

X-SUPREME8000

X-Supreme8000 for the rapid determination of sulfur in phosphate fertilizer and feed production

BACKGROUND

With a current world population of 8 billion and constant expansion, the optimum use and production of fertilizers is critical for crop yields and resulting food supply. The most common fertilizers used to boost soil productivity are phosphate based.

Phosphate rock is the raw material for production and is extracted from large deposits across Florida, the Southern Mediterranean, the Middle East (namely Morocco and Saudi Arabia), Russia and China. Sulfuric acid is added to this rock to produce phosphoric acid, which is then reacted with ammonia and elemental sulfur to create a sulfur enhanced fertiliser. During this process, the dust produced can potentially reach explosive levels, and it is safety-critical to check the fertilizers' sulfur levels during manufacturing.

OUR SOLUTION FOR RAPID TESTING OF FERTILIZERS

With the Hitachi High-Tech X-Supreme8000 benchtop X-ray fluorescence (XRF) analyzer, the determination of sulfur (S) content in fertilizers couldn't be easier. Routine analysis is carried out by grinding the sample and pouring it into a sample cup (see Sample Preparation) fitted with Poly-4 film, placing the cup on the analyzer's sample tray, closing the lid, entering the sample name, and pressing a button to start the measurement. The sulfur results are displayed within seconds on the X-Supreme's large, industrial touch screen. Pass/fail and warning messages can also be setup to clearly and rapidly show whether the product meet specifications, enabling the operator to make rapid process adjustment if needed.

Combining a field-proven X-ray tube and Hitachi's high-resolution silicon-drift detector (SDD), the X-Supreme delivers fast and accurate results day after day. It includes several features that help protect against potential damage caused by sample spills to minimise downtime and prevent costly repairs: an individual safety window is used under each cup to retain any potential spill or leak, and the analyzer's integrated sample changer only places the sample above the X-ray tube and detector for the duration of the analysis, minimising the risk of damage or contamination to critical components.

To compensate for sample inhomogeneity and deliver repeatable and reproducible results, the X-Supreme is equipped with a sample spinner that rotates each cup during analysis. This ensures that you get an average result for each sample that is representative of its entire content.



Key benefits:

- **Easy to use:** 24/7 process control carried out by shift operators
- **Reduced costs:** no need to send samples for laboratory analysis, no gas or chemicals required
- **Fast:** rapid results enable quick process adjustment for consistent quality

SAMPLE PREPARATION

In order to ensure the high accuracy required for process control, the samples were ground in a swing mill, and the resulting powder was poured directly into a sample cup fitted with Poly-4 film. Each cup was tapped gently onto a flat clean surface to compact the powder, then placed in a safety window, also fitted with Poly-4, on the analyzer's tray.

PERFORMANCE AND RESULTS

A simple empirical calibration was created by measuring a series of fertilizer samples with known S content to establish the relationship between S concentration and X-ray intensities. The optimised parameters used are shown in Table 1.

Setting-up samples (SUSs) are measured at the time of the calibration, and again in the unlikely event that the analyser would drift. There is no need to source calibration standards again or measure them, saving both time and money. These can be customer samples ground and pressed into pellets (two needed: one for low S and one for high S).

The data in Table 2 demonstrates the excellent performance the analyzer delivers for this application. The precision was determined from 10 repeat measurements of a known sample.

Note: in addition to measuring S content, the X-Supreme8000 can determine additional elements (e.g. Mg, Al, Si, P, K, Ca, Fe, Zn) in fertilizer or feed samples if required, using one single calibration. Please contact our applications engineers to discuss requirements or for assistance on how to calibrate the analyzer.



Sample introduction



Starting the analysis

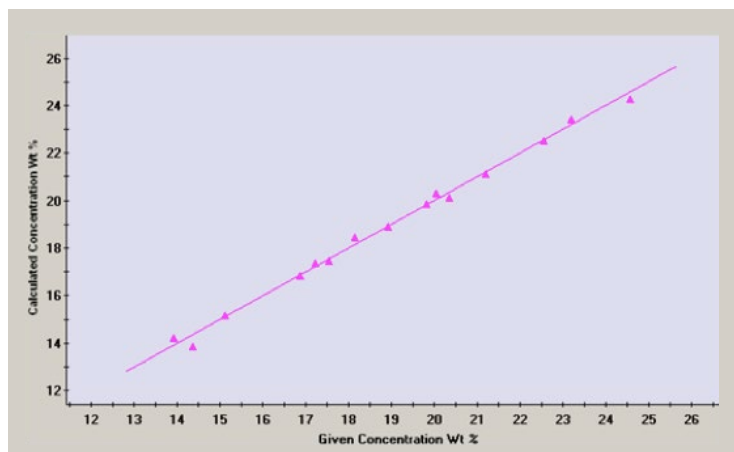
Table 1: Measurement parameters

Analyte / Other	Region of interest (keV)	Excitation condition	Regression model	Sample spinner	Measurement time (seconds)
S	2.22 – 2.40	6kV 250µA no filter, Air path	Mass absorption: P	ON	60
P	1.93 – 2.10		n/a		

Table 2: Typical calibration performance for this application

Concentration range (m/m%)	Measurement time (seconds)	Standard error of calibration (m/m%)	Mid-range precision (95% confidence) (m/m%)
14 – 25	60	0.3	0.2

Graph 1: Calibration graph for Sulfur in fertilizer powder



SUMMARY

The X-Supreme8000 offers simple, rapid, cost-effective, routine quality control analysis during fertilizer manufacture, with the added benefit of being a safety tool to ensure explosive mixtures are minimized or to identify mixtures that may be hazardous.

Sulfur content can be analysed at any point throughout the production process, and other elements can be added to the analysis if required.

With a measurement time of only 1 minute and with the simplicity of touchscreen operation, the X-Supreme8000 can be operated by production staff 24/7, resulting in consistent product quality and delivering data that can be acted upon quickly for safe and optimised production.



ORDERING INFORMATION

The minimum needed for this application is:

- | X-Supreme fitted with a W X-ray tube and a high-performance SDD
- | Sample Spinner option
- | Powders accessories pack with Poly-4 film
- | Helium path may be needed if other elements are to be measured (e.g. Mg). Please discuss with our Applications team.

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



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