Wako Product Update

Analytical Chemistry

Please visit the Wako Online Catalog
http://search.wako-chem.com

Wako

ALPHABETICAL INDEX

A. LC/MS Analysis

Solvents & Packed Column for LC/MS

Ensure higher performance of LC/MS (MS)!!

LC/MS (liquid chromatography-mass spectrometer) is widely used for the analysis of various compounds such as body, food and environmental samples.
Particularly in recent years, it is also applied to the analysis of environmental pollutants or trace amounts of drug metabolite as a result of advanced developments and drastic improvements of the interface parts of devices.

Wako provides 4 types of solvents which are perfectly suited for LC/MS. Their specifications are upgraded from those of solvents for HPLC. In addition, the reverse phase packed column for LC/MS, Wakopak® MS-5C18GT, which is designed to minimize the nonspecific adsorption is also provided.

Packed column Wakopak® MS-5C18GT for LC/MS

Methanol and Acetonitrile for LC/MS

Solvents for LC/MS

[Features]

- **Suitability test for LC/MS analysis is performed on each lot.**
- **Noise level is guaranteed in the range of m/z 150-2,000.**
- **Quality is stable long term because of the use of the aluminum cap.**

[Product List]

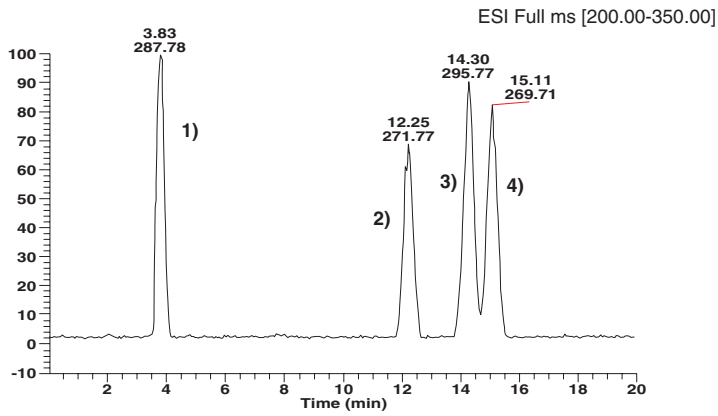
Description	Grade	Catalog No.	Package Size
NEW **Acetic Acid,** 99.5+% (HPLC)	for LC/MS Analysis	018-20061	50 mL
Acetonitrile, 99.8+% (cGC)	for LC/MS Analysis	012-19851	6 × 1 L
NEW **Formic Acid,** 99.5+% (HPLC)	for LC/MS Analysis	067-04531	50 mL
Methanol, 99.7+% (cGC)	for LC/MS Analysis	138-14521	6 × 1 L

HPLC column for LC/MS

Wakopak® MS-5C18GT

Wakopak® MS-5C18GT is a packed column optimized for LC/MS analysis. ODS, which has high separation efficiency and high durability, is adopted as the filler. The inside wall of the stainless column is glass lined to allow maximum inactivation, and high purity titanium is used for the column inlet and outlet frit to minimize nonspecific adsorption.

[Analysis of estrogen]



HPLC conditions

Column : Wakopak MS-5C18GT, 2.0 mmΦ×150 mm
Eluent : $CH_3CN/CH_3OH/H_2O$=25/25/50(v/v/v)
Flow rate : 0.2ml/min. at 40℃
Sample : 1) Estriol(E3)
2) 17β-estradiol(E2)
3) Ethynylestradiol(EE2)
4) Estron(E1)
Injection vol. : 2μL

MS conditions

LCQ(Thermo Quest) : ESI(-)
Sheath Gas Flow(arb) : 80
Aux Gas Flow(arb) : 10
Spray Voltage(kV) : 5
Capillary Temp (℃) : 240
Capillary Voltage(V) : -46
Tube Lens Offset(V) : -20

[Product List]

Description	Catalog No.	Column Size	Joint Type
Wakopak® MS-5C18GT	001-00030	2.0 mm ϕ × 50 mm NEW 2.0 mm ϕ × 100 mm NEW 2.0 mm ϕ × 150 mm	DuPont Type

B. LC/MS Analysis of Pesticide Residues

Wakopak® MS-Agri-9 GT & Presep®-C Agri

The Ministry of Health, Labour and Welfare promulgated the ordinance regarding the new water quality criteria on May 30, 2003. Since then, 101 kinds of agricultural chemicals were established as water quality management items, and served as complements to water quality criteria according to "Enactment of the ordinance regarding the water quality criteria and partial revision of the enforcement regulation of water works law" (Notification No. 1010004 of the Health Service Bureau, Ministry of Health and Welfare dated October 10, 2003). These laws have been in effect since April 1, 2004.

A new method of analysis that allows the simultaneous analysis of 28 chemicals by LC/MS has been adopted for the measurement of agricultural chemicals. Wako provides "Presep®-C Agri (Short)" for sample pretreatments, "Wakopak® MS-Agri-9 GT" for LC/MS analyses and various related reagents including standard mixture. Please use these products for the analysis of agricultural chemicals.

[Solid Phase Extracting condition for Pesticide]

Presep®-C Agri (Short)

Conditioning : ① CH_3CN 10 mL
② CH_3OH 10 mL
③ H_2O 10 mL

↓

*Water sample : 500 mL

↓

Wash : H_2O 5 mL

↓

Elute : CH_3CN 5 mL

↓

Concentrate : in N_2 gas
(0.2–0.3 mL)

