

ASOMA PHOENIX II

Analysis of Copper, Chromium, Chlorine, Zinc & Arsenic in Treated Wood and Treatment Chemicals Using Direct Excitation

Summary

This report describes the capability of the ASOMA PHOENIX II to analyze wood treatment chemicals as well as treated wood.

The PHOENIX II is available with either direct excitation or polarized source x-rays and proportional counter and offers unparalleled sensitivity and precision compared to other XRF analyzers in its price range.

In addition to ensuring product quality throughout the process, applications require little sample preparation and the analysis time is typically less than four minutes. The sample is simply poured or pressed into a XRF sample cup and analyzed. These benefits work together to maximize quality and reduce operational costs.

Introduction

The ASOMA PHOENIX II is an excellent benchtop XRF analyzer for at-line QC analysis or the laboratory alike. The PHOENIX II offers a fast, precise, simple and non-destructive analysis technique well suited for the measurement of metals in wood treating chemicals and treated wood.

The ASOMA PHOENIX II employs state-of-the-art optics. Optional polarization excitation offers unique benefits because it eliminates most of the background scatter emerging from the x-ray tube before it arrives at the sample. This results in a dramatic improvement in peak-to-background signal, especially in highly scattering materials such as wood treatment related products. This translates to a very versatile instrument with improved precision and lower detection limits as compared with other products at this price point.

Over the last ten years arsenic containing treatment chemicals such as Chromated Copper Arsenate (CCA) have been replaced by copper containing such as Copper Azole (CA) and Alkaline Copper Quaternary (ACQ). The ASOMA Phoenix II can analyze the metals content in either the treatment solutions or wood borings in typically less than two minutes with a high degree of accuracy and precision (i.e. 1% copper $\pm 0.006\%$).



The PHOENIX II helps guarantee effective wood treatment and helps to eliminate the costs of excessive chemical use. The ASOMA products have become the industry standard for wood preservative analysis because they give fast, reliable and accurate results for a wide range of wood preservatives including CCA, Pentachlorophenol (Penta), and copper containing chemicals like copper azole.

To analyze a treatment chemical, simply pour the solution into a sample cup and place it in the sample compartment. Wood samples are prepared by grinding the borings, drying and compressing them in a sample cup. Each PHOENIX II comes pre-calibrated and can analyze multiple treatment chemicals and the corresponding treated wood.

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 printed on the built-in thermal paper printer and are also stored in the hard drive of the PHOENIX II. The data can be readily transferred to a USB thumb-drive or via an Ethernet connection.

Additional calibrations are easily created using assayed standards. This ensures the traceability of results for quality control purposes. This initial calibration process is a “once only” procedure. Subsequently, the calibration can be updated through the use of a single standard.

