APPLICATION NOTE

Toys for Kids: Analysis of Harmful Elements with EDXRF Spectrometer Model XGT-1000WR

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1 Introduction

Recently some reports about toys containing lead were published especially cheap imported ones. As kids could suck or even swallow these toys, they can absorb any harmful elements that dissolve. These elements can affect the nervous system and can induce brain disorders!
Harmful elements such as Pb, Hg, Cd, Cr, Sb, As, Ba or Se are used as pigments in colored paint or stabilizers in polyvinyl chloride, which is a main material for toys. Regulations (ISO 8124-3, ASTM F963, EN 71 and CPSC) exist setting the measurement method for harmful elements in toys and also the maximum acceptable content as shown below:

EDXRF is an easy, simple and quick way to check if part of a toy is potentially dangerous.

Toy materials	Sb	As	Ba	Cd	Cr	Pb	Hg	Se
Any toy materials except the next	60	25	1000	75	60	90	60	500
Modeling clay and finger paint	60	25	250	50	25	90	25	500

*Unit: mg/kg in material

Table1. Maximum acceptable element migration from Toy materials required by ISO 8124-3

2 Principle of the Instrumentation

The XGT-1000WR is an Energy Dispersive X-Ray Fluorescence (EDXRF) spectrometer designed for qualitative and quantitative analysis of all elements from sodium (Na/11) to uranium (U/92). The XGT-WR instruments have been developed to answer to WEEE/RoHS regulations. As the toys norms have similarities with WEEE/RoHS regulations, the use of the same instruments seems obvious.

The non-destructive measurements can be carried out on various kinds of samples such as solids, liquid, powders, granulates. The big sample chamber allows large sample analysis (460x360x150mm) without preparing or cutting samples. The exact measuring spot (selectable from 3/1.2/0.1 or 0.01mm) can be visualized on the screen using the CCD video camera. The elements are determined by a high purity silicon detector (XEROPHY).

Figure 1: Fluorescent X-ray analyzer XGT-1000WR

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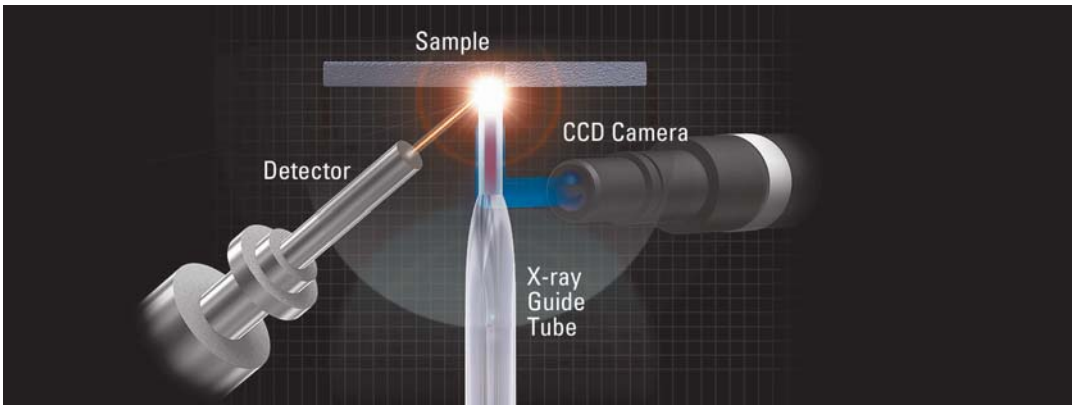

Figure 2: Operating principle

3. Analysis of a Beaded Pendant with a Metallic Clasp

Analyses were carried out on a beads pendant (Fig.3) and also on its metallic fitting.
No sample pre-treatment was performed and the samples were placed directly into the sample chamber.
The results are obtained quickly and easily by selecting the area to analyse using the CCD camera and clicking the measure button in the software.
The conditions of analyses are shown in table 2:

Table 2: XGT-1000WR Measurement Conditions for both samples

Parameter	Specification
X-ray tube voltage	50 kV
X-ray tube current	1.0 mA
X-ray radiation diameter	1.2 mm

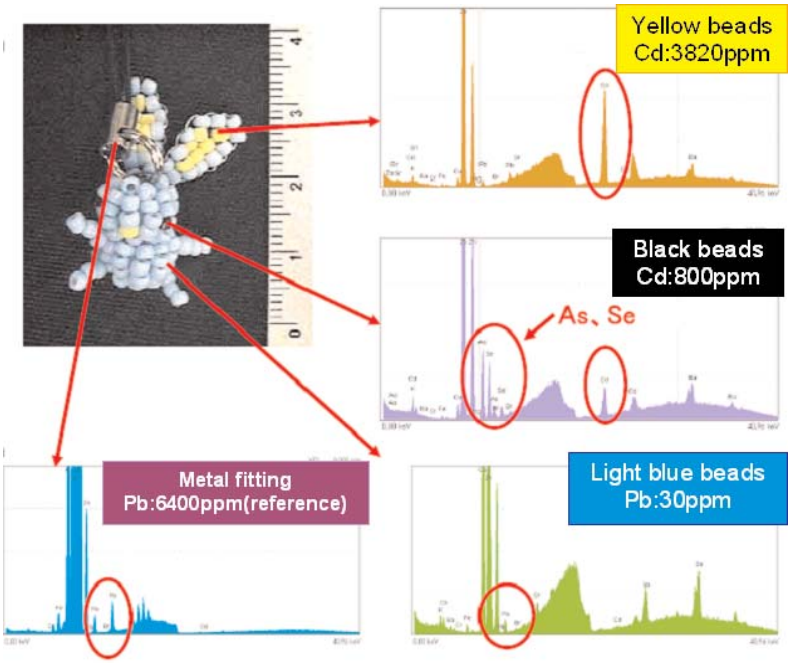

Figure 3: Analysis of Beadwork strap

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4. Conclusions

These two examples show that elements such as Pb, Cd, As or Se can be easily detected even if a coating is deposited on the bulk material.
With the help of the CCD camera, the 1.2mm spot allows one to focus on a small area of the toys and by a simple click to identify a harmful part.
The XGT-1000WR is a very easy and useful tool to quickly detect harmful parts in toys. It can be complemented by the XGT-5000WR which is able to make full mapping (100x100 mm) and display the results as a colorized image to visualize where are the harmful elements.

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