

Total solutions toward a green environment



a **focus** on the world trend and

EU WEEE/RoHS requirements

increasing waste regulations

Many countries in the world are concerned about the environmental hazards caused by disposal of waste, especially from the increasing amounts of waste electrical and electronic equipment (WEEE). The Montreal Protocol, U.S. EPA Toxic Substances Control Act and Clean Air Act and Japanese manufacturing regulations have started the general reduction in use of hazardous compounds. The directives passed in the European Union (2002/95/EC, 2002/96/EC) are the latest and most progressive in banning and restricting the use of listed hazardous substances in these products. In today's global economy, this type of regulation affects us all, since manufacturing of electronic components, electrical equipment and packaging may occur in a country with one set of regulations and find its way to countries with



different regulatory requirements. Measurement of possible contaminants at low concentrations is increasingly important on a worldwide basis.

PerkinElmer, a knowledgeable global partner, can help you to keep up with the changes facing environmental analysts. New instrumentation, software enhancements and turnkey methods from the knowledge leader in environmental analysis will ensure that you remain ahead in today's business climate.

Introduction

The directive of the European Parliament and of the Council (2002/95/EC) restricts the use of certain hazardous substances in electrical and electronic equipment (RoHS) and directive 2002/96/EC works together with this to regulate the disposal of waste electrical and electronic equipment. Together, they provide incentives to design and return equipment for recycling in a more efficient and environmentally friendly way.

The RoHS & WEEE directives set only a minimum standard. Different European countries have started to set their own regulations and requirements. In facing this trend, electrical and electronic manufacturers, including all major brands, have also set up their own standards and requirements to proactively address this trend. Table 1 shows the compounds currently of concern.

require increasing **knowledge**

Table 1. Analytical Equipment Used for Measurement of Banned and Restricted Substances.

Substance	Sample Preparation Digestion/Extraction Method	Analytical Method	Analytical Equipment
Cadmium (Cd)/Cadmium Compounds	EN-1122, U.S. EPA 3050B, 3052, EN-71-part 3	U.S. EPA 7000, 6010, 6020	Flame AA, ICP-OES, ICP-MS
Lead (Pb)/Lead Compounds	EN-1122, U.S. EPA 3050B, 3052, EN-71-part 3	U.S. EPA 7000, 6010, 6020	Flame AA, ICP-OES, ICP-MS
Mercury (Hg)/Mercury Compounds	EN-1122, U.S. EPA 3050B, 3052, EN-71-part 3	U.S. EPA 7471, 6010, 6020	Flame AA, ICP-OES, ICP-MS, or FIMS
Hexavalent Chromium (CrVI)	Extraction and Colorimetry	U.S. EPA 3060A/7196A, DIN 53314	UV/VIS Spectrophotometry, HPLC/ICP-MS
PBB, PBDE	Extraction by U.S. EPA 3540C, 3541, 3550B, 3546, with sample clean up by U.S. EPA 3620B or 3630C	U.S. EPA 8270, 1614	GC/MS
Short Chain Chlorinated Paraffin (C ₁₀ -C ₁₃), Cl Content ≥ 50 wt%	Extraction by U.S. EPA 3540C, 3541, 3550B, 3546, with sample clean up by U.S. EPA 3620B or 3630C	U.S. EPA 8270	GC/MS
PCB	Extraction by U.S. EPA 3540C, 3541, 3550B, 3546, with sample clean up by U.S. EPA 3620B or 3630C	U.S. EPA 8270, 8082	GC/MS GC/ECD
Polychlorinated Naphthalene	Extraction by U.S. EPA 3540C, 3541, 3550B, 3546, with sample clean up by U.S. EPA 3620B or 3630C	U.S. EPA 8270, 8082	GC/MS GC/ECD
Organotin	DIN 38407-13	DIN 38407-13	GC/MS HPLC/ICP-MS
Azo Dyes	LMBG 82.02	LMBG 82.02	GC/MS
Ozone Depleting Substances (Hydroflorocarbon, HFCs) or Compounds with a Global Warming Potential above 15	U.S. EPA 5021A	U.S. EPA 8260	Headspace/GC/MS
Asbestos	None		FTIR, FTIR/Microscope
PVC	None		FTIR

efficient chromatographic analysis of banned organics

With 50 years of experience in gas chromatography, PerkinElmer provides a wealth of knowledge in measuring low-level organics in complex matrices. Coupled with a global support organization to assist with application questions, your laboratory will be successful in complying with new regulations, in any country.

PerkinElmer provides a variety of chromatography tools to address the most challenging analyses, including gas chromatography (GC) with specific detectors, gas chromatography mass spectrometry (GC/MS), thermal desorption and headspace sample-introduction systems, and TotalChrom® data handling. Microwave-assisted solvent extraction can speed sample preparation for complex electrical and electronic components or mixtures of components.