↓

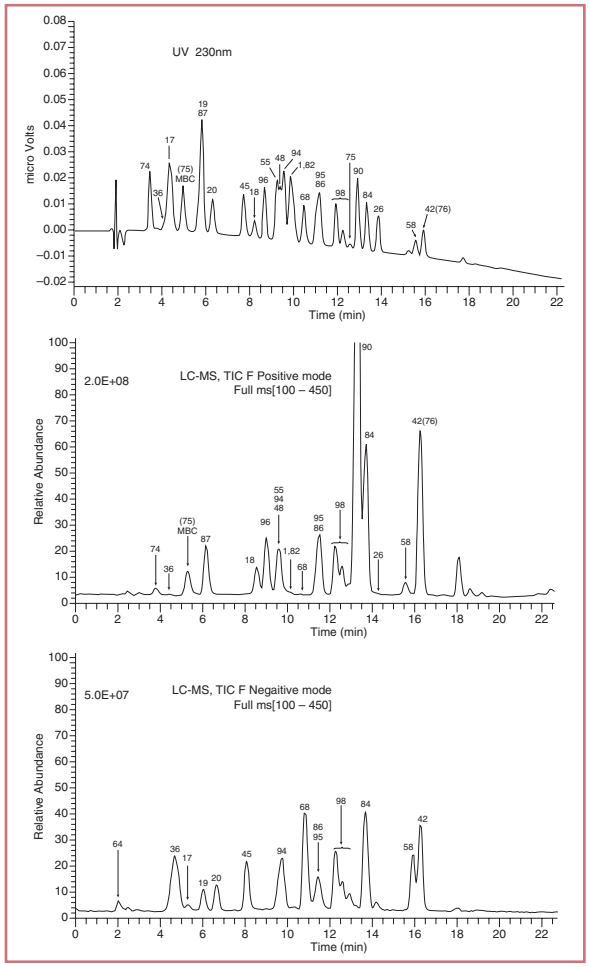
Reconstitute : 1 mL solution with H_2O

↓

HPLC-UV 10 μL

*Water sample 500 mL :
10 mL of 0.2 mol/L EDTA・2Na was added.
pH 3.5 HNO_3(1+10)
Pesticide standards were added.

[Example of simultaneous analysis by LC/MS]



HPLC conditions

Column :	Wakopak® MS-Agri-9 GT, 2.0mm ϕ × 150mm
Eluent :	A) 10 mmol/L CH_3COONH_4(pH 3.7)
	B) CH_3CN
	0-20 min. B 20-80 %
Flow rate :	0.2 mL/min. at 40℃
Detection :	(1) UV 230 nm
	(2) TIC Full : ESI(+)
	(3) TIC Full : ESI(-)
Inj. vol. :	2 μL

MS conditions

LCQ(Thermo Quest) :	ESI (+), ESI (-)
Sheath Gas Flow(arb) :	80
Aux Gas Flow(arb) :	10
Spray Voltage(kV) :	5
Capillary Temp (□□) :	240
Capillary Voltage(V) :	-46
Tube Lens Offset(V) :	-20

[Product List]

Description	Grade	Catalog No.	Package Size
Presep®-C Agri (Short)	for Sample Pretreatment	296-32651	5 × 10 ea.
Wakopak® MS-Agri-9 GT (2.0 ϕ × 150 mm)	for LC/MS analysis	001-00030	1 ea.

[Recovery data of Pesticides]

101 Pesticide No.	Description	Recovery (%)
1	Thiuram	94.3
17	Bentazone	99.3 *
18	Carbofuran (Carbosulfan metabolite)	103.1
19	2,4-D	99.1
20	Triclopyr	101.2
26	Iprodione	98.9
28	Oxine-copper	96.2
36	Asulam	99.6
42	Bensulide (SAP)	96.7
45	Mecoprop (MCPP)	99.9
48	Carbaryl (NAC)	101 *
48	Carbaryl 2	99.3 *
55	Thiophanate-methyl	96.9
58	Carpropamid	101.8
64	Dalapon Sodium	no detection

101 Pesticide No.	Description	Recovery (%)
68	Diuron (DCMU)	100.4
74	Methomyl	50.8 (85.2) *
75	Benomyl	91.0 *
76	Benfuracarb	degradable (85.5) *
82	Probenazole	98.6
84	Dymron	99.6
86	Bensulfuron-methyl	100.7
87	Tricyclazole	99.1
90	Azoxystrobin	99.6
94	Halosulfuron-methyl	99.1
95	Flazasulfuron	98.6
96	Thiodicarb	99.6
98	Siduron	99.7 *
98	Siduron 2	98.3 *
75+	Methyl-2-benzimidazolcarbamate (MBC)	97.5

Note (*):

Bentazone(17): Peak is divided according to analysis condition.
Carbaryl(NAC)(48): Peak is divided according to analysis condition.
Methomyl(74): (85.2): Recovery indicated in parenthesis is obtained when Presep®-Agri is used.
Benomyl(75): Easily degradable, changes into MBC.
Siduron(98): 2 peaks (isomer) are detected.
Benfuracarb(76): Easily degradable by acid, unrecoverable from sample water of pH 3.5. Changes into other chemicals such as carbofuran.
(85.5): Recovery from sample water of nonadjusted pH is shown in parenthesis.
Dalapon: UV undetectable, recovery not confirmed.

Mixture Standard Solutions

Description	Grade	Catalog No.	Package Size
12 Pesticides Mixture Std. Soln. (LC/MS))	for Pesticide Residue Analysis	164-21471	5 × 1 mL
Carbofuran (#18), Iprodione (#26), Asulam (#36), Bensulide (#42), DCMU (Diuron)(#68), Methomyl (#74), Probenazole (#82), Bensulfuron-methyl (#86), Tricyclazole (#87), Azoxystrobin (#90), Thiodicarb (#96), Siduron (#98)-20 μg/mL each in Acetonitrile			
10 Pesticides Mixture Std. Soln (LC/MS)	for Pesticide Residue Analysis	168-21511	5 × 1 mL
Thiuram (#1), Bentazone (#17), 2,4-PA (#19), Triclopyr (#20), MCPP (#45), Thiophanate-methyl (#55), Carpropamid (#58), Dymron (#84), Halosulfuron-methyl (94), Flazasulfuron (#95)-20 μg/mL each in Acetonitrile			

[Warning]

1. Before use, please prepare the solution of agricultural chemicals which are not included in standard mixtures.
   (The composition is determined based on stability data)
2. Please store under the indicated condition, because gradual degradation will occur at 2-10 ℃.
3. Please use as immediately as possible after dilution, otherwise, gradual degradation will occur.
4. Please use reagents of analytical grade with high purity for dilution.
5. Package size is about 1.5 mL per ampoule.

Related Products

Description	Grade	Catalog No.	Package Size
Oxine-copper Standard Solution (50 μg/mL Methanol Soln) [#28]	for Pesticide Residue Analysis	159-01961	5 × 1 mL
NAC Standard [#48]	for Pesticide Residue Analysis	148-03831	200 mg
DPA Sodium Standard [#64]	for Pesticide Residue Analysis	046-25141	200 mg
Benfuracarb Standard [#76]	for Pesticide Residue Analysis	023-09551	200 mg
Methyl 2-Benzimidazolecarbamate Standard	for Pesticide Residue Analysis	135-06841	200 mg

C. HPLC column

Wakopak® Navi series

The ultimate column for the examination of analytical conditions!!

