility. If you have to guarantee your product, use our instruments for peace of mind because they are reliable and accurate, easy to validate and require minimal maintenance to keep them in operating specifications.

In addition, Rigaku offers several unique software features that expand the scope of the analysis into the world of accurate semiquant analysis using our unique Scatter FP procedure. With highly accurate modelling of real world phenomena, this method attains levels of accuracy not previously available for these materials.

### Introducing the ZSX Petro

The ZSX Petro WDXRF spectrometer\* is powered specifically to handle volatile liquid samples with the highest sensitivity, while maintaining the integrity of the sample during the analysis time window.

The ZSX Petro is a cost-effective variable-power WDXRF instrument with the full complement of analytical features necessary for all of the routine analyses that today's petroleum refinery laboratory needs to carry out. Whether you are characterizing the sulphur content of incoming crude oil at weight percent levels or qualifying final product sulphur content for the full product line of gasolines, diesels, naphthas, kerosene and jet fuels at single digit ppm levels or weight percent levels of sulphur, the ZSX Petro will handle the analyses with minimal operator intervention. Just set it up and leave it to do the work.

Precise, reproducible data are the trademark of the ZSX Petro XRF. The performance exceeds the guidelines



FIG 1. ZSX Petro WDXRF

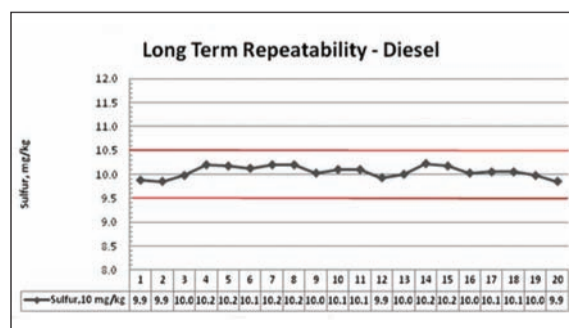


FIG 2. Plot of long term repeatability for sulphur in diesel over 20 days showing ASTM D2622-2008 limits (red lines)

set out by the ASTM procedures by a sizeable margin, enabling very tight process control from 1 ppm to 5 wt% sulphur.

\* Currently only available in North American market

### Supermini

This powerful benchtop WDXRF instrument can serve as the reserve or overflow unit in your refinery laboratory, or it can serve as your primary ASTM 2622 compliant WDXRF spectrometer at remote or satellite sites.

If high-volume throughput is not your primary concern then this benchtop instrument is a very cost-effective method of getting top-class analytical capability and compliance in a reasonable analysis time. The Supermini, with its multi-position sample changer and intuitive software, will make a welcome ally in your daily sulphur analysis routine. It can be set up quickly to perform these important analyses and be left unattended while the analyst takes care of more labor-intensive analytical tasks.



FIG 3. Supermini WDXRF

Results can be sent directly to the Laboratory Information Management system for process control feedback or for reporting purposes. The reliable Rigaku Petro-Pak software will ensure that your results are validated and flag any out-of-specification data that is encountered. The system helps make you more productive and enhances the reliability and speed of your analytical feedback to process control. This gain in efficiency translates directly into bottom-line profits.

Supermini Performance Data

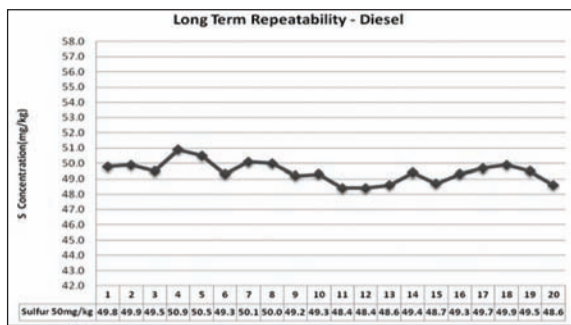


FIG 4. Plot of replicate analysis over 20 days vs mg/kg sulphur with ASTM D2622-2008 limits (red lines)

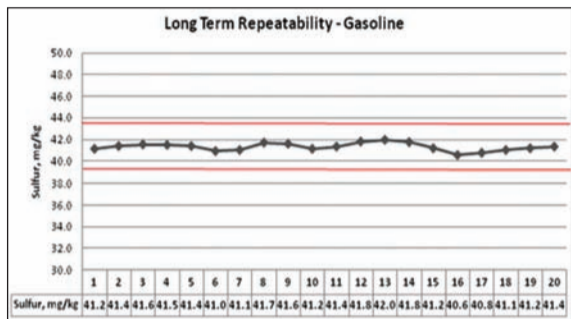


FIG 5. Plot of replicate analysis of NIST 2294 - 40.9 mg/kg sulphur over 20 days vs mg/kg sulphur in reformulated gasoline with ASTM D2622-2008 limits (red lines)

Mini-Z Sulphur

This dedicated analyser is designed for ultra-low sulphur control. Its unparalleled precision, ASTM 2622 – 2008 compliance, ISO 20884 compliance and ease-of-use

make it the tool of choice when implementing company-wide ultra low sulphur control strategies. The more precise the analysis result, the closer the cutoff value can be run to the limit while the control system stays in specification. The cost savings realised make the return on investment a rapid process for this precision instrument.

With its dedicated high-precision X-ray optics and patented background correction capability, this instrument is the only benchtop system with ASTM 2622-2008 compliance available on the market today.



FIG 6. Mini-Z Sulphur analyser

Mini-Z Performance Data

The Mini-Z performance data speaks for itself when it comes to range applicability and precision. With a minimum detection limit of 0.26 ppm (300 s counting time) and precision of around 12% on 1 ppm sulphur in diesel standards, the Mini-Z shows its ability to help you control ultra-low sulphur fuels with unprecedented precision.

Note - Better precision and lower detection limits can be attained by using longer counting times.

In addition to Petro-Pak, Rigaku also offers Oil-Pak™, a comprehensive applications package designed to help the lubricating oil manufacturing and blending control processes by measuring all of the crucial additives that are blended into the final lube oil products.

Rigaku is committed to helping you implement refinery-wide cost-effective solutions for sulphur control. Contact us today with your challenges and let us partner with you to shape solutions that meet your needs and exceed your expectations.

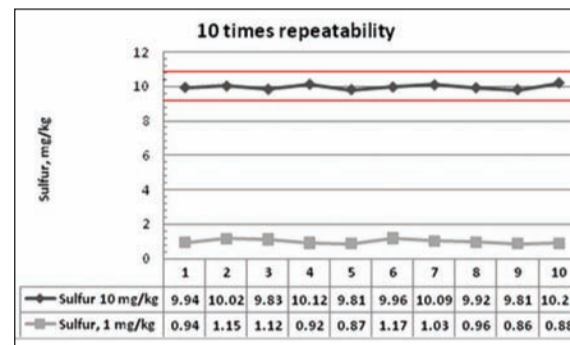


FIG 7. Plot of repeatability data for 10 days vs sulphur, mg/kg showing long term repeatability and ASTM D2622-2008 limits (red lines)

Conostan Sulphur Standards	15 ppm	10 ppm	5 ppm	1 ppm
Average	15.0	10.1	5.1	0.9
Standard Deviation	0.244	0.183	0.143	0.115

Table 1. Ultra-low sulphur in diesel standards. New preps, 10X, counting time 300 s including background measurement