ASOMA PHOENIX II

Determination of Zinc in Polystyrene using Direct Excitation

Summary

This report demonstrates the suitability of the ASOMA PHOENIX II Benchtop XRF analyzer with direct excitation optics for measuring zinc in polystyrene pellets.

The PHOENIX II can quickly and accurately give results for zinc at-line. Zinc is added to polystyrene to ensure the pellets move properly through the production chutes. Measuring the zinc ensures quality is monitored and controlled throughout the manufacturing process. The measurement requires no sample preparation; simply fill an XRF sample cup with pellets and analyze. These benefits work together to maximize quality and reduce operational costs.

Introduction

The PHOENIX II direct excitation system is an excellent QC benchtop analyzer that offers a fast, precise, simple and non-destructive analysis technique well suited for the analysis of zinc in polystyrene.

The PHOENIX II is a powerful tool for monitoring zinc in plastics. The analyzer uses a rugged, time-proven proportional counter as its detection system and a direct excitation X-ray tube. This combination of ruggedness, power and simplicity using a small benchtop analyzer enables fast and precise results.

The PHOENIX II uses an onboard PC computer with a simple touch screen interface. Thus, an external computer is not required. Data handling and results storage can be obtained on a thermal paper print out and are stored in the hard drive of the PHOENIX II. The data can be readily transferred to a USB thumb-drive or a network Ethernet connection.

Calibrations are readily carried out using assayed standards. This ensures easy traceability of results for quality purposes. This initial calibration process is a “once only” procedure. Subsequently, the curve can be restandardized, if required, by the touch of a button on the main analysis screen.

The PHOENIX II offers power, versatility and performance all in a small, compact, easy-to-use design.

Experimental Portion

Equipment

All measurements were conducted using a PHOENIX II XRF analyzer using direct excitation optics. Performance is shown for a measurement time of 100 seconds.

Sample Preparation

No sample preparation is required. Each sample cup was placed in the sample chamber for analysis.

Measurement Parameters

All measurement parameters are easily controlled through the touch screen on the display panel. Operators simply choose the correct method from the analysis screen (there may be more than one method stored, e.g. to deal with pellets or plaques, etc.) and then press the green ANALYZE button.

The results can be reported using a variety of different options: results are reported on the display screen; on a thermal paper printout; on an optional external printer; and in the database history within the analyzer.

Instrument Configuration

ASOMA PHOENIX II

Excitation: Direct excitation 30 kV 9 W Air-cooled X-ray Tube

Detection: Gas-filled Proportional Counter

Analyte Optimization: X-ray voltage, current and X-ray filters

Atmosphere: Air

Options: Tube filter; Sample spinner

Note: No consumable gases required.

XRF Sample Cup

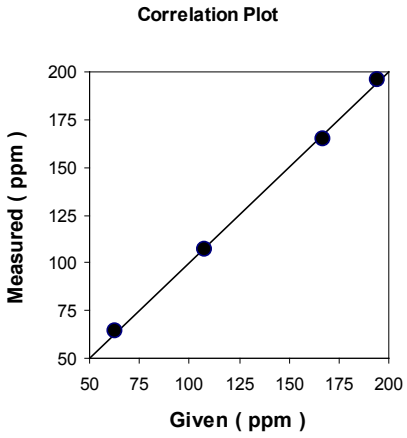
Sample Spinner

The following results section show performance for typical zinc in polystyrene samples, submitted by an ASOMA user.

Results - Low Concentration

Calibration for Zinc in Polystyrene - Low Concentration

Element: Zn	**Std. Error of Estimate: 1.86**	
Units: ppm	**RMS: 0.66**	
Sample	**Given**	**Measured**
1	194	195.6
2	167	165.2
3	108	107.3
4	63	63.9



Precision Zinc in Polystyrene – Low Concentration

10 repeat analyses at 100 seconds per measurement

Element: Zn		Units: ppm		
Sample	Given	Mean	Std. Dev.	% Rel.
1	194	194.2	0.54	0.28
3	107	107.2	0.58	0.58
4	63	64.5	0.56	0.86

Minimum Detection Limit

Zinc in Polystyrene – Low Concentration

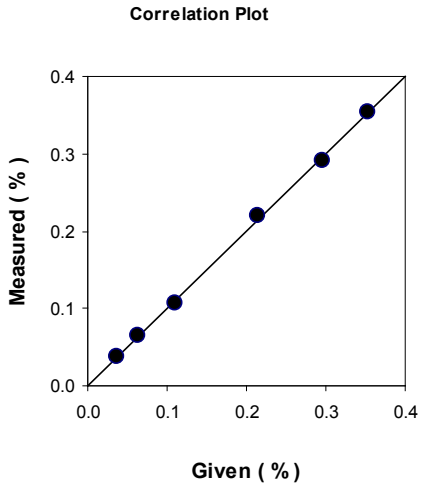
The Minimum Detection Limit (MDL) for an element is determined as three times the standard deviation of ten analyses of the blank sample containing no Zn. The following MDL was derived using this empirical method and applies to this matrix and concentration range.

Element	Count Time	MDL
Zn	100 sec	1.5 ppm

Results - High Concentration

Calibration for Zinc in Polystyrene - High Concentration

Element: Zn	Std. Error of Estimate: 0.004	
Units: %	RMS: 0.001	
Sample	Given	Measured
1	0.3540	0.3541
2	0.2949	0.2914
3	0.2147	0.2205
4	0.1112	0.1075
5	0.064	0.0656
6	0.037	0.0367



Precision Zinc in Polystyrene – High Concentration

10 repeat analyses at 100 seconds per measurement

Element: Zn		Units: %		
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.3540	0.3549	0.0019	0.52
4	0.1112	0.1121	0.0010	0.91
6	0.037	0.0373	0.0007	1.80

Conclusion

As can be seen from the above data, the use of the PHOENIX II XRF system using direct excitation gives excellent performance when applied to the determination of Zinc in Polystyrene. Results are rapid, precise and analysis is easily carried out, even by non-laboratory personnel. Because no consumable chemicals are used, the relative ”cost of ownership“ is much lower than other analytical techniques.

Determination of Zinc in Polystyrene

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Application Note

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