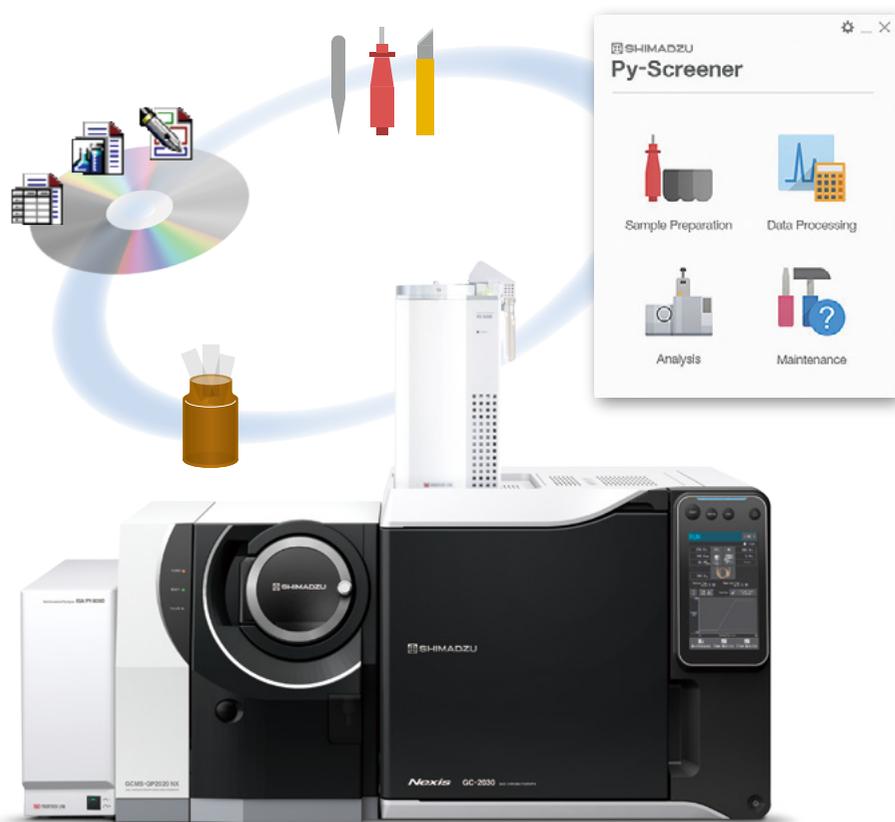


Screening System for Phthalate Esters,  
Brominated Flame Retardants and Other Regulated Substances

# Py-Screener Ver.3



# Making the Difficult Simple

The Py-Screener™ Ver. 3 can screen for 7 types of phthalate esters and brominated flame retardants (PBBs, PBDEs), including substances regulated under the RoHS Directive. In addition, it can also test for PIP (3:1), which is regulated under the US TSCA (Toxic Substances Control Act), as well as UV-328, Dechlorane Plus (DP), and short-chain chlorinated paraffins (SCCPs) and medium-chain chlorinated paraffins (MCCPs), which are regulated under the Stockholm Convention (POPs Convention) on Persistent Organic Pollutants (POPs). These regulated compounds, thermally extracted from the sample by Pyrolysis-GC-MS (Py-GC-MS), are selectively detected and quantified. Py-Screener Ver. 3 consists of dedicated software for easy screening, special standard samples, and a sampling tool kit, making it simple to operate even for first-time users.\*

