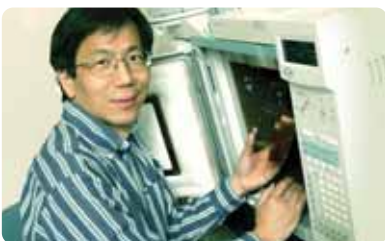
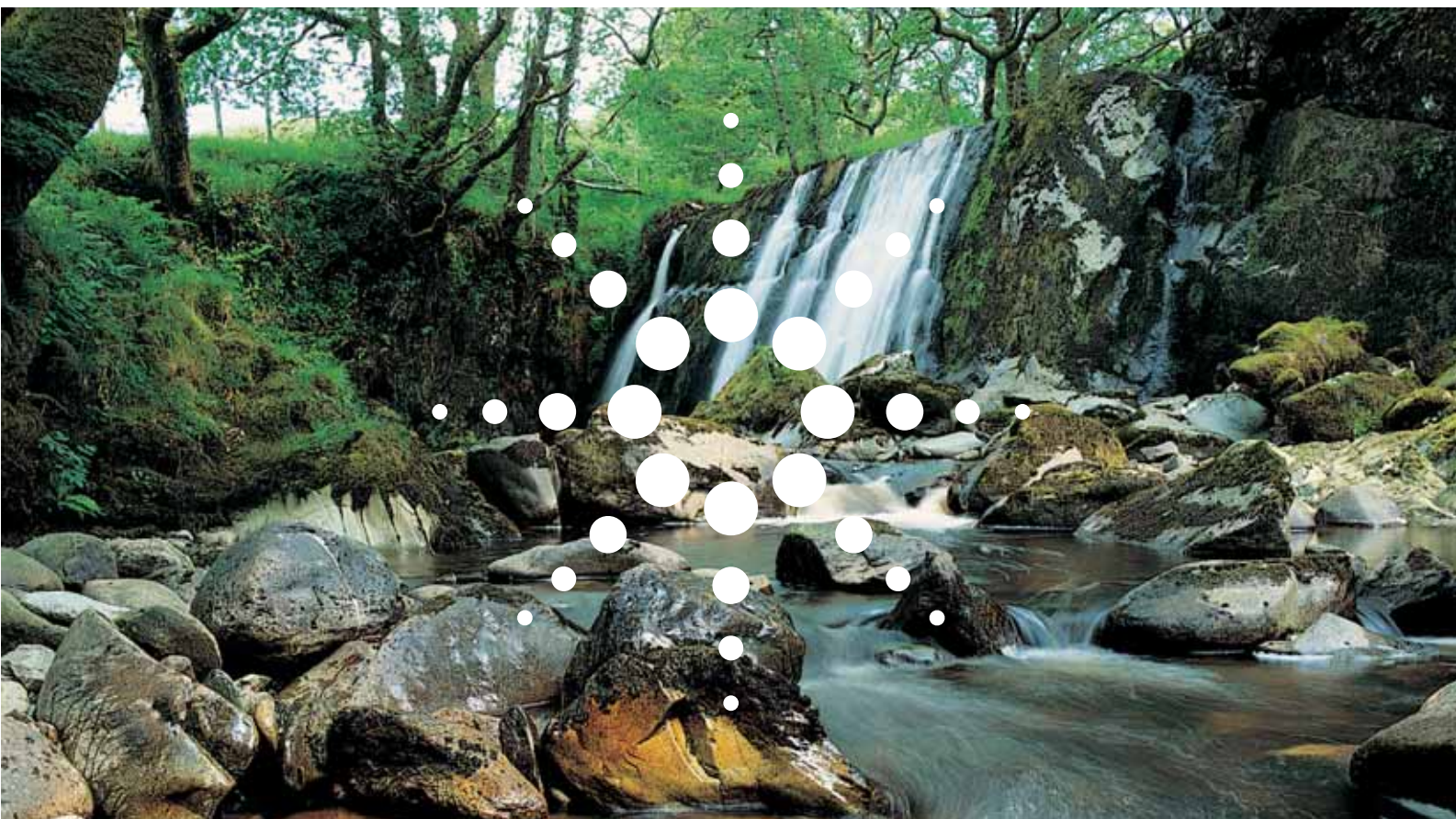