Gas chromatography mass spectrometry is increasingly applied to difficult environmental analyses. The ability to save time by providing confirmatory structural information at the same time as quantitative information is an advantage for the busy laboratory. The Clarus® GC/MS provides low detection limits for the measurement of semivolatile and volatile organic compounds in this RoHS application. Increased sensitivity, further enhanced by large-volume injections, makes the determination of multi-component analytes such as PCB, PBB

and PBDE in electronic products feasible. The wide mass range (1-1200 Da) ensures capability to measure higher molecular weight compounds, such as highly halogenated compounds and drug derivatives. Figure 1 shows the simultaneous collection of data using selected ion recording and full scanning mode (SIFT™) to combine quantitative sensitivity with library-searching capabilities, a new technique further enhancing laboratory productivity. Plus, advances in technology, such as a quadrupole pre-filter and new detector technology, make the system more rugged for the analysis of dirty samples, minimizing downtime and cleanup frequency.

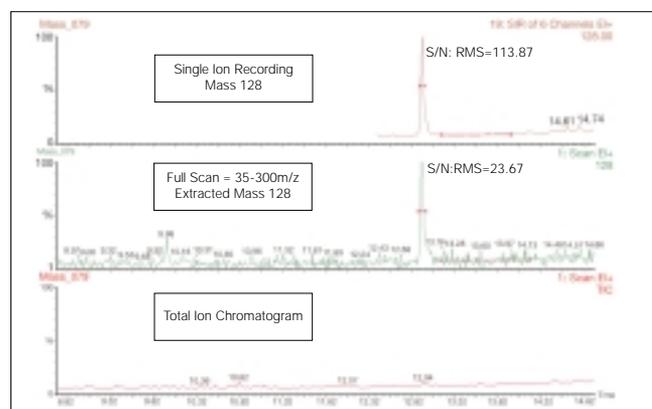


Figure 1. Acquisition of selected ion and full scan data from the same chromatographic injection.

Clarus GC/MS Benefits

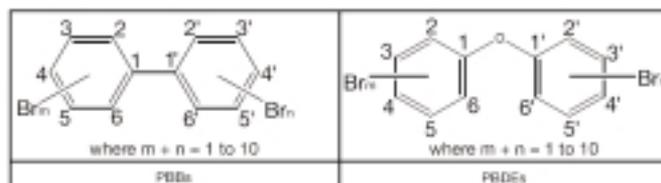
Feature	Benefit
Fastest scan rates	Provide unprecedented speed with better chromatographic peak definition, ensuring better quality results. Open the use of quadrupole technology to fast GC applications.
Widest mass range	Offers uncompromised performance over a wide mass range.
SIFI scanning mode	Includes Selected Ion Monitoring (SIM) and full scan in the same run, resulting in the most complete characterization of the sample. Eliminates the need to run the sample twice.
Gold component technology	Improves stability and reduces maintenance.
Easy-access ion source	Allows changeover in less than 15 minutes.
Sealed, long-life photomultiplier	Eliminates expensive replacement costs of electron multipliers. Improves reliability.
Special venting modes, including MSVent™	Enable the efficient use of large-volume injections, maintenance without venting the MS, and protect the detector from contamination.

selected applications demonstrate capability

Brominated fire retardants

Polybrominated diphenylethers (PBDEs) are one of the four main classes/substances that are commonly referred to as brominated flame retardants (BFRs); the others being polybrominated biphenyls (PBBs), tetrabromobisphenol A (TBBP-A) and hexabromocyclododecan (HBCD). Brominated flame retardants are used extensively in a variety of consumer products such as in thermoplastics and circuit boards for electrical equipment (including TVs and computers), building materials, foams for furniture and insulation materials, as well as in textiles and upholstery.

The most important PBDEs are the penta-BDEs, octa-BDEs and deca-BDEs. They are used in electrical and electronic equipment (including computers, TVs), textiles and plastics in vehicles, building materials, paints and insulation foam, in order to reduce fire risk. Previously, most concerns had been expressed over polybrominated biphenyls (PBB), which have similar properties to PCBs (extremely stable – accumulate in the food chains and in sediments and degrade very slowly), and whose use is fairly restricted. Recently, polybrominated diphenylethers (PBDEs), hexabromo-



cyclododecan (HBCD) and tetrabromobisphenol A (TBBP-A) have also been examined for serious health and environmental hazards.

