Application Note: 41620

Analysis of Traces in Aqueous Solutions

ARL ADVANT'X IntelliPower™ 2500 Sequential X-Ray Fluorescence Spectrometer

Key Words

- ARL ADVANT'X
- XRF
- X-Ray Fluorescence
- Aqueous Solutions

Introduction

Analysis of heavy metals and toxic elements as traces in aqueous solutions is becoming increasingly important in view of the environmental concern. Such an analysis demands high sensitivity and accuracy of measurement. The Thermo Scientific ARL ADVANT'X Series with its optimized geometry and flexible analytical configuration meets these demands. Thanks to a clever management of power, this spectrometer can operate up to 2500W without requiring external water cooling. Furthermore, operation is made easy through its new state-of-the-art OXSAS software under MS-Windows® XP Professional.

The analysis of liquids can be performed with ease and minimum sample preparation in XRF. The ARL ADVANT'X integrates an innovative shutter separating the primary chamber from the goniometer chamber. When liquid samples are analyzed, helium gas is introduced only in the primary chamber keeping the analytical devices under vaccum. This allows a rapid change-over from vacuum to helium environment (less than 2 min.) and permits the measurement of solids and liquids in the same batch without compromizing the stability of analysis. In addition, it protects the goniometer from any liquid spillage. Helium consumption is also kept to a minimum.

Sample preparation and results

Solutions with different concentrations of individual elements are prepared by diluting standard solutions with a blank solution. Thus solutions with 2, 5, 10 and 100 ppm were prepared from a standard solution of 1000 ppm and measured in order to derive calibration curves. Limits of detection for the various elements were calculated from these curves. Figure 1 shows a scan on a sample containing trace amounts of Hg and As in a water solution.

Table 1 lists the lines used, crystal/detector combinations and limits of detection obtained for the various elements. X-ray tube conditions were set at 60 kV - 41 mA. Cd is measured with a primary beam filter to eliminate overlap from rhodium tube lines.

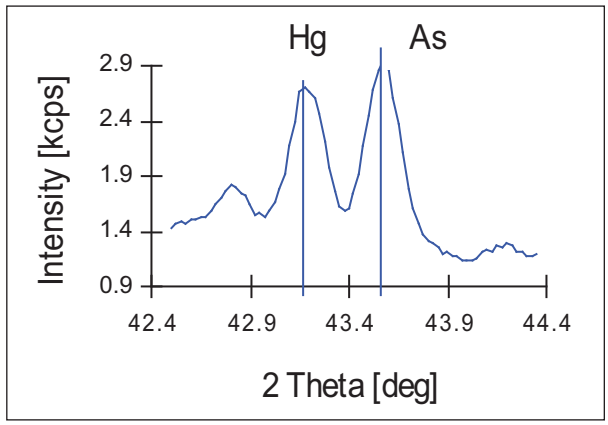

Fig. 1: XRF scan showing traces of Hg and As in water solution

ELEMENT	LINE	CRYSTAL	DETECTOR	COLLIMATOR	LOD (PPM)
As	Kβ	LiF 220	SC	0.15	1.1
Ba	Lα	LiF 200	FPC	0.25	0.9
Cd*	Kα	LiF 200	SC	0.25	1.1
Co	Kα	LiF 200	SC	0.25	0.3
Cr	Kα	LiF 200	FPC	0.25	0.3
Cu	Kα	LiF 200	SC	0.25	0.2
Hg	Lα	LiF 200	SC	0.15	0.6
Ni	Kα	LiF 200	SC	0.25	0.2
Pb	Lβ	LiF 200	SC	0.25	0.4
Zn	Kα	LiF 200	SC	0.25	0.2

Table 1: Analytical results (100s counting time).

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Conclusion

In conclusion, it is seen that analysis of aqueous solutions can be performed rapidly and with ease using the mid power sequential XRF spectrometer ARL ADVANT'X IntelliPower 2500. Limits of detection for toxic elements and heavy metals range from below 0.2 ppm up to 1 ppm in 100 seconds counting time. Therefore the ARL ADVANT'X is well suited for the analysis of typical waste waters or industrial waters.

Using a mid-power instrument allows also the installation to be simpler because no external water is necessary for X-ray tube and anode cooling. Therefore neither tap water, nor a water cooler is required.

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

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