With wide applications, it is the column of choice for the examination of analytical conditions.

[Features]

▶ **Navi C18-5**
- **Octadecyl (C18) modification is refined and the filler is fully end-capped.**
- **The filler is widely applicable to basic, acidic and coordination compounds.**

▶ **Navi C22-5**
- **The filler is end-capped after dococyl (C22) modification.**
- **By using mobile phase with high water content, purification and retention characteristics higher than that of C18 can be obtained.**

▶ **Navi C30-5**
- **The filler is end-capped after polymeric modification of triacontyl group (C30).**
- **C30 shows outstanding ability to recognize the structure.**

New reverse phase HPLC column

Wakopak® Navi C18-GT

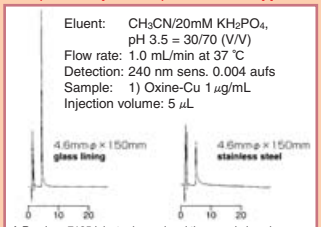
Wakopak® Navi C18-GT is a packed column with glass lined inside wall. With better features than those of the Wakopak® Navi C18-5, it is an upgraded ODS column that has been well received as one of the new reverse phase HPLC columns.
In addition, high purity titanium is used for frit at both ends of the column to minimize the nonspecific adsorption.

[Features]

- Avoids contact with metal (Fe), and inhibits the influence of metal coordination compounds to an absolute minimum
- Peak shape and recovery ideal for trace analysis in a body sample

Inert like glass, Firm like stainless

[Analysis example (Analysis of oxine-copper)]



A Reodyne 7125 injector is used and the sample loop is replaced with 20 μL loop made of PEEKsil*). Tubing made of PEEK resin is used from the injector to a detector.
*) Made by SGE

Description	Column Size	Column Joint Type
Wakopak® Navi C18-5GT	2.0 mmφ × 150 mm 2.0 mmφ × 250 mm 4.6 mmφ × 150 mm 4.6 mmφ × 250 mm	(D)

* Only available in these sizes and types. These products cannot be repacked. (D): DuPont type

A Selection Guide for Each Column

For usual analyses, start with Navi C18-5. Use Navi C30-5 for the analyses of structural analogs.

Various compounds such as basic, acidic, coordination and neutral compounds.

→ **Navi C18-5**

When you want to change the separation behavior of analysis using Navi C18-5.

→ **Navi C22-5**

Structural analogs such as homolog

→ **Navi C30-5**

Comparison of analysis examples

Various compounds were analyzed under the same condition using 3 Navi columns and ODS columns made by other companies (see table below). All the columns could be used, but analyses using the columns made by other companies showed bad peak shapes depending on compounds.

[Comparison of separation abilities between each filler]

		Navi C18-5	Navi C22-5	Navi C30-5	Company A	Company B	Company C	Company D
Basic performance		◎	◎	○	◎	◎	◎	◎
Basic compound	Procainamide	◎	◎	○	○	◎	◎	◎
	Catecholamine	◎	◎	◎	◎	△	◎	◎
Acidic compound	Straight-chain carboxylic acid	◎	◎	○	◎	△	○	△
	Aromatic carboxylic acid	◎	◎	◎	◎	◎	△	◎
Coordination compound	Oxine copper	◎	◎	○	△	○	◎	◎
Homolog	Vitamin E	△	△	○	△	△	△	△
	Carotenoid	○	○	◎	○	○	○	○

Analysis results: ◎ Excellent ○ Fair △ Poor

[Column Size]

	*Inside diameters	*Lengths	Joint Type
Wakopak® Navi C18-5	2.0 mm 3.0 mm 4.0 mm 4.6 mm	150 mm 250 mm	DuPont Type (D) Waters Type (W)
Wakopak® Navi C22-5			
Wakopak® Navi C30-5			

Please select a column size and type.
[(D): DuPont type, (W): Waters type]

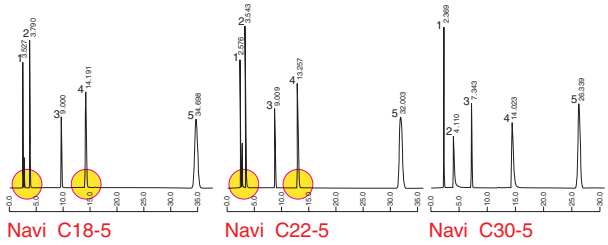
* Available in a variety of inside diameters and lengths. Please contact us or your local distributor for details.

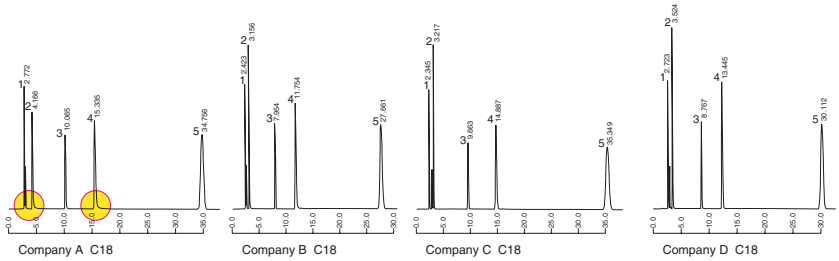
Analysis of basic compound (Analysis of procainamide and 2,4,6- trimethyl pyridine)

Procainamide and 2,4,6- trimethyl pyridine are eluted sharply using Navi C18-5 or C22-5, but tailing occurs with the Company A's product.