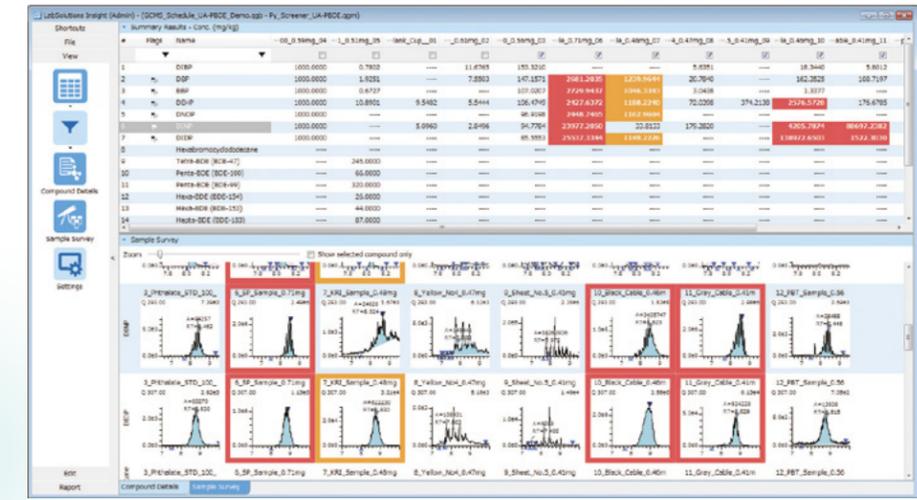
\* Dedicated standard samples are for phthalate esters and brominated flame retardants only. PIP (3:1), UV-328, DP, and SCCPs/MCCPs are calculated from the relative response factor with DEHP in the phthalate ester standard sample.

## Data Processing

Easy to Operate Even for Novices

### Tabular Display of Concentrations and Criteria Clarifies the Results

The concentrations of target substances detected by continuous analysis are displayed in a list, and pass/fail judgment is performed for concentrations within set concentration ranges. The continuously analyzed test sample results can be checked at a glance. Also, the system is equipped with accuracy control functions in order to ensure the reliability of blank concentrations, instrument sensitivity, and other data, so even novices can feel confident that they are reporting reliable measurement results.



LabSolutions Insight Analysis Window

## Sample Preparation

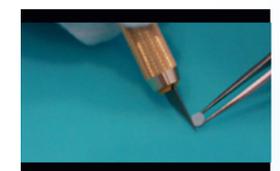
Easy to Operate Even for Novices

### Organic Solvents are Not Required for Sample Preparation

Analytical standards and test samples can be prepared without using organic solvents. To prepare a sample, just use the cutter to remove a portion from the test material, place it in the sample cup, and weigh it. Sample preparation videos provide support so that even novices can easily prepare samples.



Preparation of a Phthalate Ester Standard

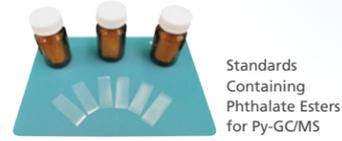


Preparation of a Test Sample

All Required Items are Available

### Special Standards for Phthalate Esters Toolkit Required for Sample Preparation

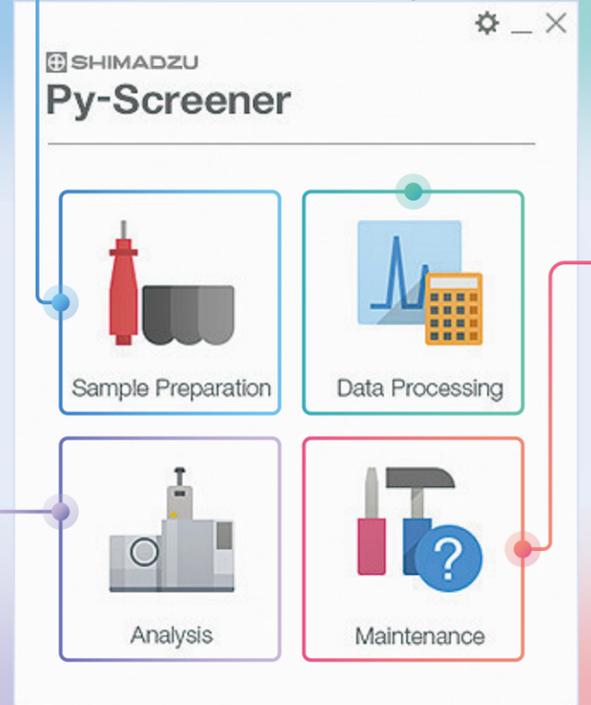
The standard samples for this system were developed jointly with SGS Japan Inc., the market leader in RoHS testing. The standards of phthalate esters for sensitivity confirmation, quantitation, and blank tests can be prepared simply by punching out a portion of a standard material using the micro puncher. A toolkit used for preparing samples has been created with Frontier Laboratories Ltd.