Like PCBs, there are 209 congeners for PBBs and PBDEs, respectively. Due to their complexity and high molecular weight, it is also very challenging to properly measure these compounds. The molecular weights for PBBs range from 230 to 944 amu and for PBDEs range from 246 to 960 amu. For tuning and mass calibration, perfluorotributylamine (PFTBA), which is commonly used as GC/MS calibrant, cannot be used due to the limitation of the molecular weight of 671 and the highest fragment ion is m/z of 614. Over m/z of 700, PFK (perfluorokerosene) can be used, but requires careful assignment of the fragment ions. PerkinElmer suggests the use of tris (perfluoroheptyl)-s-triazine (TPFHST) as calibration compound, with molecular weight of 1185.

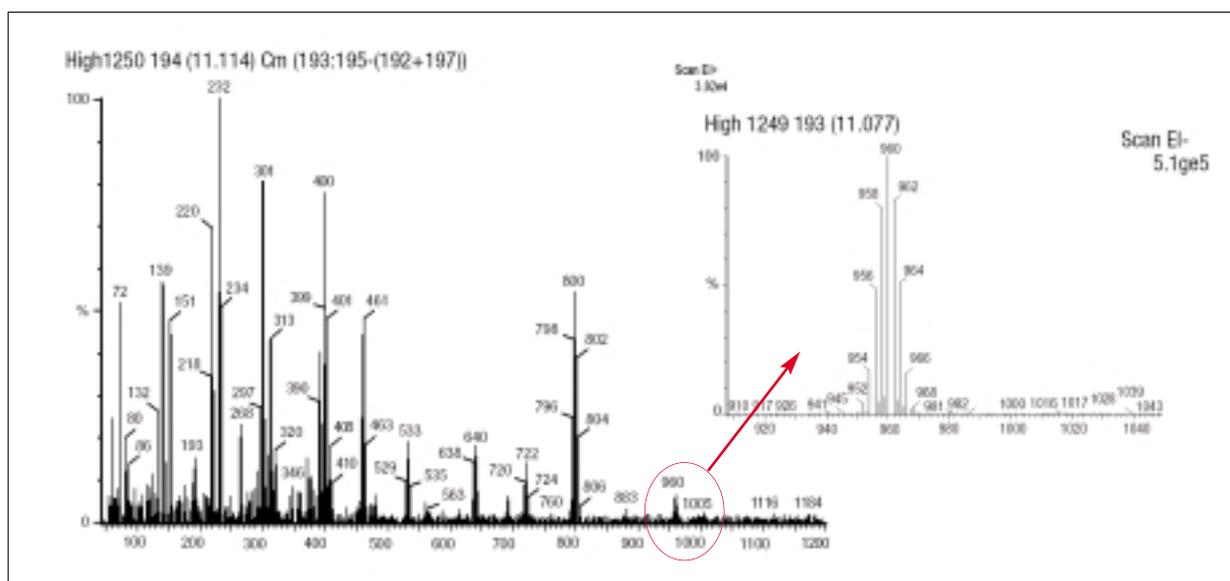


Figure 2. The spectrum of DeBDE (10 Br) and the enlarged molecular ion cluster at mass 960.

When performing an analysis, not only is the full scan spectrum important, but also the need to monitor specific molecular ion clusters, such as 954, 956, 958, 960, 962, 964 and 966 m/z for Deca(10)BDE. These ions should have an intensity ratio at 2:5:8:10:8:5:2 to comply with 10 Br isotope pattern. If the instrument is not properly tuned and calibrated, the results will be incorrect. Without the ability to monitor the higher molecular weight masses, confidence in the results is compromised.

Figure 2 (page 5) shows the spectrum of DeBDE (10 Br) and the enlarged molecular ion cluster at mass 960.

The chromatogram shown in Figure 3 shows a clear separation of a PBDE mixed standard solution, including mono- to heptabromodiphenylethers and DeBDE. All compounds are separated and detected. The quantitation range of DeBDE is 100 ppb to 100 ppm, allowing a rugged analysis of a wide range of unknown samples.

The analytical capabilities of the Clarus GC/MS, coupled with PerkinElmer's application and service support, provide confidence in a difficult, but critical analysis.

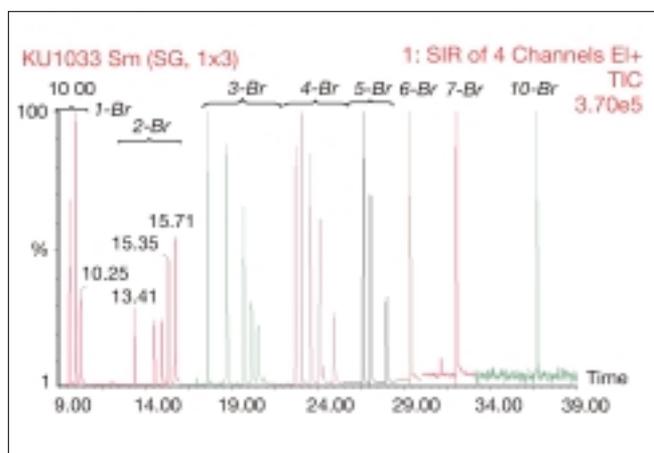


Figure 3. PBDE standard solution, showing resolution of various brominated components.