[HPLC Conditions]

Column size : 4.6 mm × 250 mm
Eluent : CH_3CN/10mM KH_2PO_4(pH 7.0) = 30/70(v/v)
Flow rate : 1.0 mL/min.
Temp. : 35℃
Detection : UV 254 nm, 0.16 AUFS
Sample : 1) Uridine
2) Procainamide HCl
3) Phenol
4) 2,4,6-Trimethylpyridine
5) Methyl Benzoate



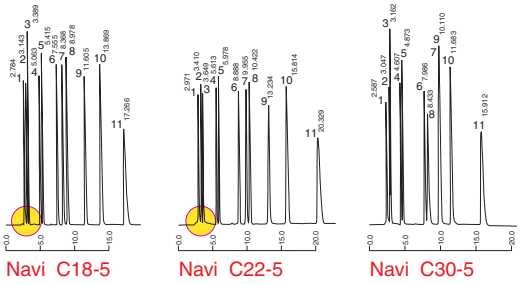


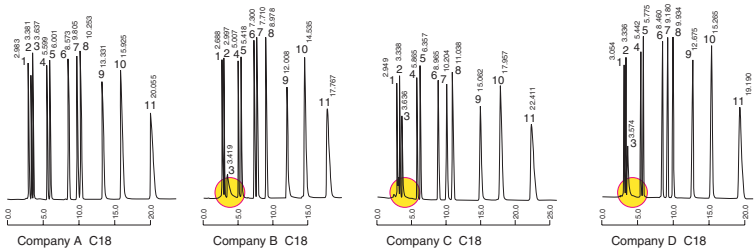
Analysis of acidic compound (Analysis of straight-chain carboxylic acid)

All the Navi columns show excellent peak shapes. Especially, few tailings are observed in analyses using Navi C18-5. Navi C22-5 shows higher separation and high retention than Navi C18-5 although only buffers are used as mobile phase. As for Navi C30-5, elution order is partly reversed.
Tailing occurs at a formate peak by using the products of other companies except

[HPLC Conditions]

Column size : 4.6 mm × 250 mm
Eluent : 20 mM NaH_2PO_4(pH 2.5)
Flow rate : 1.0 mL/min.
Temp. : 35℃
Detection : UV 210 nm, 0.04 AUFS
Sample : 1) Oxalic Acid 2) Tartaric Acid
3) Formic Acid 4) Lactic Acid
5) Acetic Acid 6) Citric Acid
7) Fumaric Acid 8) Succinic Acid
9) Acrylic Acid 10) Propionic Acid
11) Levulinic Acid



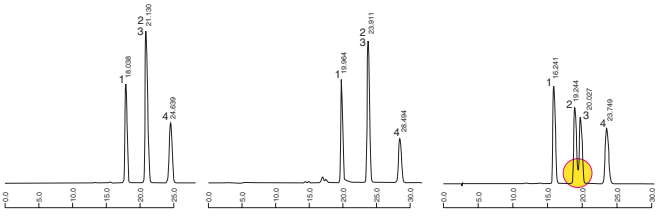


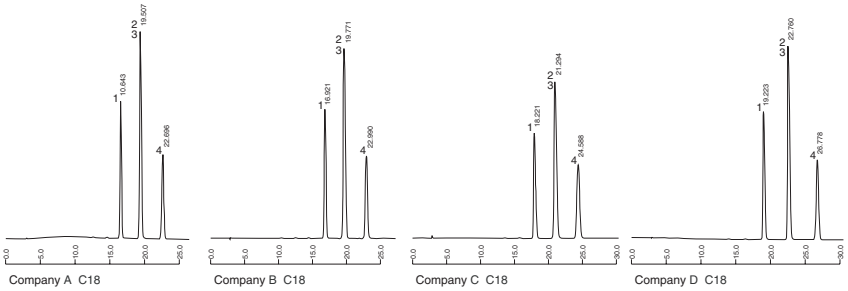
Analysis of homolog (Analysis of vitamin E)

Separation between β and γ-vitamin E are achieved with Navi C30-5. Other columns including Navi C18-5 and C22-5 bring about overlapped peak.

[HPLC Conditions]

Column size : 4.6 mm × 250 mm
Eluent : CH_3CN (100%)
Flow rate : 1.0 mL/min.
Temp. : 35℃
Detection : UV 295 nm, 0.064 AUFS
Sample : 1) d-δ-Tocopherol
2) d-γ-Tocopherol
3) d-β-Tocopherol
4) d-α-Tocopherol





D. Environmental Analysis

a. for Anionic Surfactant Analysis

Wakopak® Wakosil AS-Aqua & Standard Solution

Complies with the revised Water Works Law

With water quality criteria and test methods being revised, so did the anionic surfactant analysis method; it has changed from flow injection absorptiometry to high performance liquid chromatography. HPLC-fluorescence detection is adopted in the revised law. With this method, a column packed with silica gel, which is chemically modified with octadecylsilyl group (ODS column) or a column with equivalent quality to ODS column, is used as the separating column. According to this method, when analysis of water is carried out using Wakopak® Navi C18-5 (ODS column), numerous peaks may be detected.

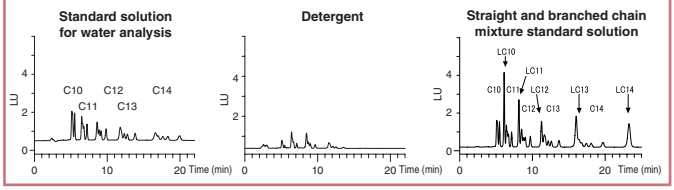
On the other hand, the amount of anionic surfactant is prescribed a the total amount in the water quality criteria. Therefore, if these peaks are reduced, it improves the detectability and simplifies the quantitative calculation. Wakopak® Wakosil AS-Aqua is packed with the filler which recognizes the number of carbon atoms and not the branched condition, and is the best column for simple analysis of anionic surfactants. According to the change in the analysis method, anionic surfactants of C10-C14 including branched alkyl chain are available as a reference standard. Presep®-C C18, solid-phase extraction column, is also available for pretreatment of samples. This column is hardly affected by the quality of water samples and good recovery results are obtained. The combined use of these products is recommended.

Analysis of anionic surfactants mixture standard solution

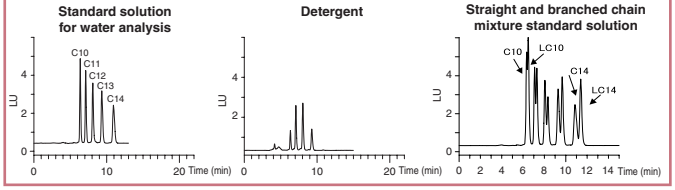
Eluent: CH_3CN/H_2O=65/35 (V/V), with $NaClO_4$ 12.3 g/1000 mL
Detection: EM. 221 nm, EX. 284 nm
Injection: each 10 mg/L (CH_3OH), 10 μL
Sample: Anionic surfactants mixture standard solution
(Sodium alkyl benzene sulfonate: C10, C11, C12, C13, C14)

[Remarks]
Linear anionic surfactant (L) is marketed as a standard solution. In HPLC analysis, this solution shows a different elution pattern from that of actual detergents (our standard solution including branched chain). Wakopak® Wakosil AS-Aqua can distinguish and separate straight chains from branched chains.