Standards Containing Phthalate Esters for Py-GCMS



Sampling Toolkit



Easy to Operate Even for Novices

### Easy to Operate Using Special Software

Using customized software, operations are easy, even for novices. The analytical conditions for the pyrolyzer and GC-MS are preset, and continuous analysis begins automatically when the prepared standard samples and test samples are placed in the autosampler, the number of samples, sample names, and sample volumes are entered, and the analysis start button is pressed. In addition, by linking with the AP125WD-AD analytical balance (manufactured by Shimadzu Corporation), sample volume information can be automatically transferred from the balance. This prevents errors when transcribing sample volumes, and reduces human error.



Weighed sample is set in the sampler



Enter sample information

Visit	Sample Name	Sample Amt
1	Blank_Cup	0.4
2	Phthalate STD 180	0.51
3	Phthalate STD 180	0.51
4	Phthalate STD 180	0.51
5	Test_Sample	0.51
6	Test_Sample	0.51
7	Test_Sample	0.51
8	Test_Sample	0.51



AP125WD analytical balance



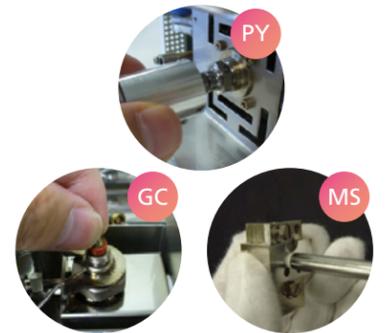
Start inspection

## Maintenance

Ample Maintenance Support

### Maintenance Navigation Supports Long-Term Operation with Periodic Replacement Kits

Using the Maintenance Navigator, the procedures appropriate for pyrolyzer and GC-MS maintenance can be performed easily and confidently. If a leak occurs, you can easily identify the cause by following the navigation menu. In addition, the regular replacement parts kit, which is made up of parts that become contaminated during long-term operation, enables safe operation, even over a long period of time.



- ✓ Detailed maintenance steps with photos attached (Photos can be enlarged)
- ✓ A list of solutions for troubleshooting is included
- ✓ A list of consumables is included

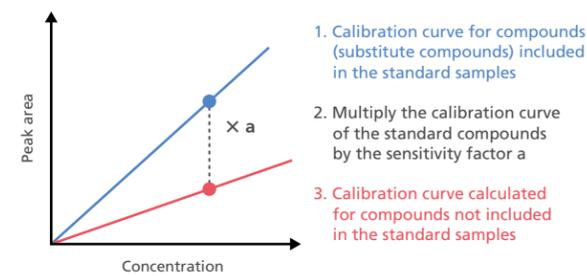
# Testing System Complying with the RoHS Directive

The Py-Screener Ver. 3 supports simultaneous analysis of phthalate esters in accordance with the international analytical standard IEC 62321-8, and simultaneous analysis of phthalate esters and brominated flame retardants in accordance with IEC 62321-3-3. In addition, by using a high-durability column (manufactured by Shimadzu Corporation), high-speed simultaneous analysis of phthalate esters and brominated flame retardants is enabled.

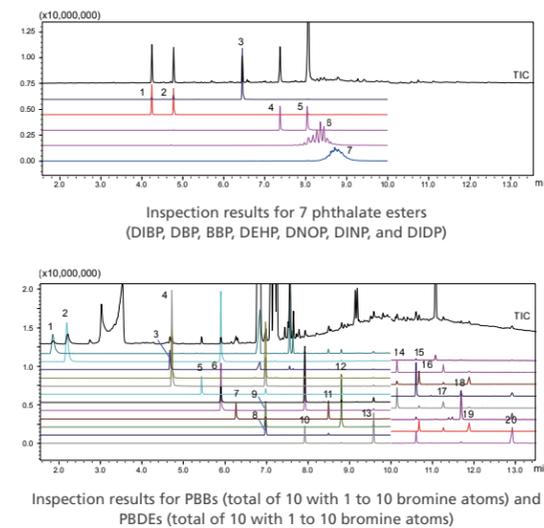
## 1. Simultaneous Inspections for Phthalate Esters and Brominated Flame Retardants (Total of 20 PBBs and PBDEs)

The system can perform batch inspections for phthalate esters and a total of 20 PBBs and PBDEs with between 1 and 10 bromine atoms. Using the correction factor database, the software can automatically create calibration curves for substances not included in the standard sample, based on the calibration curve information for substances contained in the measured standard sample, and calculate the concentrations of all of the above substances. It is possible to perform detailed RoHS inspections, by comprehensively testing for phthalate esters, PBBs, and PBDEs, which are regulated under the RoHS Directive.