Your lab is smarter

when your analysis capabilities meet international WEEE/RoHS/ELV standards



Agilent Technologies



The world is getting greener. In many countries new legislation ensures that manufacturers of electrical and electronic equipment control the amount of potentially toxic substances in new products (RoHS) and have waste management policies when they reach the end of their useful life (WEEE). New regulations in China, statutes in the US and directives of the European Union (EU) restrict the use of hazardous substances, most notably the heavy metals cadmium (Cd), mercury (Hg) and lead (Pb); hexavalent chromium (Cr(VI)); and brominated flame retardants (BFRs). As well as WEEE/RoHS directives that focus on electrical and electronic goods, the EU has also passed legislation on the safe disposal of vehicles with the End of Life Vehicles Regulation (ELV) that focuses on the same potentially hazardous materials. Agilent's long history of providing labs with the most reliable, cutting-edge technology in measurement equipment, ensures that your company not only meets, but exceeds these new compliance challenges.

The rules are getting tighter

The EU Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) provides an incentive for manufacturers to design new equipment for recycling in a more efficient and environmentally friendly way. A second, complementary Directive, 2002/95/EC (on the Restriction of the Use of Certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment), defines limits for heavy metals such as cadmium (Cd), mercury (Hg) and lead (Pb); hexavalent chromium (Cr(VI)); and the brominated flame retardants polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) used in the manufacture of many consumer electronic products.

As well as the EU directives, other countries are also drafting similar RoHS regulations. In China, the regulation “Measures for the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment” is often referred to as “China RoHS” because it mirrors the limits of those substances included in the EU Directive. While there are no federal laws in the US that deal with potentially hazardous substances, many states have legislation in place, including California's Proposition 65, sometimes called the “California RoHS”.



Brominated Flame Retardants (BFRs)

Brominated flame retardants (BFRs) are used extensively in the casings and circuit boards of many consumer products, in building materials as well as in foams for furniture and insulation materials and textiles. These compounds make up 5-20% of product by weight and are not covalently bound, so are easily released into the environment. There are four groups of brominated flame retardants; tetrabromobisphenol A (TBBP-A), hexabromocyclododecane (HBCD), polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs). PBBs and PBDEs are the compounds that are regulated in most RoHS/ELV legislation.

Polybrominated biphenyls (PBBs), like PCBs, are extremely stable; accumulate in the food chains and degrade very slowly. Recently the various PBDE congeners have also been examined for serious health and environmental hazards. The most important PBDEs are the penta-BDEs (used in foam products in mattresses, furniture etc.), octa-BDEs (used in computer and other business machine housings and keyboards) and deca-BDEs (used in electrical and electronic equipment, automotive equipment, construction materials and textiles). Like PCBs, there are 209 congeners for PBBs and PBDEs respectively, with widely varying environmental mobility, bioavailability, toxicity and stability. The species are high molecular weight, high boiling point compounds and these factors make measuring them in the environment a challenge.

Heavy Metals

Four element species are defined in most RoHS/ELV regulations – chromium (Cr), cadmium (Cd), mercury (Hg) and lead (Pb).

The toxic effects of lead (Pb) are well documented and while once used extensively in industrial processes, the metal is gradually being phased out and alternatives are becoming more common. Pb is currently used in virtually all solders, electronic components and many printed wiring boards (PWBs). The EU limits for Pb are 1000mg/kg (0.1%) in the finished materials.

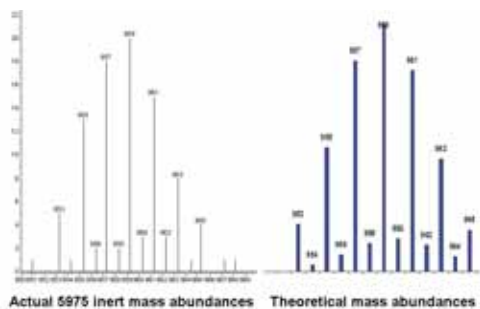
Cadmium (Cd) is used in batteries (Ni-Cd), plastic stabilizers and many surface platings. Cadmium Oxide (CdO) is a well documented cancer-causing agent (carcinogen) and is especially associated with prostate and kidney cancers in humans. EU limits for Cd are 100mg/kg.