[Fig.1 Wakopak® Navi C18-5, 4.6 × 250 mm (Flow rate; 1.0 mL/min.)]



[Fig.2 Wakopak® WS AS-Aqua, 4.6 × 250 mm (Flow rate; 0.7 mL/min.)]



Sample pretreatment of anion surfactant analysis

[Pretreatment by solid-phase extraction column]

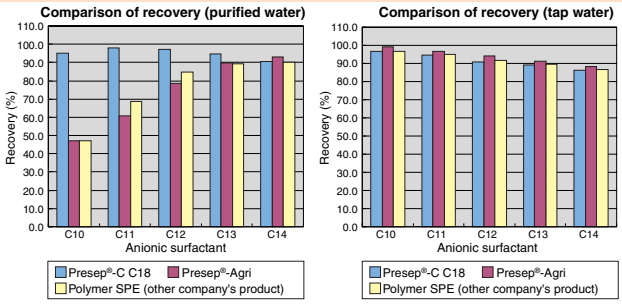
Presep®-C C18 (ODS)	Presep®-Agri
Cartridge type	Syringe type
Filler: C18 (ODS)	Filler: Polymer

[Solid-phase extraction column]

Conditioning: ①CH_3OH 5 mL
②H_2O 5 mL
↓
Sample: 1 L of water, 20 mL/min.
↓
Dry: Vacuum for 5 min. (N_2 purge 5 min.)
↓
Elute: CH_3OH 5 mL
↓
(Concentrate: to 2 mL by blowing N_2 gas), omitted

Sample:
1L of purified water + 0.1 mg each of reference standard
1L of tap water + 0.1 mg each of reference standard

[Recovery]



[Product List]

Description	Catalog No.	Column Size
Wakopak® Wakosil AS-Aqua	001-00030	4.6 ϕ × 250 mm
Wakopak® Navi C18-5	001-00030	4.6 ϕ × 250 mm

[Standard Solution and others]

Description	Grade	Catalog No.	Package Size
Anionic Surfactants Mixture Standard Solution (1mg/mL each in Methanol Solution)	for Water Analysis	013-20131	5 × 1 mL
Sodium Decylbenzenesulfonate Standard Solution (1 mg/mL in Methanol Solution)	for Water Analysis	195-13111	5 × 1 mL
Sodium Undecylbenzenesulfonate Standard Solution (1 mg/mL in Methanol Solution)	for Water Analysis	192-13121	5 × 1 mL
Sodium Dodecylbenzenesulfonate Standard Solution (1 mg/mL in Methanol Solution)	for Water Analysis	199-13131	5 × 1 mL
Sodium Tridecylbenzenesulfonate Standard Solution (1 mg/mL in Methanol Solution)	for Water Analysis	196-13141	5 × 1 mL
Sodium Tetradecylbenzenesulfonate Standard Solution (1 mg/mL in Methanol Solution)	for Water Analysis	193-13151	5 × 1 mL
Presep®-C C18 (ODS)	for Sample Pretreatment	292-32251	5 × 10 ea.
Presep® Agri	for Pesticide Residue Analysis	291-26851	50 ea.

E. Sample Pretreatment

a. Presep® Series

Syringe-type solid phase extraction cartridge

Presep® Florisil

Solid phase extraction is a method used to extract the intended substance from samples with complex compositions and has the advantage of being simple and requiring only small quantities of solvents.
Wako released "Presep® Florisil" for sample pretreatment with a syringe type (6 mL) pack with Florisil (1.0 g). With the existing cartridge type column "Presep®-C Florisil", please choose the most appropriate product, depending on your purpose.

[Features]

- **Excellent recovery and reproducibility**
- **Easy-to-use aluminum package with zipper**

	Presep® Florisil	Presep®-C Florisil
Filler amount	1.0 g	0.95 g
Column type	PP syringe column (6 mL)	PP cartridge column
Particle size of Florisil	75-150 μm (100-200 mesh)	

[Product List]

Description	Grade	Catalog No.	Package Size
NEW Presep® Florisil	for Sample Pretreatment	291-44051	5 × 10 ea.
Presep®-C Florisil	for Sample Pretreatment	290-31951	5 × 10 ea.

Related Products

	Syringe Type	Cartridge Type
Agri	Presep® Agri [291-26851 (5 × 10 ea.)]	Presep®-C Agri (Short) [296-32651 (5 × 10 ea.)]
Alumina		Presep®-C Alumina (N) [290-32051 (5 × 10 ea.)]
C18 (ODS)		Presep®-C C18 (ODS) [292-32251 (5 × 10 ea.)]
Diatomaceous Earth, Granular	Presep® Diatomaceous Earth, Granular (100 ea.) [292-35051 (1 g/ 6 mL); 298-35151 (2 g/ 15 mL); 294-35251 (4.5 g/ 25 mL)]	
DNPH		Presep®-C DNPH (20 ea.) [290-34251 (1.9 ϕ × 5.0 cm]; 291-43951(Short) (1.9 ϕ × 3.8 cm)]
Na_2SO_4		Presep®-C Na_2SO_4 [296-32151 (5 × 10 ea.)]
RPP	Presep® RPP (5 × 10 ea.) [294-36851 (60 mg/ 3 mL); 290-36951 (200 mg/ 6 mL)]	Presep®-C RPP (5 × 10 ea.) [293-41951(Long); 297-41851 (Short)]
Silicagel		Presep®-C Silicagel [294-31851 (5 × 10 ea.)]

b. Presep® Dehydration series for Organic Synthesis

Presep® Dehydration

Presep® Dehydration is a pretreatment column with double structure, which is used in conjunction with inner cylinder and outer component. The side of the inner cylinder is slit open and hydrophobic membrane filter is attached. It enables to separate water and solvents of low specific gravity like ethyl acetate.
Recently, a large volume syringe type (30 mL) and a 48 well plate which can be applied to many samples were added to the existing syringe type (6 mL).

Presep® Dehydration


Presep® Dehydration 48 well plate (3 mL)

[Specifications]

	Presep® Dehydration	Presep® Dehydration, 30 mL	Presep® Dehydration 48 well plate (3 mL)
Outer cylinder and component	Polypropylene		
	column (6 mL)	column (30 mL)	48 well plate
Inner cylinder	Polypropylene		
	column (5 mL)	column (25 mL)	8 well (3 mL each) × 6
Filter	Teflon membrane filter		

[Directions for use]

After application of a sample to the inner cylinder, organic solvents can be filtered and separated from water.
These products are particularly useful for the separation of water from water insoluble organic solvents such as ethyl acetate, hexane and diethyl ether.