### Expanding the number of target compounds using the new correction factor database function



Equipped with the correction factor database function, which registers the area ratio information of the compounds (substitute compounds) included in the standard samples and the compounds not included in the standard samples. A wide range of compounds can be quantified just with standards samples for some compounds.



## 2. Support for High-Speed Simultaneous Testing of Phthalate Esters and Brominated Flame Retardants (22 Minutes)

The testing time for phthalate esters and brominated flame retardants can be greatly reduced by the high-speed simultaneous testing method. Both productivity and reliability can be achieved for testing of a wide range of regulated compounds.

Note: This edition also includes the conventional (35 minute) simultaneous inspection method for phthalate esters and brominated flame retardants, and an inspection method compatible with high-speed screening exclusively for phthalate esters.

Inspection Method	Supported Column	Inspection Time
Simultaneous inspection method for phthalate esters and brominated flame retardants	SH-1MS, UA-PBDE	Inspection time: 35 min Pyrolyzer operation time → GC-MS operation time → GC oven cooling time
High-speed simultaneous method for phthalate esters and brominated flame retardants	SH-1MS	Inspection time: 22 min *1 → GC-MS operation time → GC oven cooling time Significantly Shortens Inspection Times Shortens by approx. 40 %
High-speed method only for phthalate esters	SH-1MS, UA-PBDE	Inspection time: 17 min*2 *1 → GC-MS operation time → GC oven cooling time Significantly Shortens Inspection Times Shortens by approx. 50 %

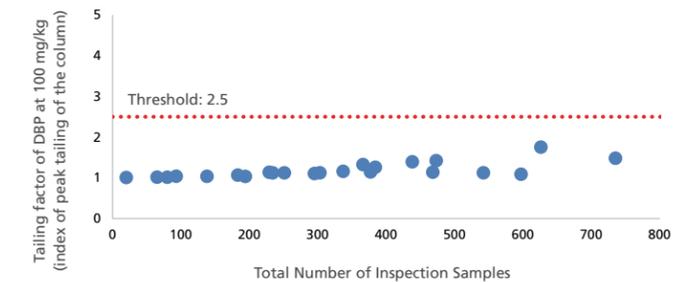
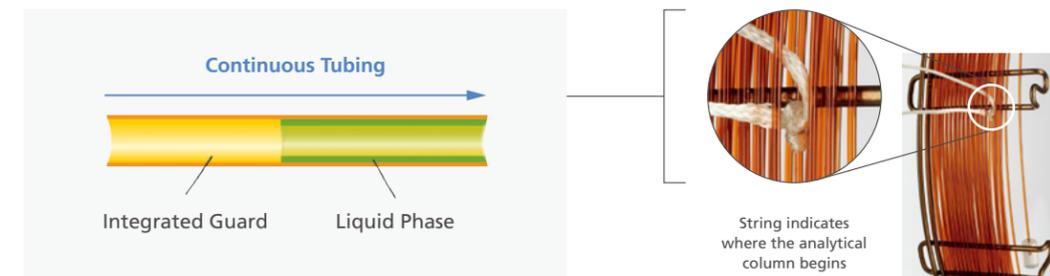
\*1 Pyrolyzer operation time  
\*2 For UA-PBDE column. 19 min for SH-1MS column.

## 3. High Durability Columns Dedicated for Py-Screener

A high-durability column (with SH-1MS guard column) (manufactured by Shimadzu Corporation) extends the column's life, and reduces maintenance and running costs. This is ideal for customers with high inspection frequency.

### Integrated Guard Column

The analysis column and guard column are integrated. The analysis column is shipped with a guard column attached, eliminating the risk of leaks at the connections and preventing adsorption or decomposition of target substances.