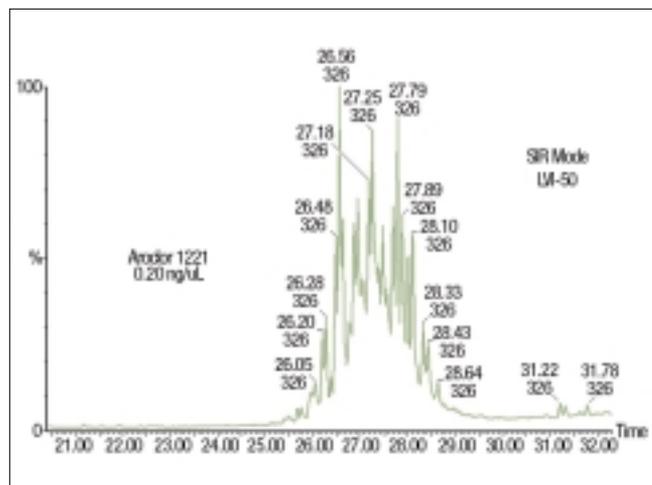


Figure 4. Aroclor 1221 chromatogram, showing multiple peaks.

Polychlorinated compounds

PCBs are mixed commercial compounds and, consisting of chlorinated phenyl compounds that are stable and highly resistant to burning at high temperatures, have good insulation properties and are generally inert. PCBs were widely used in power-generation plants. PCBs are also used as insulating oils, flame retardants, plasticizers, lubricants and transformer oil. PCB, CP and PCN are well known compounds, having very long-term environmental impact, and evidence has shown that they are persistently bio-accumulative and toxic. PCBs are often multi-component analytes. When analyzed by chromatography, they give multiple peaks for any commercial product. Figure 4 shows a chromatogram for Aroclor 1221 (one of PCBs) with the resulting multiple peaks that make quantitation difficult. Analyzing PCBs at low levels can be challenging because analyte area is distributed among many peaks. It also requires analytical skill to identify all of the peaks and ensure accurate integration. Second column confirmation is required if a specific detector, such as an electron capture detector, is used.

The PerkinElmer Clarus GC/MS provides several features that simplify the analysis. Mass spectrometry can provide conformational analysis without a second column because structural information is provided, saving time. Coupled with an efficient large-volume injection, sensitivity is improved with minimal sample preparation. SIFI can isolate identifying peaks and further improve detection limits, while obtaining full-scan information simultaneously to ensure accurate identification. Figure 5 shows the selected ion chromatogram of toxaphene for several concentrations of the standard. Note that less than 0.05 ng/ μ L can be reliably measured.

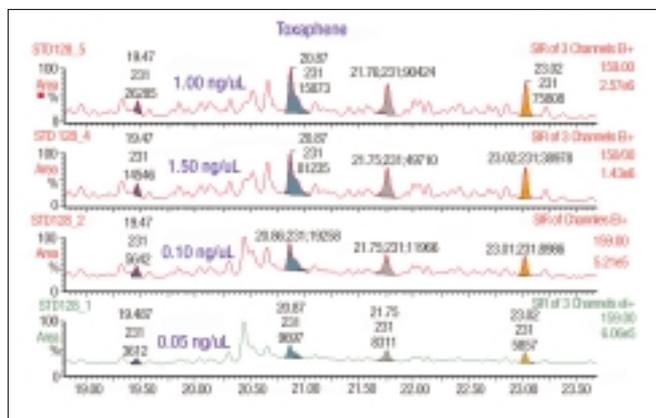


Figure 5. Selected ion chromatogram of toxaphene for several concentrations of the standard.

Figure 6 shows a chromatogram of two polychlorinated naphthalenes (PCN), demonstrating good separation.

Ozone depleting substances

In part of the latest amendment, gases that are ozone depleting or have a global warming potential above 15 were suggested for phasing out of use in these products. Most of the compounds included in this category are highly volatile and may be measured by U.S. EPA, ASTM or DIN methods. For example, some of the methods used for this type of analysis are U.S. EPA 5021, 8260, 8015, 8021, ASTM D3749, D4322,

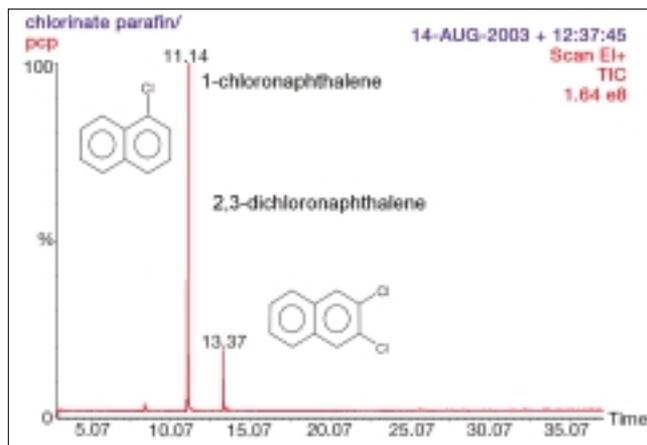


Figure 6. Chromatogram of polychlorinated naphthalenes.