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

XRF Sample Cup

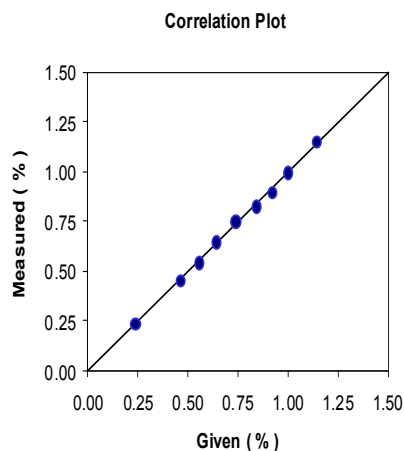


Easy assembly with film window

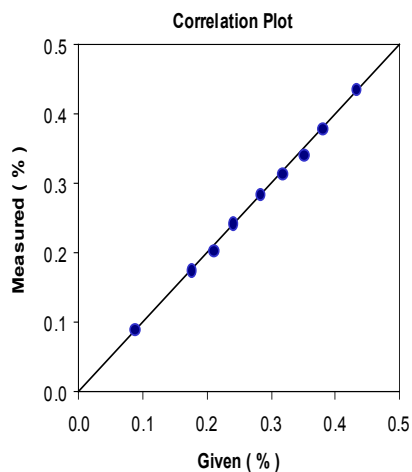


CCA Solution

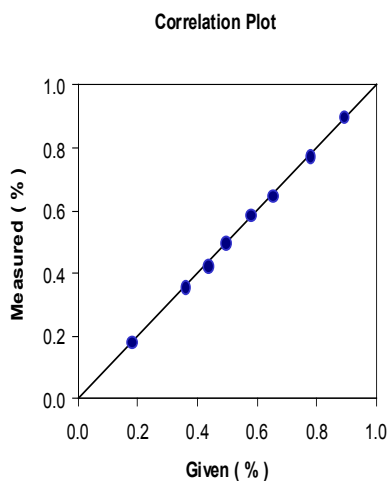
Element: Cr Std. Error of Estimate: 0.011 Units: % CrO3		
Sample	Given	Measured
1	1.14	1.15
2	1.00	1.00
3	0.92	0.90
4	0.84	0.83
5	0.74	0.75
6	0.64	0.65
7	0.55	0.55
8	0.46	0.46
9	0.23	0.24



Element: Cu Std. Error of Estimate: 0.004 Units: % CuO		
Sample	Given	Measured
1	0.43	0.44
2	0.38	0.38
3	0.35	0.34
4	0.32	0.32
5	0.28	0.29
6	0.24	0.24
7	0.21	0.21
8	0.18	0.18
9	0.09	0.09



Element: As Std. Error of Estimate: 0.007 Units: % As ₂ O ₅		
Sample	Given	Measured
1	0.89	0.90
2	0.78	0.78
3	0.72	0.70
4	0.65	0.65
5	0.58	0.59
6	0.49	0.50
7	0.43	0.42
8	0.36	0.36
9	0.18	0.18



Precision

10 repeat analyses at 100 seconds per analysis

Analyte: CrO ₃ Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	1.14	1.179	0.0040	0.34
5	0.74	0.773	0.0007	0.09
9	0.32	0.242	0.0011	0.45

Analyte: CuO Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.43	0.450	0.0014	0.31
5	0.28	0.294	0.0008	0.27
9	0.09	0.091	0.0003	0.33

Analyte: As ₂ O ₅ Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.89	0.913	0.0031	0.34
5	0.58	0.602	0.0022	0.37
9	0.18	0.186	0.0002	0.11

Total CCA Units

TOTAL CCA Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	2.46	2.444	0.0061	0.25
5	1.60	1.669	0.0027	0.16
9	0.50	0.519	0.0014	0.27

Limit of Detection

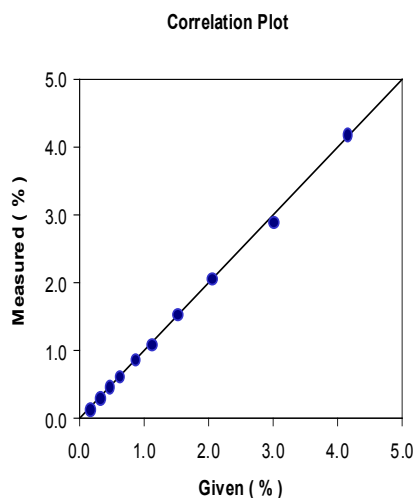
The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of a distilled water sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cr	18 ppm Cr ₂ O ₃
Cu	3 ppm CuO
As	6 ppm As ₂ O ₅

CCA Wood

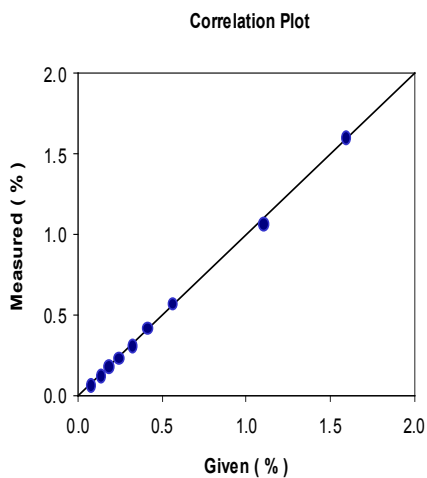
Element: Cr Std. Error of Estimate: 0.033
Units: % CrO₃

Sample	Given	Measured
1	0.16	0.14
2	0.32	0.31
3	0.46	0.48
4	0.62	0.63
5	0.86	0.88
6	1.12	1.10
7	1.52	1.55
8	2.05	2.07
9	3.00	2.91
10	4.15	4.19



