S6 JAGUAR

● Analysis of vital elements in milk powder for infant nutrition

Introduction

Milk powder is essential for baby nutrition and the accurate control especially of vital elements is critical: Since milk powder is the only food source over a long period of time, children's health strongly depends on the correct concentration of Na, Mg, P, K, Ca and Fe. Additional elements needs monitoring since they could possibly contaminate the milk powder such as Cl, e.g. from ion exchange resins.

For quality control laboratories in the food industry wavelength dispersive X-ray fluorescence analyzers are an important tool: They enable quick analysis of production samples based on easy sample preparation and in addition the accurate control of incoming milk and other materials. The S6 JAGUAR is the perfect tool combining compact size with high excitation power for precise trace determination and high versatility for all different kind of samples.

Innovation with Integrity

Instrument

The S6 JAGUAR is a full-blown WDXRF spectrometer in compact size: Solid samples are analyzed under vacuum for optimal light element sensitivity and low cost of ownership. For quicker sample analysis the S6 JAGUAR can also run loose powders filled in cups under helium atmosphere. The implemented reduced helium mode offers lower cost-of-operation for liquid and loose powder samples. The HighSense goniometer can be equipped with up to 4 analyzer crystals and two detectors to cover the entire element range for a food quality control laboratory.

For a few samples per day the S6 JAGUAR can be configured with manual sample loading, in case of higher sample throughput the system can be equipped with a 24 position EasyLoad sample magazine and Touch-Control to ensure a smooth workflow and best productivity. So ensures the S6 JAGUAR optimal productivity. With its unique SampleCare technology and the added vacuum pump it offers lowest cost-of-operation and optimal instrument uptime. By adding TouchControl the S6 JAGUAR is easy to operate and ensures data integrity by its failsafe operation.

Preparation

All milk powder samples have been prepared as pressed pellets. Seven grams of sample material have been pressed gently without binder. In need of quicker sample analysis time and lower control limits the samples can be analyzed as loose powders by filling them into a liquid cup with 4 μm Prolene foil on the bottom.

Figure 1: S6 JAGUAR with EasyLoad sample magazine

Measurement

Each element is analyzed with an optimal set of instrument parameters: Light elements are excited with low voltage at maximum power, while all heavy elements starting from Ca upwards are best excited with 50 kV. For Na and Mg the XS 55 multilayer, for the elements P and Cl the PET crystal is used and for the elements K and Ca the LiF200 is applied. The setup scan for Cl next to Rh Lα is shown in fig 2.
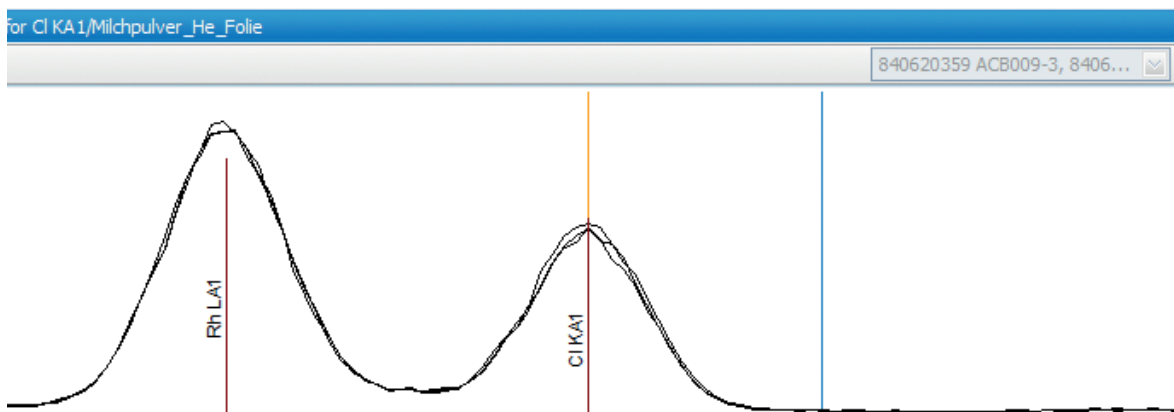