Results of a durability test using the high-durability column (SH-1MS with integrated guard column)

## 4. Phthalate Ester Screenings in Accordance with the European REACH Regulation

Since 2020, under the European REACH Regulation, the same 4 phthalate esters (DIBP, DBP, BBP, and DEHP) regulated under the RoHS Directive have become regulated in a wide range of molded items including toys and childcare articles. Under the REACH Regulation, regulatory concentration values are established with respect to individual concentration values and total calculated concentration values, which means that this regulation must be managed differently than the RoHS Directive. This system is capable of automatic screening determinations with respect to the total calculated concentration of these 4 phthalate esters. Py-Screener Ver. 3 can also be used for phthalate ester inspections to support compliance with the REACH Regulation.

Individual concentrations of DIBP, DBP, BBP, and DEHP

Summary Results		
#	Name	Sample R2
<input checked="" type="checkbox"/>		Conc.
<input checked="" type="checkbox"/>	1 DIBP	141.83
<input checked="" type="checkbox"/>	2 DBP	372.04
<input checked="" type="checkbox"/>	3 BBP	302.52
<input checked="" type="checkbox"/>	4 DEHP	447.40
<input checked="" type="checkbox"/>	5 DNOP	---

Screening for RoHS

Total concentrations of DIBP, DBP, BBP, and DEHP

<input checked="" type="checkbox"/>	30 Total PBDEs	0.00
<input checked="" type="checkbox"/>	31 Total PBBs	0.00
<input checked="" type="checkbox"/>	32 DIBP, DBP, BBP, DEHP	1263.80

Screening for REACH

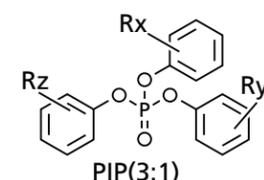
## Support for Compounds Regulated under the US TSCA and the POPs Convention

In addition to phthalate esters and brominated flame retardants, the Py-Screener Ver. 3 enables simultaneous analysis of various regulated compounds. The system can screen for PIP (3:1) and Deca-BDE, which are regulated under the US TSCA, as well as UV-328, Dechlorane Plus (DP), and short-chain chlorinated paraffins (SCCPs) and medium-chain chlorinated paraffins (MCCPs), which are regulated under the POPs Convention.

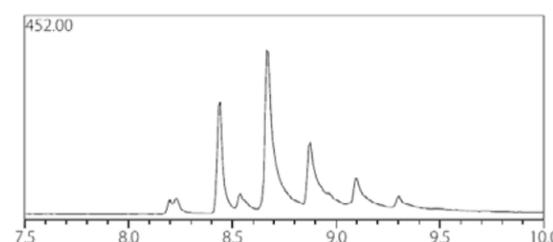
### Support for PIP (3:1) Regulated under the US TSCA

PIP (3:1), which is regulated under the US TSCA, is defined as a phosphate compound containing 3 phenyl groups, at least one of which is isopropylated, with numerous isomers and congeners. Using Py-Screener Ver. 3, complex PIP (3:1) tests can be screened simply and with high accuracy using patented technology\*1. For quantitation of PIP (3:1), the concentration can be calculated from the relative response factor with DEHP in a phthalate ester standard sample, so preparation of a standard sample is not required.

\*1 Japanese Patent Number 7582491

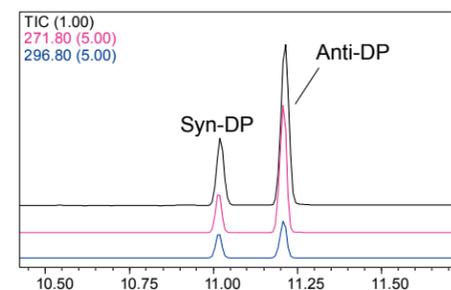
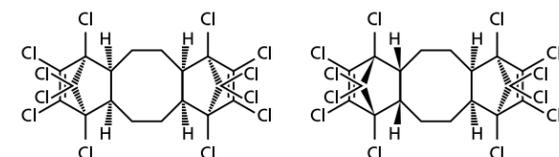
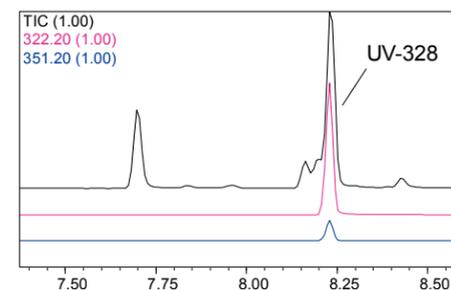
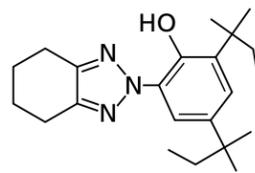