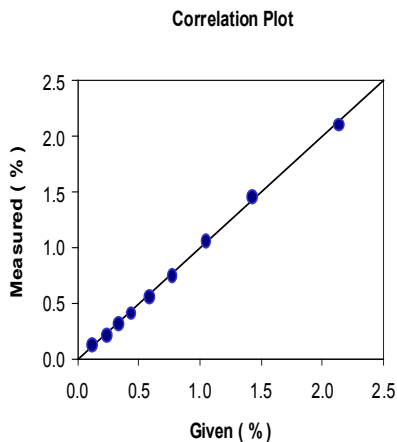
Element: Cu Std. Error of Estimate: 0.008
Units: % CuO

Sample	Given	Measured
1	0.07	0.07
2	0.13	0.13
3	0.18	0.18
4	0.24	0.24
5	0.32	0.32
6	0.41	0.42
7	0.56	0.58
8	0.74	0.73
9	1.10	1.07
10	1.59	1.61



Element: As Std. Error of Estimate: 0.013
Units: % As₂O₅

Sample	Given	Measured
1	0.11	0.13
2	0.23	0.22
3	0.33	0.32
4	0.43	0.42
5	0.58	0.56
6	0.77	0.75
7	1.04	1.06
8	1.42	1.47
9	2.13	2.11
10	3.02	3.00



Precision

10 repeat analyses at 100 seconds per analysis

Analyte: CrO₃ Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.16	0.160	0.0012	0.75
4	0.62	0.630	0.0028	0.44
10	4.15	4.194	0.0096	0.23

Analyte: CuO Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.07	0.066	0.0002	0.30
4	0.24	0.236	0.0008	0.34
10	1.59	1.616	0.0073	0.45

Analyte: As₂O₅ Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.11	0.132	0.0005	0.38
4	0.43	0.417	0.0013	0.31
10	3.02	3.003	0.0087	0.29

Total CCA Units

TOTAL CCA Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.34	0.338	0.0014	0.41
4	1.29	1.282	0.0038	0.30
10	8.76	8.813	0.0160	0.18

TOTAL CCA Units: PCF (density = 32 pounds per cubic foot)				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.11	0.108	0.0005	0.46
4	0.42	0.410	0.0012	0.29
10	2.80	2.820	0.0051	0.18

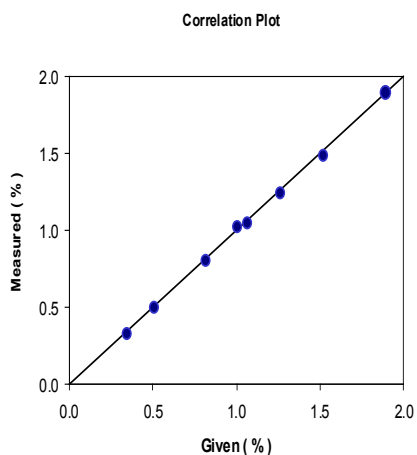
Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of the untreated wood sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cr	21 ppm Cr ₂ O ₃
Cu	6 ppm CuO
As	6 ppm As ₂ O ₅

CuO Solution

Element: Cu Std. Error of Estimate: 0.015 Units: % CuO		
Sample	Given	Measured
1	1.89	1.90
2	1.51	1.50
3	1.26	1.25
4	1.06	1.05
5	1.00	1.03
6	0.81	0.81
7	0.50	0.51
8	0.34	0.33



Precision

10 repeat analyses at 100 seconds per analysis

Analyte: Cu Units: %				
Sample	Given	Mean	Std. Dev.	% Rel.
1	1.89	1.909	0.0028	0.15
4	1.06	1.042	0.0023	0.22
10	0.34	0.339	0.0010	0.31

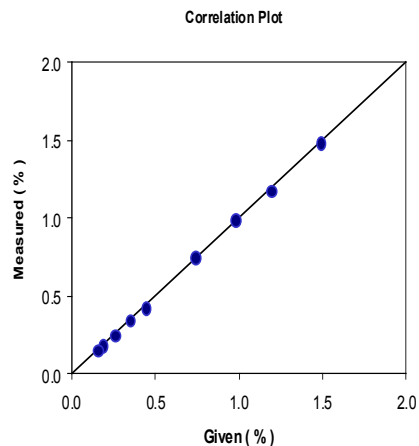
Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of a distilled water sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cu	3 ppm CuO

CuO Wood

Element: Cu Std. Error of Estimate: 0.009 Units: % CuO		
Sample	Given	Measured
1	1.49	1.49
2	1.19	1.18
3	0.98	0.99
4	0.74	0.75
5	0.44	0.43
6	0.35	0.35
7	0.26	0.25
8	0.19	0.19
9	0.15	0.15