Figure 2: Setup Scan for Cl next to Rh Lα

Calibration

A set of 16 validated production samples were used to prepare the calibration for the 6 elements. Light elements were analyzed with up to 100 s for optimal detection of lower concentrations heavy elements only required 30 s measurement time. Two calibration curves, one for P and one for Ca, are shown in figure 3 and 4.
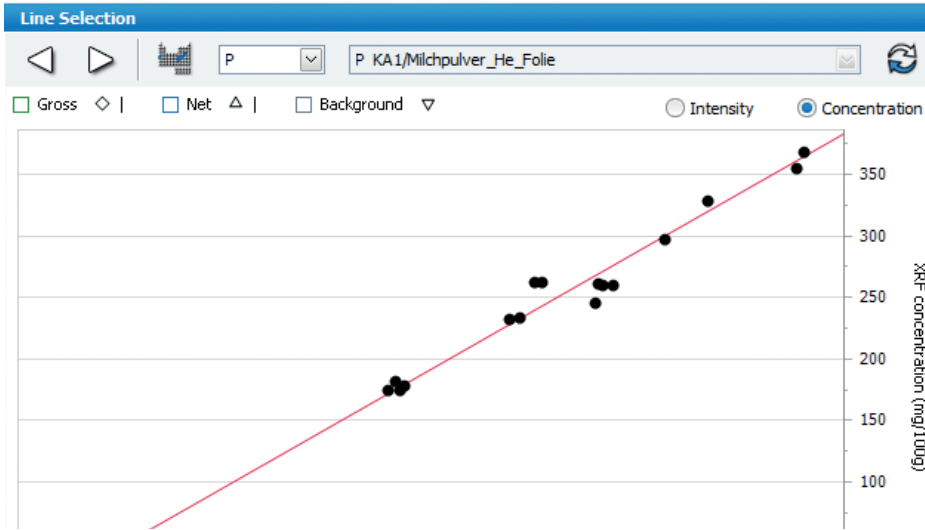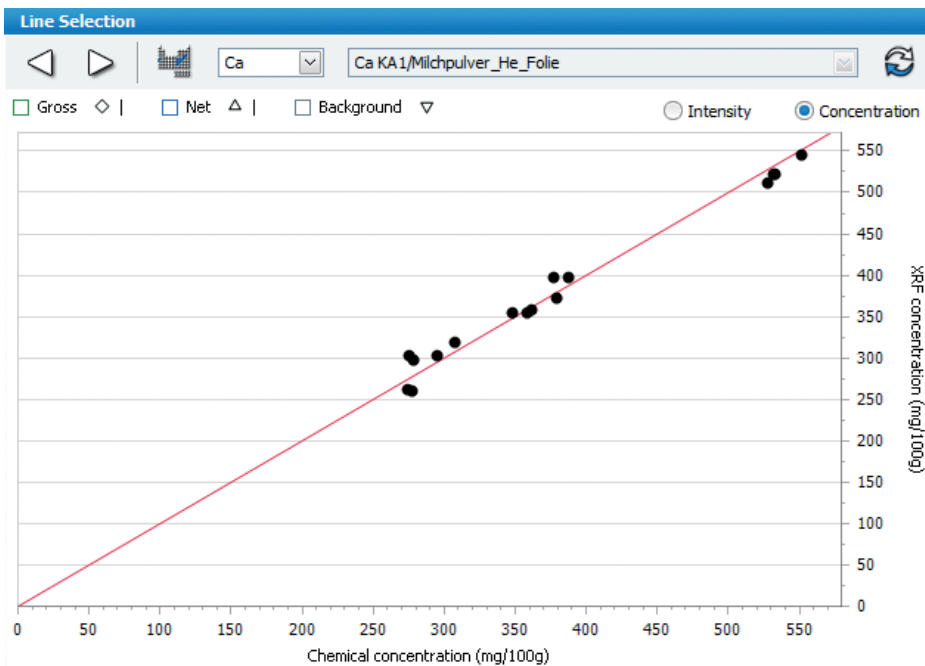

Figure 3: Calibration curve for P

Figure 4: Calibration curve for Ca

Results

For successful quality control the analytical precision is important. The precision test for milk powder analysis on S6 JAGUAR is shown in table 1 based on a 6 times measurement within two days. The absolute standard deviation is for all elements below 2 ppm, only Na shows a slightly higher variation. The relative standard deviation is less than 2% for all elements.

Table 1: Precision test for milk powder prepared as pressed pellet

	Na [mg/100 g]	Mg [mg/100 g]	P [mg/100 g]	Cl [mg/100 g]	K [mg/100 g]	Ca [mg/100 g]
	455.5	83.8	263.9	472.5	582.7	436.0
	455.1	83.0	266.3	473.1	584.7	434.7
	458.7	84.4	265.7	473.4	585.0	436.2
	451.6	82.0	266.6	470.7	586.9	437.9
	450.7	82.6	266.6	471.8	586.9	437.1
	460.0	85.3	267.3	473.3	586.7	436.7
	460.6	84.1	266.0	472.8	588.5	438.4
	460.4	85.2	268.7	476.7	587.6	438.4
Mean Value [mg/100g]	456.6	83.8	266.4	473.0	586.1	436.9
Abs. Std. Dev. [mg/100g]	3.9	1.2	1.4	1.7	1.8	1.3
Rel. Std. Dev. [%]	0.86	1.46	0.51	0.37	0.31	0.29

Conclusion

The S6 JAGUAR is the ideal tool for quality control in food production, whenever nutritional elements must be analyzed in liquids or powders, such as the milk powder in this example, the analytical performance matches the requirements for precision and accuracy. Based on the high sensitivity and excellent spectral resolution the S6 JAGUAR covers the entire range of application in a food quality control laboratory.

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