Like Pb, the toxicity of mercury (Hg) compounds is well known. Hg is still used in some electrical components, small batteries and in some pigments. Hg compounds may cause severe gastrointestinal irritation, renal failure and death. Organic mercury, especially methyl mercury, rapidly enters the central nervous system resulting in behavioral and neuromotor disorders. EU limits for Hg are 1000mg/kg in the finished goods.

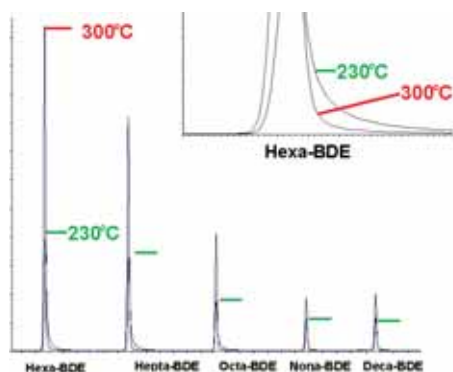
Hexavalent chromium (Cr(VI)) is used in dyes, pigments, plating solutions, alloys, catalysis and tanning. Cr(VI) is much more toxic, stable and mobile in the environment than Cr(III). The hexavalent species is a respiratory tract irritant and a known human carcinogen. EU RoHS and ELV limits for Cr(VI) are 1000mg/kg.

Agilent 6890GC and Agilent 5975 Inert MSD

The unique Retention Time Locking (RTL) feature of the 6890 gas chromatograph (GC) and the wide mass range combined with fast scanning of the new 5975 MSD, make them a perfect fit for the measurement of BFRs. With the new eMethods feature, implementing the Agilent method for PBDE analysis could not be easier.



A wide mass range makes identification of the heavier congeners of PBBs and PBDEs straightforward, but mass accuracy is also crucial. The true hyperbolic quadrupole and fast scanning high performance electronics of the Agilent 5975 MSD allow operation to 1050 Daltons, with accurate mass assignments of all ions across the mass range. This is particularly important when measuring legislated compounds such as the BFRs, as poor mass accuracy could lead to false negative results being reported. The spectra illustrates that a measurement of decabromodiphenyl ether (PBDE-209) on a 5975 MSD accurately reflects the theoretical mass abundance.



Agilent's 5975 MSD has the Agilent patented inert ion source that can be heated to 300°C, and a robust quadrupole that can be heated to 150°C. These temperatures help to keep the source clean and maintain good peak shape. Note the peak tailing that comes from running the source at "normal" temperature (230°C). Peak tailing reduces the resolution and sensitivity. Note that the horizontal lines next to each peak show the peak height when the source is set to 230°C. The peak height roughly doubles at the higher source temperature and tailing is greatly reduced.

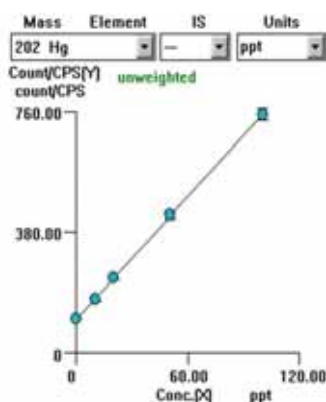
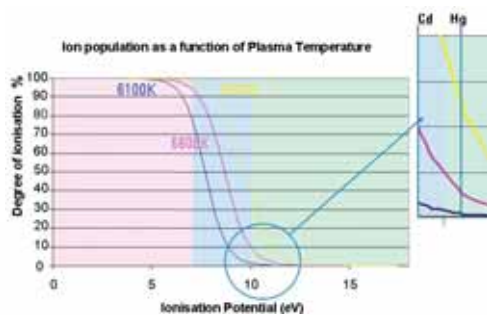
eMethods or "electronic methods" are a quick and easy way to obtain packaged application solutions from Agilent. No more manual entering of method parameters. Agilent's integrated eMethod process allows you to download any new Agilent eMethod application solution from the Agilent Web site and import it to your Agilent 5975 inert MSD or 5973 series MSD and receive all information without any manual editing errors. It's a process that can greatly improve your laboratory's productivity. Agilent is constantly expanding its library of eMethods so that users can stay updated when regulations change.