D4443, D4526, DIN 38407 Part 9 and DIN 38413 Part 2. Headspace sample introduction is a convenient and reliable technique for collecting the volatile components of a sample and introducing them into the GC/MS in one step. PerkinElmer has a long history of developing headspace-sampling products since this technology was invented in the 1960s. Pressure balanced time-based sampling, in addition to overlapped sample processing, not only ensures the highest sensitivity, but also maintains the productivity needed for the RoHS application.

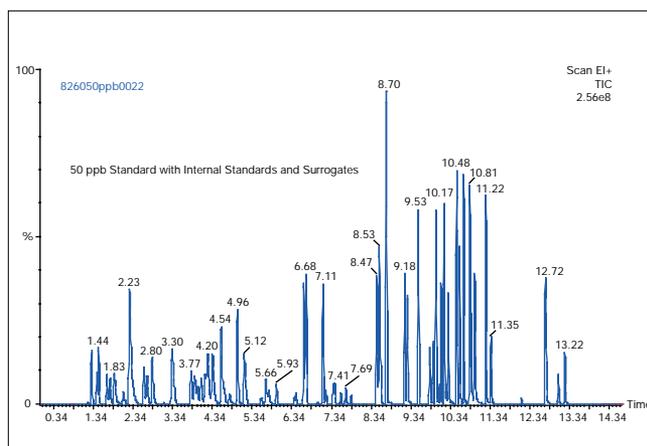


Figure 7. Volatile organic compounds, such as vinyl chloride or styrene that may contribute to ozone depletion, can be separated and measured with a GC/MS method such as U.S. EPA 8260.

heavy metals instrumentation from the world leader

The analysis of lead, cadmium, mercury and chromium are just a few of the metals routinely examined for environmental compliance around the world. PerkinElmer provides a full suite of instruments to choose from, depending on the analytical capability and capacity required by your laboratory. Coupled with world-class service and support, you will be confident in understanding the environmental impact of electronic waste.

Flame atomic absorption (AA) spectroscopy

An inherent single-element technique, the absorption of light by an element, is related to its concentration at a specific wavelength. The technique can measure many elements in the low part-per-million concentration range. It is rapid and simple to use. It is most suitable for the determination of a few elements or limited numbers of samples. As an alternative to the simple touch-screen interface, it can be expanded with easy to learn and use WinLab32™ for AA software for additional options. The PerkinElmer AAnalyst™ 200/400 atomic absorption spectrometers can be upgraded to the furnace option for trace analysis. The Stabilized Temperature Platform Furnace (STPF) technique virtually eliminates interferences arising from complex matrices. This allows analysis at part-per-billion concentrations with confidence.

Flow injection mercury system (FIMS)

Mercury is a toxic volatile element, which must be measured at low concentrations. The flow injection mercury system (FIMS) provides standalone automated mercury determinations. The capability



Figure 8. FIMS 400 mercury system with autosampler.

of the system can be further extended, when coupled with amalgamation, to achieve the ultimate detection limits for mercury.

Inductively coupled plasma optical emission spectroscopy (ICP-OES)

When several elements need to be measured or the sample workload is high, ICP-OES provides an economical analysis. Several elements can be measured simultaneously, reducing analysis time, especially important if samples or clients are waiting. The state-of-the-art Optima™ series of ICP-OES instrumentation provides features such as WinLab32 software to reduce



Figure 9. The Optima 5000 DV instruments deliver the performance required to maximize ICP productivity.

your learning curve when switching from AA to ICP-OES. A customized detector and RF power supply improve accuracy and reliability. The quick-change sample module is easy to maintain, even for newer users. Coupled with the standard dual-view system to cover a wide range of concentrations, real samples become routine.

Inductively coupled plasma mass spectrometry (ICP-MS)

For the ultimate in low detection limits, ICP-MS provides a wide range of capabilities. Sample throughput is similar to ICP-OES. Hexavalent chromium can be estimated by measuring the total chromium and by assuming it is all composed of the valence state VI. If it exceeds permissible limits, additional analysis time may be considered to determine how much of the chromium is actually chromium III and how much is chromium VI.