[Precautions]

Gravity filtration is recommended.
When water soluble organic solvents are used, they may not be sufficiently separated.
When a column is left for a long time after sample application, water repellency of the filter may disappear, which may result in the water passing through the filter.

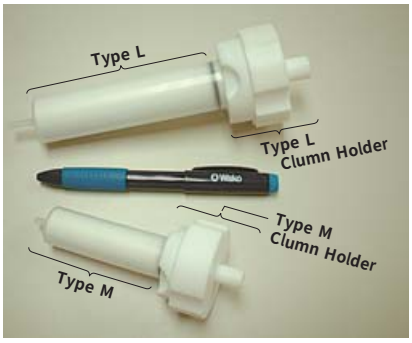
Description	Grade	Catalog No.	Package Size
Presep® Dehydration	for Organic Synthesis	299-40451	100 ea.
Presep® Dehydration (30mL)	for Organic Synthesis	293-59901	50 ea.
Presep® Dehydration, 48 Well Plate (3mL)	for Organic Synthesis	299-44351	10 ea.

F. Flash Chromatography

Presep® Silica Gel Type M & L

Columns for Flash Chromatography

Presep®Silica Gel is a column packed with high quality silica gel into polypropylene syringe and used for flash chromatography. Wako also provides a special column holder for Presep® Silica Gel which is easy to put on or take off. The combination use of these products will help you separate various samples.



[Features]
- **Excellent cost performance**
- **High quality silica gel**
- **Adaptable to FlashMaster™ series (Argonaut)**

[Product List]

Description	Particle Size	Pore Size	Column Size	Filler Amount	Grade	Catalog No.	Package Size
Presep® Silica Gel Type M	20–40 μm	7 nm	25 mL	11 g	for Sample Pretreatment	297-44151 (2 × 10 ea.)	293-44153 (10 × 10 ea.)
Presep® Silica Gel Type L			70 mL	30 g		293-44251 (2 × 10 ea.)	299-44253 (1 × 10 ea.)

[Accessory]

	for Presep® Silica Gel Type M	for Presep® Silica Gel Type L
Column Holder	291-45151 (1 ea.)	299-44851 (1 ea.)
Filter	297-45251 (10 ea.)	295-44951 (10 ea.)
O-ring	293-45351 (10 ea.)	295-45051 (10 ea.)

G. Thin Layer Chromatography

a. Preparative TLC

Thin layer chromatography (TLC) is an extremely simple but convenient analysis method, and is commonly used for analysis and preparation.
Recently, the new product Preparative TLC plate "Silicagel 70PF_{254} Plate-wako" was added to the existing Silicagel 70 Plate Series. Porous silica gel with even size particles of pore diameter 7 nm is adopted and the amount of adhesive agent is reduced to the minimum, thereby enabling easy sampling.

[Physical properties]

- ▶ Particle Size: 5-40 μm
- ▶ Pore Diameter: Approx. 7 nm
- ▶ Specific Surface Area: 450 m^2/g
- ▶ Pore Volume: 0.8 mL/g
- ▶ Thickness of Silica Gel Layer: 0.7-0.9 mm
- ▶ Adhesive agent: Polymer
- ▶ Fluorescent substance added: Single-color fluorescent substance

[Product List]

Description	Grade	Catalog No.	Package Size
Silicagel 70 PF_{254} Plate-wako (20 cm × 20 cm)	for Thin Layer Chromatography	195-12871	10 ea.

b. Related Products –Analytical TLC–

Description	Fluorescent Substance added	Wako Catalog No. (Package Size)			
Silicagel 70 FM Plate-wako	Fluorescent mixture (red, green and blue)(λ=250–400 nm)	190-08391 (5 × 10 cm; 10 ea.)		194-08394 (5 × 20 cm; 100 ea.)	196-08393 (20 × 20 cm; 25 ea.)
Silicagel 70 F_{254} Plate-wako	A green fluorescent substance (λ=254 nm)	193-08401 (5 × 10 cm; 10 ea.)	193-08406 (5 × 10 cm; 200 ea.)	197-08404 (5 × 20 cm; 100 ea.)	199-0840 (20 × 20 cm; 25 ea.)
Silicagel 70 Plate-wako	No fluorescent substance	193-09381 (5 × 10 cm; 10 ea.)		197-08384 (5 × 20 cm; 100 ea.)	199-08383 (20 × 20 cm; 25 ea.)
Chromato Sheet	A green fluorescent substance (λ=254 nm)	036-17151 (20 × 20 cm; 25 ea.)			

H. Ion Exchange Cellulose

CM-Cellulose & QA-Cellulose

Biopolymers including functional proteins such as enzymes are generally isolated and purified through several separation steps. Ion exchange chromatography is one of the many important methods incorporated in these steps. Recently, CM-cellulose, cation type, and QA-cellulose, strong basic anion type, were added to the existing DEAE-cellulose. These products are available as preswollen microgranular ion exchange cellulose. Please choose the most appropriate product, depending on your purpose.

[Features]

- **High exchange capacity for proteins or other polymers.**
- **Because they are available in the preswollen microgranular form, this makes acid or alkaline treatments and removal of fine particles unnecessary. Usable immediately after replacement with buffers used.**
- **Lot-to-lot uniformity and high reproducibility.**

[Characteristics]

	CM-cellulose	QA-cellulose	DEAE-cellulose
Replacement group	Carboxymethyl	Quaternary amine	Diethylaminoethyl
Ion exchange capacity (meq/dg*)	0.90–1.15	1.00–1.20	0.88–1.08
Protein exchange capacity (mg/dg*)	1180	750	700

*dry gram

[Product List]

Description	Grade	Catalog No.	Package Size	Storage
NEW CM-Cellulose	for Column Chromatography	033-19361	100 g	Keep at 2~10℃
		035-19365	500 g	
NEW QA-Cellulose	for Column Chromatography	175-00561	100 g	
		177-00565	500 g	
DEAE-Cellulose	for Column Chromatography	041-26171	100 g	
		043-26175	500 g	

A. Super Absorbent Polymer (Acrylate Type)

Capable of absorbing as much as 400 times its own weight of water!

What is a Super Absorbent Polymer?