PIP (3:1) Structural Formula



### Support for UV-328 and DP Regulated under the POPs Convention

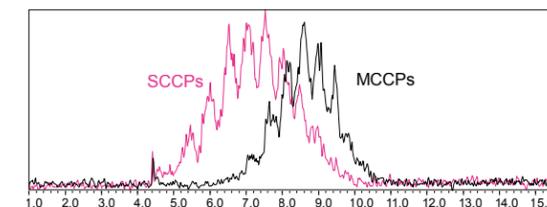
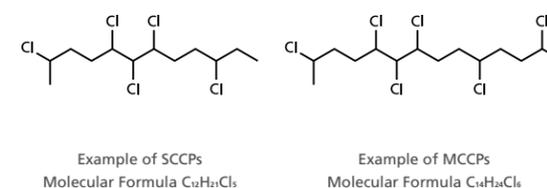
UV-328 and DP are highly persistent and bioaccumulative, so there are concerns regarding their effect on the environment. They are listed in Annex A (Elimination) of the POPs Convention. In the case of DP, peaks are detected for their syn- and anti-stereoisomers. Py-Screener Ver. 3 can easily screen for such compounds by combining the peaks of stereoisomers. Also, the concentrations of UV-328 and DP can be easily calculated using the relative response factor with DEHP in the phthalate ester standard sample. This method improves the efficiency of the analytical process by eliminating the need for preparation of UV-328 and DP standard samples.



### Support for SCCPs/MCCPs Regulated under the POPs Convention

SCCPs/MCCPs are designated as substances subject to elimination under Annex A of the POPs Convention due to their persistent, highly bioaccumulative, and toxic properties. SCCPs/MCCPs are normally analyzed by negative ion chemical ionization (NCI), because they have many isomers. However, with the Py-Screener Ver. 3, analysis can be performed by the electron ionization (EI) method, enabling simultaneous analysis with other regulated compounds. Also, flammable gas is not required. Similarly, the concentration can be calculated from the relative response factor with DEHP in a phthalate ester standard sample, allowing quantitation without preparing an additional standard sample\*1.

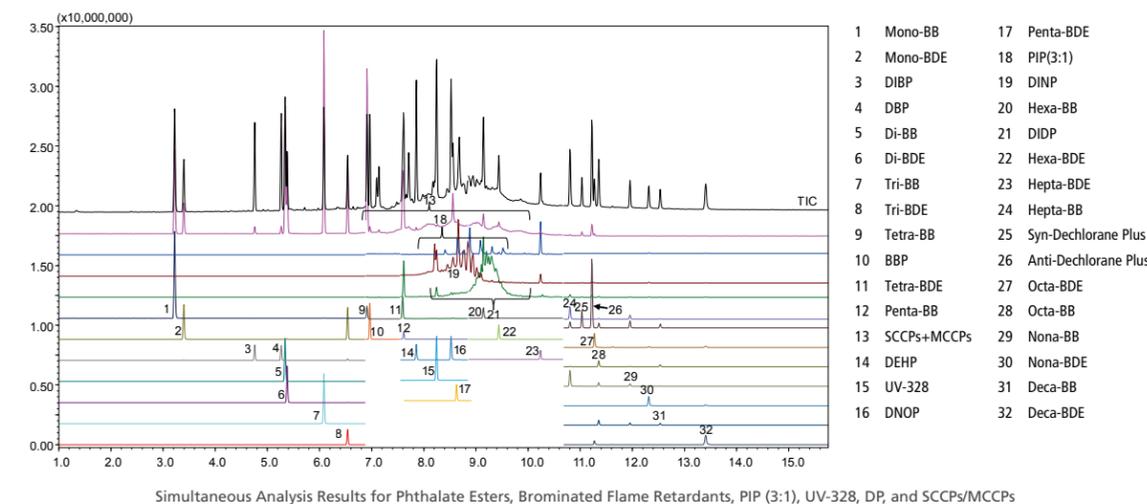
\*1 Py-Screener Ver.3 detects and quantitates SCCPs and MCCPs. It does not differentiate between individual compounds and quantifies them as a sum (SCCPs/MCCPs). However, long-chain chlorinated paraffins (LCCPs) may be detected as SCCPs/MCCPs if present.