Sample preparation becomes critical when measuring speciated elements because the forms of the element may not be stable and will change with temperature, acid content and the addition of other chemicals. This makes the determination of speciated elements in solid materials particularly difficult, since they are generally extracted or digested before analysis.

In addition to routine analysis of most environmental elements, ELAN® ICP-MS systems can be coupled with a chromatographic technique to separate and quantitate different organic forms or valence states of an element. Figure 10 shows the separation and detection of low levels of chromium VI in a public drinking-water supply using HPLC/ICP-MS.

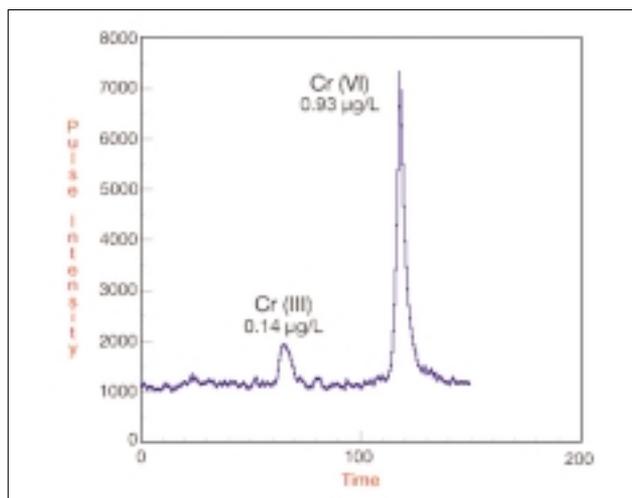


Figure 10. Chromium VI detected in a public drinking-water supply, using HPLC/ICP-MS.

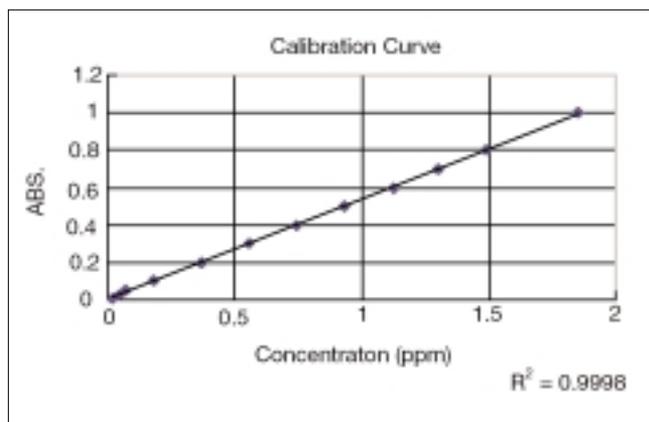


Figure 11. Calibration curve for hexavalent chromium measured at low levels, using UV/Vis.

Ultraviolet/visible spectrophotometry (UV/Vis)

Hexavalent chromium can also be economically measured by extraction and detection of chromium after reaction with a chelating solution. The absorbance is measured using a specific wavelength of light and the concentration determined. Figure 11 shows a calibration curve for hexavalent chromium measured at low levels.

The LAMBDA™ 25 UV/Vis spectrometer (Figure 12) provides an economical and reliable system for this measurement. The spectrometer can be set up to measure 0.01-10 mg/L of hexavalent chromium.

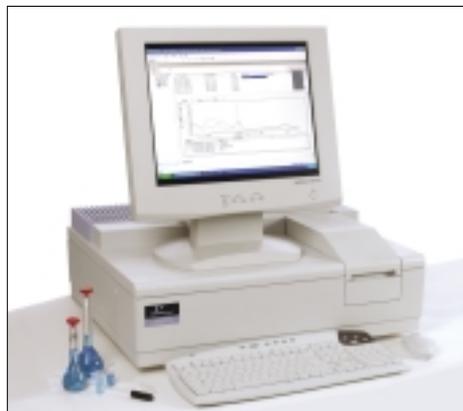


Figure 12. LAMBDA 25 UV/VIS spectrometer.

plastics and asbestos measurements identify hazards

Infrared spectroscopy measurements are versatile

Infrared and infrared microscopy are excellent tools for materials identification and contamination identification, in compliance with WEEE & RoHS directives. The FTIR technique uses the unique infrared light-absorbance fingerprint of materials for identification. It is a flexible and sensitive technique and is well documented for many applications such as the identification of PVC, phthalates and asbestos. FTIR can often be used for more detailed information, such as the concentration of the components present. The main plastic of concern is polyvinyl chloride (PVC), which contains phthalates, that make it soft and flexible, but can accumulate in body tissues and damage organs, especially in young infants. The common availability of phthalates in consumer products causes consumers to be chronically exposed to phthalates. Di-ethylhexyl phthalate (DEHP) has been most commonly used and has been replaced in recent years by DINP (di-isononyl phthalate) in children's products. PVC cannot be used in electrical and electronic products in the future.