Benefits of the Agilent 6890/5975 Inert GC/MSD for RoHS

- High Performance Gas Chromatography.
- Permanent & universal Retention Times (RTL) produce superior RT reproducibility allowing correct identification of the specific congeners.
- Wide Mass Range (up to 1050 m/z) MSD.
- Superior mass accuracy for correct identification of the isomers.
- Heated MSD Zones provide robust operation and rugged sensitivity.
- Synchronous SIM and Scan data acquisition for excellent productivity.
- Exclusive eMethods capability for faster method startup.
- Deconvolution Reporting software to speed up interpretation of data.
- Operating software in Chinese, Japanese and English.

Agilent 7500 series ICP-MS



Inductively Coupled Plasma Mass Spectrometry (ICP-MS) offers both low detection limits and wide dynamic range. Being a multi-element technique, with ppt (ng/L) reporting limits along with 9 orders of magnitude linear dynamic range, the Agilent 7500 series ICP-MS can quantify all of the specified elements in WEEE/RoHS/ELV regulations quickly and easily.

A well optimized high temperature source ensures a good population of ions of all elements including those with high ionization potential such as Cd and Hg. High temperatures in the plasma ensure an excellent signal to noise with excellent stability even at low concentrations. As the Hg calibration on the left illustrates, the 7500 series is uniquely capable of measuring Hg down to low ppt levels. For WEEE/RoHS/ELV applications, the 7500a can easily meet all criteria and is the recommended instrument for these types of samples.

ICP-MS can also be used to screen samples for high levels of total Cr. Those samples that have concentrations of total Cr greater than the regulated limit can be verified using either ion chromatography linked to ICP-MS (IC-ICP-MS) or colorimetrically with diphenyl carbide (USEPA Method 7196 or 7199) with detection using an economical yet high performance UV-Vis spectrophotometer.

Designed for demanding laboratories, the Agilent 7500a ICP-MS system offers:

- A well optimized sample introduction system that produces superb matrix tolerance and good ionization of Cd and Hg.
- High transmission, off-axis, ion lens for increased sensitivity and matrix tolerance.
- Easy to set up and use for routine trace analysis of complex, often unknown sample matrices retaining the full capability of ICP-MS as a multi-element measurement technique.
- Dynamic range from low-ppt for elements such as cadmium and mercury to 1000s of ppm for major elements such as sodium in the same analytical run, thereby eliminating the need for additional analytical techniques, such as ICP-OES, GFAAS, and cold vapor.

Agilent 8453E UV-Visible spectroscopy system

Agilent's 8453E is the UV-Visible spectrometer for laboratories that demand ultimate performance. Features such as fast scanning, excellent sensitivity, better than two nanometer resolution, wavelength range of 190 to 1100 nm; less than 0.03 % stray light; virtually absolute wavelength reproducibility, exceptional ruggedness and reliability are standard. Other benefits include:

- Easy to use - built-in buttons for measuring sample, standard and blank.
- Space saving small laboratory benchtop footprint.
- Easy to exchange prealigned deuterium and tungsten lamp light sources.
- Future-proof firmware upgrades possible through PC disk.
- Open sample area makes access and exchange easy.
- Stable optics - Thermally stable ceramic spectrograph with one nanometer slit width from 190 - 1100 nm.
- GLP built-in - Serial and firmware revision number held in firmware.
- Extensive self-test procedures for lamp intensity, wavelength accuracy and noise to ensure consistent performance between validation.
- Built-in log book carries the results of self-tests plus notes on instrument maintenance.



Agilent Support Services

Agilent also provides a comprehensive range of customer-focused services for all stages of an instrument's life cycle.

- Compliance services
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Make the smart choice for your laboratory with Agilent's total solution.

With analysis solutions tailored to your unique needs, you can now enjoy peace-of-mind with Agilent's extensive suite of equipment. In addition, Agilent Technologies offers the world-class applications and service support required to rapidly implement these measurement tools into your process.

Access to Agilent's depth of knowledge and expertise in the laboratory analysis of BFRs and heavy metals and meet the new WEEE/RoHS/ELV standards with confidence.

Find out more about how Agilent can help your lab meet the new WEEE/RoHS/ELV standards.
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