Precision

10 repeat analyses at 100 seconds per analysis

Element: Cu Units: % CuO				
Sample	Given	Mean	Std. Dev.	% Rel.
1	1.49	1.483	0.0014	0.22
5	0.44	0.435	0.0008	0.16
10	0.15	0.153	0.0004	0.25

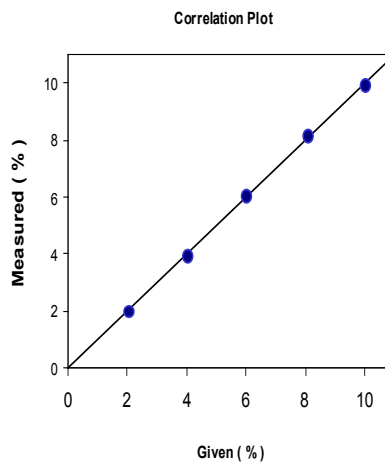
Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of the untreated wood sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cu	3 ppm CuO

Penta Oil

Element: Cl Std. Error of Estimate: 0.045		
Units: % Pentachlorophenol		
Sample	Given	Measured
1	10.01	9.93
2	8.08	8.17
3	6.00	6.06
4	4.02	3.96
5	2.03	2.01



Precision

10 repeat analyses at 100 seconds per analysis

Element: Cl Units: % Pentachlorophenol				
Sample	Given	Mean	Std. Dev.	% Rel.
1	10.01	9.974	0.0602	0.02
5	2.03	2.070	0.0041	0.20

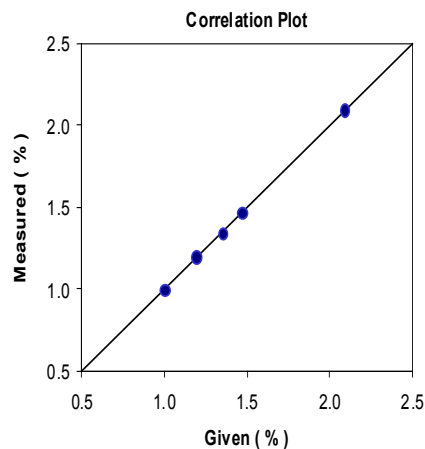
Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of a blank oil sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cl	60 ppm Pentachlorophenol

Penta Wood

Element: Cl Std. Error of Estimate: 0.006 Units: % Pentachlorophenol		
Sample	Given	Measured
1	2.09	2.09
2	1.47	1.47
3	1.35	1.34
4	1.19	1.20
5	1.00	1.00



Precision

10 repeat analyses at 100 seconds per analysis

Element: Cl Units: % Pentachlorophenol				
Sample	Given	Mean	Std. Dev.	% Rel.
1	2.09	2.096	0.0106	0.51
5	1.00	1.001	0.0021	0.21

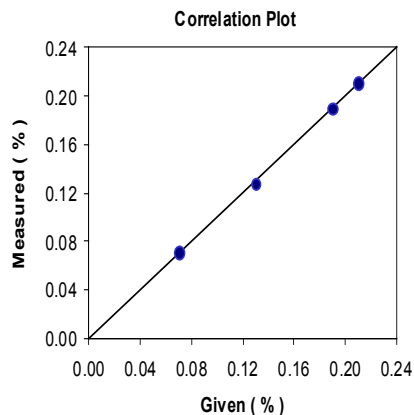
Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of an untreated wood sample, the LOD for this matrix can be estimated to be:

Element	LOD
Cl	21 ppm Pentachlorophenol

ZnO Wood

Element: Zn Std. Error of Estimate: 0.002 Units: % ZnO		
Sample	Given	Measured
1	0.21	0.211
2	0.19	0.190
3	0.13	0.128
4	0.07	0.071



Precision

10 repeat analyses at 100 seconds per analysis

Element: Zn Units: % ZnO				
Sample	Given	Mean	Std. Dev.	% Rel.
1	0.21	0.211	0.0003	0.14
4	0.07	0.072	0.0002	0.28

Limit of Detection

The Limit of Detection (LOD) is defined as three times the standard deviation of analyzing the blank sample ten times in a static position. Based on the 100 second analysis of an untreated wood sample, the LOD for this matrix can be estimated to be:

Element	LOD
Zn	3 ppm ZnO



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