A Super Absorbent Polymer is a polymer characterized by rapid water absorption and swelling when it comes into contact with water, and capable of absorbing as much as several hundred times its own weight. It also has the characteristics of retaining most of the absorbed liquid even if pressure is applied. Therefore, it is used as a disposable diaper or sanitary goods and applied to the fields of agriculture, medicine and civil engineering as water absorbent, moisture absorbent, gelling agent and humectant. Its application as a research reagent is also becoming widespread.

This product is a partially neutralized cross-linked poly (acrylic acid) and forms a relatively hard gel by absorbing as much as 400 times its own weight of water. It is insoluble in water and organic solvents.

[Specification]

- Appearance: White, crystals–powder
- Particle Size: 150 μm–1.4 mm (min. 90 %)
- Loss on drying at 150 ℃: max. 10.0 %
- Nitrogen compounds (as N): max. 0.5 %
- pH: approximately 7

[NOTE] Capacity of water absorption varies with different types of liquids.
Water: About 400 times, Physiological saline: About 50 times, Artificial urine: About 45 times

[Example of use] Used for Various Purposes

For pretreatment of environmental water samples in rapid analysis of stable nitrogen isotope ratio.
(Described in the literature below by Dr. Nishikawa, National Institute for Environmental Studies)
The water sample can be analyzed simply and rapidly as a solid sample by absorbing and immobilizing into Super Absorbent Polymer.
[Reference] Ogawa,Y., Nishikawa,M., Nakasugi,O., Ii,H. and Hirata,T.: *Analyst,* **126**, 1051 (2001).

[Product List]

Description	Grade	Catalog No.	Package Size
Super Absorbent Polymer (Acrylate Type)	for Water Analysis	197-12451	50 g
		193-12453	250 g

B. Residual Chlorine Analysis

DPD Phosphate Buffer Powder

Residual chlorine is measured in drinking water, swimming pool water, water for building management, water in the purifier tank and sewage at environmental control facilities.
Residual chlorine is measured by comparing the standard colorimetric liquid to pink or pinkish red color developed by allowing residual chlorine to react with diethyl-p-phenylenediamine (DPD) according to the testing method for tap water[1].
A simple DPD measuring instrument for residual chlorine is marketed and generally used in many facilities.
Wako released "DPD Phosphate Buffer Powder" for residual chlorine analysis which is adaptable to simple measuring instruments.

[Features]

- **Reagent is composed according to the testing method for tap water.**
- **The measurement is also possible by absorption photometry.**
- **Available chlorine can be measured easily.**
  1) 1 package of the product is dissolved in 10 ml of sample water. The pink to pinkish red color is developed about 5 seconds after dissolution.
  2) The concentration of color is measured with a commercially available simple measuring instrument.

[Measuring procedure]

- **Measurement of free chlorine and combined chlorine using DPD phosphate buffer powder**
  1. Collect 10 ml of sample water in a test tube of a measuring instrument. Add 1 package of DPD phosphate buffer powder to the test tube and shake lightly. (Incomplete dissolution will not affect the results)
  2. After color development, set the test tube in the central part of the instrument.
  3. Compare the developed color with the color tone table of the instrument and read the free residual chlorine content (mg/L).
  4. Add about 0.1g of potassium iodide to the solution as referred to in 2, and allow to stand about for 2 min. Compare the developed color with the color tone table and read the residual chlorine content (mg/L).
  5. Determine the combined residual chlorine content (mg/L) by the difference between residual chlorine (mg/L) and free residual chlorine (mg/L).

[Product List]

Description	Grade	Catalog No.	Package Size	Storage
DPD Phosphate Buffer Powder	for Residual Chlorine Analysis	042-28781	100 ea. × for 10 mL	in a dark place
		048-28783	500 ea. × for 10 mL	

Related Products

Description	Grade	Catalog No.	Package Size	Storage
Active Cl-DPD Test wako <Kit Contents> 1. DPD Tablet 100 tablets (Mixture of 0.002g of DPD and 0.048 g of Sodium Sulfate, Anhydrous 2. KI Tablet 100 tablets 3. Phosphate Buffer 8 mL 4. Color Tone Table 1 sheet	for Residual Chlorine Analysis	297-56501	100 tests	RT
Active Cl-DPD Test Tube	for Residual Chlorine Analysis	294-34151	5 ea.	RT
DPD Reagent (DPD : Sodium Sulfate, Anhydrous = 4 : 96)	for Residual Chlorine Analysis	042-28002	25 g	RT
		044-28001	100 g	
N,N-Diethyl-p-phenylenediamine Sulfate	for Residual Chlorine Analysis	042-27642	25 g	RT
Sodium Sulfate, Anhydrous	JIS Special Grade	197-03345	500 g	RT
Phosphate Buffer Solution, pH 6.5	for Residual Chlorine Analysis	161-20185	500 mL	~25 ℃
Potassium Dihydrogenphosphate	JIS Special Grade	169-04245	500 g	RT
0.2mol/L Sodium Hydroxide Solution	for Volumetric Analysis	190-05395	500 mL	RT
Acid Red 265	for Residual Chlorine Analysis	015-18241	1 g	RT
Potassium Iodide	JIS Special Grade	164-03972	25 g	RT

[Reference]

1) "method of examining water 2001" p247 (Japan Water Works Association)

A. Crude Drug Test

Crude Drug Standards that Confirm to Japanese Pharmacopoeia

Gomisin Standard

Gomisins are active ingredients contained in the fruit of *Schisandra chinensis* Baillon (*Schisandraceae*).
It has been reported that they have various pharmacological actions such as CNS depression, antitussive effect, anti-inflammation, antiallergy and diuresis.
Gomisin standards are used for crude drugs test listed in the Japanese Pharmacopoeia.

