

Analysis of Heavy Elements in Plastics

ARL QUANT'X Energy Dispersive X-Ray Fluorescence Spectrometer

Key Words

- ARL QUANT'X
- ED-XRF
- Plastics, PVC
- WEEE/RoHS

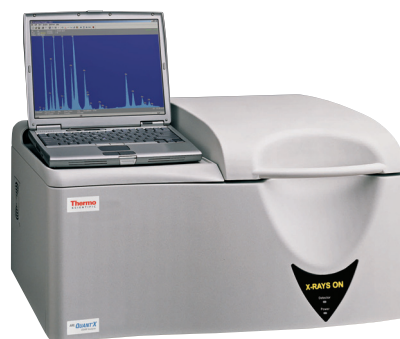
Introduction

Heavy metals have been used for many years in the production of plastics. Plastic, in turn, has become a leading material in the production of goods and the packaging of goods. However, the destruction or recycling of plastics and the goods which contain them has led to the potential release of these heavy metals as toxins into the environment. In recognition of these effects and of the growing size of consumerism and waste sites, Europe & Japan are enforcing new regulations for monitoring the level of hazardous substances in the manufacture, recycling and destruction of products that include plastic, to prevent the release of hazardous toxins into the environment.



Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS) regulations have set rules regarding the highest tolerable limit that certain metals (particularly Pb, Cd, Hg, Br and Cr) can be released into air or solids through incinerators or any other treatment methods. For the given ranges specified in these regulations, EDXRF is the most appropriate solution featuring rapidity, ease of use and reliability.

Instrumentation



Energy Dispersive X-ray Fluorescence (EDXRF) is a fast and economical technique for analysis of all inorganic elements in a variety of states, shapes and sizes. The most common advantages of EDXRF over other analytical techniques include speed of analysis and relatively little sample preparation, if any at all. X-rays are also non-destructive, as long as the sample isn't alive.

The Thermo Scientific ARL QUANT'X Energy-Dispersive X-ray Fluorescence Spectrometer is a scientific instrument designed for the most challenging analytical requirements in laboratory and manufacturing environments. Its power and flexibility will maximize your productivity across a wide range of elemental analysis applications.

Calibration and results

This note demonstrates the high precision and low detection limits of the ARL QUANT'X EDXRF when performing a fast analysis of Cd and Pb in a Polyvinyl Chloride (PVC) sample. Three commercially available standards with the following reference values were used for this test:

	Cd PPM	Pb PPM
Std1	<0.15	8 +/-2
Std2	35 +/-3	89+/-6
Std3	85+/-6	837+/-52

Table 1: Reference values of the standards used

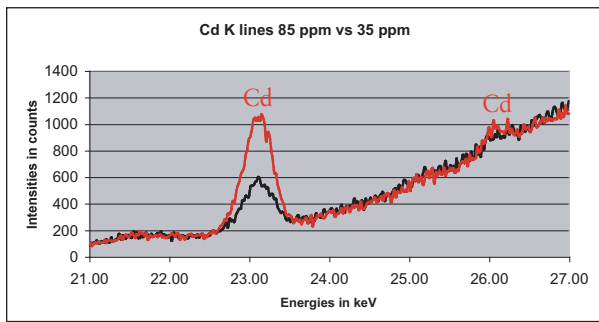


Figure 1: Comparison of the spectrum of PVC containing 35 ppm of cadmium (black) with the spectrum of PVC containing 85 ppm of cadmium (Red)

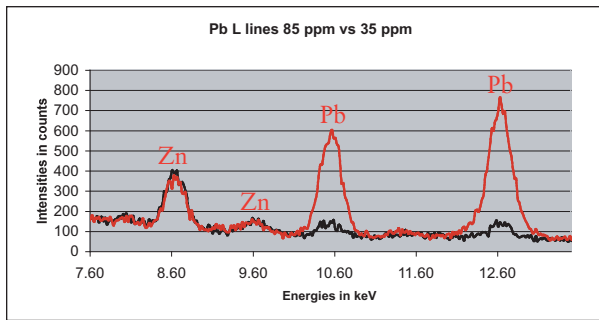


Figure 2: Comparison of the spectrum of PVC containing 35 ppm of lead (black) with the spectrum of PVC containing 85 ppm of lead (Red)

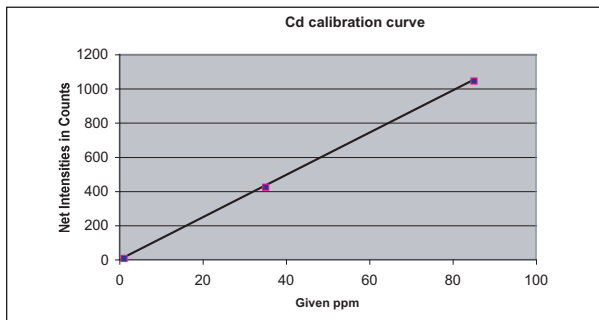


Figure 3: Calibration curve for Cd in PVC

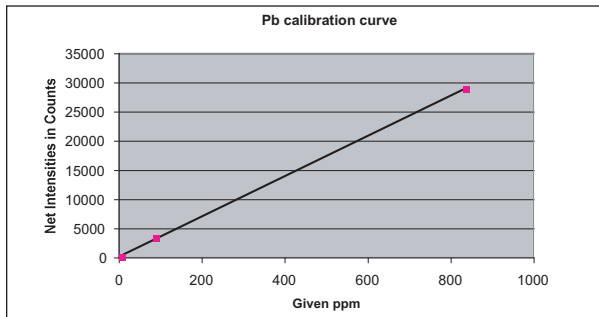


Figure 4: Calibration curve for Pb in PVC

	Cd	Pb
LoD	0.9 ppm	1 ppm
Precision	1.8 @ 35 ppm	5.2 @ 89 ppm
Precision	3.7 @ 85 ppm	14.1 @ 837 ppm

Table 2: Limits of detection (LoD) and precisions

Conclusion

These results show that the ARL QUANT'X can perform WEEE/RoHS analysis accurately and quickly as they were obtained with a total analysis time of just 60 seconds.

In addition to the measurement of specific elements, the ARL QUANT'X can perform the quantification of an unknown in just 60 seconds. This is due to the high sensitivity of the Peltier-cooled detector. Furthermore, extra elements can be added to the calibration (in this application we may wish to add Hg, Cr and Br which are also regulated by WEEE/RoHS) with no change to the total analysis time. With the added benefit of field-transportability, the ARL QUANT'X is ideal for fast, accurate and repeatable results in this field of environmental analysis.

In addition to these offices, Thermo Fisher Scientific maintains a network of representative organizations throughout the world.

Australia
+61 2 8844 9500
Austria
+43 1 333 50340
Belgium
+32 2 482 30 30
Canada
+1 800 532 4752
China
+86 10 5850 3588
Denmark
+45 70 23 62 60
France
+33 1 60 92 48 00
Germany
+49 6103 408 1014
India
+91 22 6742 9434
Italy
+39 02 950 591
Japan
+81 45 453 9100
Latin America
+1 608 276 5659
Netherlands
+31 76 587 98 88
South Africa
+27 11 570 1840
Spain
+34 91 657 4930
Sweden/Norway/Finland
+46 8 556 468 00
Switzerland
+41 21 694 71 11
UK
+44 1442 233555
USA
+1 800 532 4752

www.thermo.com



Thermo Electron SA, Ecublens, Switzerland is ISO certified.

©2007 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific Inc. and its subsidiaries.

Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details.

AN41901_E 06/07C