There are several ways to prepare a sample for infrared identification. One can make a film using a heated film maker or abrade the sample with an abrasive pad and then place the pad in a diffuse reflectance accessory to collect the spectrum. However, the most convenient technique will be to place the sample on a Universal

ATR accessory. A good-quality spectrum can be obtained by this technique in a very short time, as long as there is good contact between the sample and the crystal.

The spectrum obtained can be identified using several methods. The spectrum of the unknown can be compared to known spectra of polymers manufactured by the facility, using the simple COMPARE function of the PerkinElmer Spectrum software. Alternatively, reference libraries can be searched for a match to the unknown spectrum and the closest matches ranked (Figure 13).

Asbestos is a mineral fiber of which there are several types, some of which are carcinogens. In the past, asbestos was added to a variety of products to strengthen them and to provide insulation and fire resistance. The presence of these materials in consumer products places responsibility on the analytical laboratory for accurate analysis.

There are many methods to analyze asbestos, such as polarized light microscopy, transmission electron microscope, x-ray diffraction and, of course, infrared spectroscopy. Sampling methods for IR-asbestos analysis are well documented and suitable for large to small samples, even single fibers, using IR microscopy. Chrysotile, amosite, anthophyllite and crocidolite forms of asbestos can be identified individually by infrared spectroscopy.

PerkinElmer has offered infrared instrumentation since the technique was introduced in the 1940s and has accumulated many years of experience. The Spectrum One is based on a proven-workhorse design, which is highly reliable and sensitive. The Spectrum One can be configured with the Universal ATR and, together with the COMPARE correlation function and Search software with polymer library, it is an ideal tool for polymer identification. For asbestos analysis, the PerkinElmer IR microscopy family provides excellent sensitivity with a wide range of automation options. The correct instrument can be selected based on the laboratory's throughput requirement, while retaining the highest confidence in results.

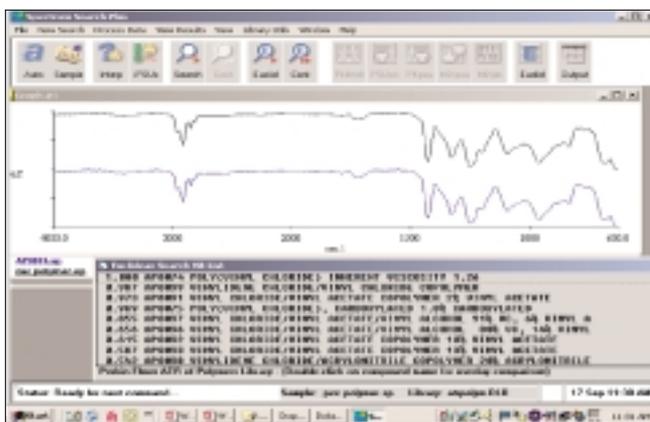


Figure 13. Search results identifying a PVC sample.

sample preparation and data handling complete the picture

Microwave assists both organic and inorganic sample preparation

The most difficult step in many analyses is the preparation of the sample. With electrical and electronic equipment, this is even more pronounced. Components may be mixed together, ground up or crushed, and have varying properties. The Multiwave™ 3000 provides a safe system to accelerate both solvent extraction and acid digestion. It is a highly modular and flexible platform system that can be equipped with different combinations of rotors, vessels and accessories for both organic and inorganic sample pretreatment. Features such as sophisticated sensors and a reinforced door ensure laboratory safety.

Microwave-assisted solvent extraction accelerates preparation

Microwave-assisted solvent extraction is a procedure using microwave energy to produce elevated temperature and pressure conditions (i.e., 100-115 °C and 50-175 psi) in a closed vessel, containing the sample and organic solvent(s) to achieve analyte recoveries equivalent

Table 2. Microwave-assisted Extraction Compared with Conventional Extraction for a Certified Reference Material – BRC 392 PCB in Soil.

Compound	Certified	Found Multiwave 3000
PCB 28	100 ±10	88.3 ±15.5
PCB 52	79 ±9	81.0 ±14.0
PCB 101	134 ±11	132.4 ±9.2
PCB 153	288 ±18	275.3 ±15.4
PCB 180	313 ±24	302.8 ±10.5

(values in ng g⁻¹)

to those from Soxhlet extraction (U.S. EPA method 3540). It uses less solvent and takes significantly less time than the Soxhlet procedure. Target compounds will be released from the sample and dissolve in the solvent. The use of microwave energy to rapidly heat the solvent allows for reduced extraction times, resulting in increased throughput. Higher pressure, safely achieved with the Multiwave closed system, further accelerates the solvent-extraction process.