### Enables Simultaneous Analysis of Regulated Compounds in Accordance with the RoHS Directive, US TSCA, and POPs Convention

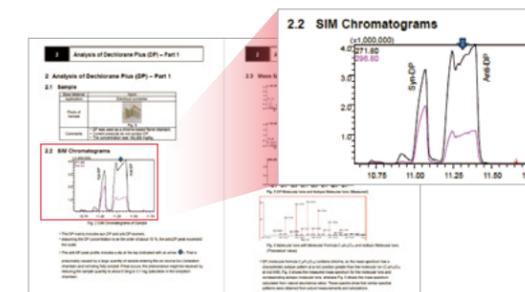
PIP (3:1), UV-328, DP, and SCCPs/MCCPs can be analyzed together with phthalate esters and brominated flame retardants\*2. The efficiency of analysis operations can be improved by testing multiple compounds simultaneously.

\*2 This is not compatible with the high-speed simultaneous testing method.



### Support for Detection of Regulated Compounds in Actual Test Samples

Py-Screener Ver. 3 includes an Analysis Handbook with many examples of GC-MS analysis using actual test samples. The collection includes analyses of target compounds such as PIP(3:1), DP, and SCCPs/MCCPs, featuring complex chromatograms unique to real samples and not obtainable from standard samples. Real samples contain a wide variety of compounds, so the chromatograms are more complex and are relevant to actual analysis situations. This analysis example collection can be used for hints and as reference material for daily analysis work. In case of difficulty with peak separation and identification, these practical examples can help with the analysis.



## Shimadzu Corporation's Solutions for Complying with International Hazardous Substance Regulations

When manufacturing and exporting products, it is necessary to comply with the chemical and hazardous substance regulations established by each country. Products contain many parts and use various materials and substances. Therefore, it is the manufacturer's responsibility to manage the entire supply chain to ensure that harmful substances are not contained. Shimadzu Corporation provides analysis solutions that comply with these regulations.

### Analysis Correspondence Table

Regulation	Regulated Compound	Energy Dispersive X-Ray Fluorescence Spectrometer (EDX)	Pyrolysis-GC-MS (Py-GC-MS)
RoHS	Lead (Pb)	○	×
	Mercury (Hg)	○	×
	Cadmium (Cd)	○	×
	Hexavalent chromium (Cr <sup>6+</sup> )	○	×
	Phthalate esters (DIBP, DBP, DEHP, and BBP)	×	○
	Brominated flame retardants (PBBs, PBDEs)	○	○
US TSCA	PIP(3:1)	Screening analysis of phosphorus (P) element	○
POPs Convention	UV-328	×	○
	Dechlorane Plus, SCCPs/MCCPs	Determination of chlorine (Cl) content	○

### Applicable Systems and Software

GC-MS : GCMS-QP™2020 NX, GCMS-QP2020, GCMS-QP2010 Ultra  
 Pyrolyzer : EGA/PY-3030D multi-shot pyrolyzer  
 Autosampler : AS-2020E, AS-1020E auto-shot sampler  
 GC-MS Workstation : GCMSsolution™ (Ver. 4.60SP2 or later) + LabSolutions Insight™ (Ver. 5.0 or later)  
 Py Workstation : EGA-PY3030 program (Ver. 1.54 or later)

### Cautions

- Note that there are no guarantees regarding the accuracy of the information contained in the method files, or the usefulness of the information obtained from the results of their use.
- In order to accurately identify the registered substances, perform the measurements using the system conditions in the method files contained in the product.

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