Table 3. U.S. EPA Microwave Digestion Procedures.

Method	3015A Microwave-assisted acid leaching of aqueous samples and extracts	3051A Microwave-assisted acid digestion of sediments, sludges, soils and oils	3052 Microwave-assisted acid digestion of siliceous and organically-based matrices
Typical Samples	TCLP extracts, wastes containing suspended solids, aqueous samples	Sediments, soils, sludges, oils	Ashes, biological tissues, oils, soils, sediments, sludges
Elements	Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Sr, Tl, V, Zn	Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Sr, Tl, V, Zn	Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Mo, Ni, K, Se, Ag, Na, Sr, Tl, V, Zn
Procedure	45 mL sample Add 5 mL HNO ₃ or 4 mL HNO ₃ + 1 mL HCl	0.5 g solid or 0.25 g oil or contaminated soil Add 10 mL HNO ₃ or 9 mL HNO ₃ + 3 mL HCl	0.5 g solid or 0.25 g oil or contaminated soil Add 9 mL HNO ₃ + 3 mL HF (HF quantities may be varied between 0-5 mL. Addition of HCl, H ₂ O ₂ or water is permitted)
Temperature Profile	Ramp: 10 min Temp: 170 ±5 °C Hold: 10 min Total: 20 min	Ramp: 5.5 min Temp: 175 ±5 °C Hold: 4.5 min Total: 10 min	Ramp: 5.5 min (up to 10 min for critical samples) Temp: 180 ±5 °C Hold: 9.5 min Total: 15-19.5 min

Method 3546 is a procedure for extracting water-insoluble or slightly water-soluble organic compounds from a variety of environmental matrices, including wastes. This method is applicable to the extraction of semivolatile organic compounds, organophosphorus pesticides, organochlorine pesticides, chlorinated herbicides, phenoxyacids herbicides, substituted phenols, PCBs and PCDDs/PCDFs. Table 2 shows the recovery of PCBs from a certified reference material when prepared with microwave-assisted solvent extraction. The values compare well and the time for extraction was reduced from 24 hours with Soxhlet to less than two hours with microwave-assisted extraction.

Microwave digestion speeds time to analysis

Inorganic components can be prepared by extraction with a mild acid, such as in the U.S. EPA Toxicity Characteristic Leaching Procedure (TCLP), a hot-acid leach or a total digestion. Depending on whether potential environmental mobility in the presence of weakly acidic components must be assessed or the exact composition of the waste material is required, the appropriate sample preparation must be chosen to provide the desired information. The Multiwave digestion system provides a rapid, reproducible, self-contained system to prepare difficult matrices by hot-acid leach or total digestion. Increased temperature and pressure, combined with a choice of acids, will rapidly achieve the preparation desired.

Methods EN1122 and U.S. EPA 3051 and 3015 are hot-acid-leach methods. Methods EN-71, part 3 and U.S. EPA method 3052 are total digestions. Table 3 summarizes the U.S. EPA microwave digestion methods and their parameters, also stored on the Multiwave digestion system.

LIMS brings it together

LABWORKS™ ES Laboratory Information System (LIMS) provides a comprehensive solution for meeting

new regulatory requirements. PerkinElmer is a leader in the environmental LIMS industry with a history of providing solutions to local, state, federal and commercial laboratories. One of the main benefits is its ability to meet the needs of the environmental industry, fully operational upon installation, without the need for customization. Add to that our commitment to the highest quality support – from pre-implementation, to installation and training – and you've got a LIMS that leads the industry. In fact, over 90% of our current customers would recommend LABWORKS to other LIMS users. From our detailed discovery process that helps labs understand workflow, to our knowledgeable implementation team and comprehensive support plans – LABWORKS is the LIMS of choice.

LABWORKS understands the demands placed on environmental laboratories to meet increasing regulations with limited resources. Our solutions help labs increase workflow, eliminate errors and provide secure, audit-trailed results. The combination of LABWORKS ES LIMS and PerkinElmer instruments creates a total solution for routine environmental laboratories, or laboratories with a variety of analyses, including environmental.

Whatever you're looking for, we've got it

PerkinElmer is a leading provider of scientific instruments, consumables and services to the environmental testing, pharmaceutical, biomedical, forensics and general industrial markets, providing integrated solutions, from sample handling and analysis to communication of test results. With over 60 years of experience and over 1000 factory-trained professionals serving more than 125 countries worldwide, PerkinElmer is your single source for instrument care and repair, validation services, software and hardware upgrades, education and more. If you are designing a new laboratory or updating an existing facility, look to partner with PerkinElmer to provide a full range of analytical solutions for your business – for the long term.

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