Description	Grade	Physical Data	Chemical Structure	Catalog No.	Package Size
Gomisin A Standard, 98.0+% (HPLC) from *Schisandra chinensis* Baillon *(Schisandraceae)*	for Crude Drugs Determination	Appearance: powder Solubility in Acetonitrile: clear TLC test: to pass test	$C_{23}H_{28}O_7$ = 416.46 CAS: 58546-54-6	077-04951	10 mg
Gomisin N Standard, 98.0+% (HPLC) from *Schisandra chinensis* Baillon *(Schisandraceae)*	for Crude Drugs Determination	Appearance: powder Solubility in Acetonitrile: clear TLC test: to pass test	$C_{23}H_{28}O_6$ = 400.46 CAS: –	074-04961	10 mg
Schizandrin Standard, 99.0+% (HPLC) from *Schisandra chinensis* Baillon *(Schisandraceae)*	for Crude Drugs Determination	Appearance: powder Solubility in Methanol: clear TLC test: to pass test	$C_{24}H_{32}O_7$ = 432.51 CAS: 7432-28-2	192-10441	20 mg

Shikonin and Alkannin Standards

Shikonin is contained in the root of gromwell (*Lithospermum erythrorhizon Sieb.'et Zucc.*), a perennial plant grown naturally in Japan, China and the Korean Peninsula. Reddish purple pigment extracted from the gromwell root is also used as a raw material for cosmetics. It has been reported that shikonin have pharmacological actions such as anti-inflammation, wound healing and antitumor effects.
Alkannin is an enantiomer of shikonin.
New products, Shikonin Standard and Alkannin Standard are listed in the Japanese Pharmacopoeia, 14th edition and used for crude drug tests.

Description	Grade	Physical Data	Chemical Structure	Catalog No.	Package Size
Shikonin Standard, 99.0+% (HPLC) from *Lithospermum erythrorhizon Siebold et Zuccarini (Boraginaceae)*	for Crude Drugs Determination	Solubility in Acetone: clear Chemical Name: (+)-5,8-dihydroxy-2-(1-hydroxy-4-methyl-3-pentenyl)-1,4-naphthoquinone	$C_{16}H_{16}O_5$ = 288.30 CAS: 517-89-5	191-13331	10 mg
Alkannin Standard, 99.0+% (HPLC) from *Lithospermum erythrorhizon Siebold et Zuccarini (Boraginaceae)*	for Crude Drugs Determination	Solubility in Acetone: clear Chemical Name: (-)-5,8-dihydroxy-2-(1-hydroxy-4-methyl-3-pentenyl)-1,4-naphthoquinone	$C_{16}H_{16}O_5$ = 288.30 CAS: 517-88-4	013-19901	10 mg

Rhynchophylline Standard

Rhynchophylline is alkaloid isolated and purified from Ramulus uncariae cum uncis, a crude drug. This product is used for crude drugs test listed in Supplement I to the Japanese Pharmacopoeia 14th Edition.

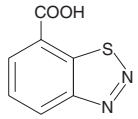
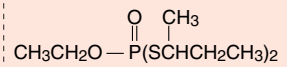
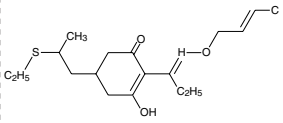
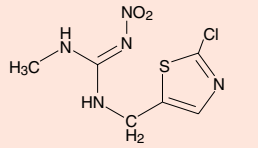
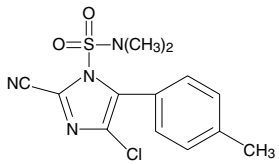
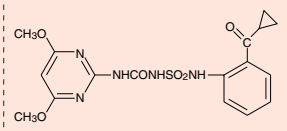
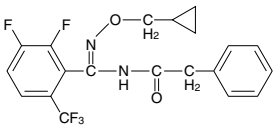
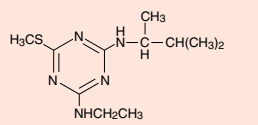
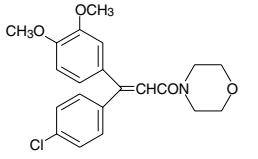
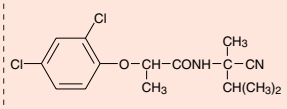
Description	Grade	Physical Data	Chemical Structure	Catalog No.	Package Size
Rhynchophylline Standard, 99.0+% (HPLC) from *Uncaria rhynchophylla Miquel, Uncaria sinensis Haviland Uncaria macrophylla Wallich (Rubiaceae)*	for Crude Drugs Determination	Solubility in Acetone: clear TLC test: to pass test Chemical Name: (7β,16E,20α)-16,17-Didehydro-17-methoxy-2-oxocorynoxan-16-carboxylic acid methyl ester	$C_{22}H_{28}N_2O_4$ = 384.47 CAS: 76-66-4	186-01871	10 mg

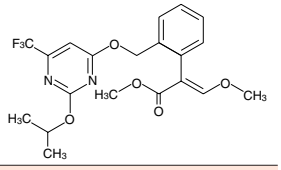
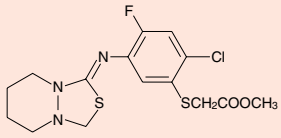
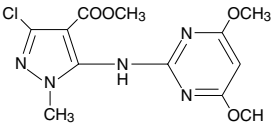
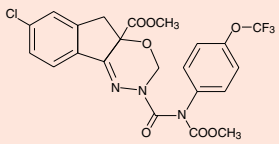
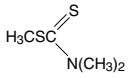
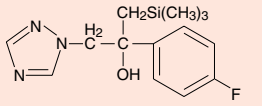
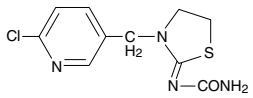
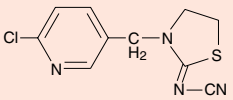
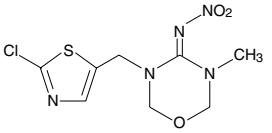
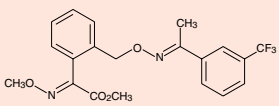
B. Arsenic Analysis

Environmental pollution caused by chemical weapons produced by the Imperial Japanese Army has been observed in many places in Japan and has become a social issue. Follow-up survey of "national surveillance of chemical weapon like gas shell of the Imperial Japanese Army (1973)" were carried out and published by the Ministry of the Environment in November 2003. Immediate measures such as environmental research and safety measures in the case of land alteration should be taken. Diphenylarsinic acid is a degradation product of sneezing gas (diphenylchloroarsine, diphenylcyanoarsine) which is one of the chemical weapons, and is used as a reference standard when the actual condition of these chemicals is investigated.

Description	Grade	Physical Data	Chemical Structure	Catalog No.	Package Size
Diphenylarsinic Acid Standard, 97.0+% (HPLC)	for Arsenic Analysis	Appearance: solid		040-29181	200 mg

C. Standards for Pesticide Residue Analysis

Description	Catalog No.	Package, Storage	Physical Data	Appearance	Note	Chemical Structure
Acibenzolar Acid Std., 99.0+% (HPLC)	018-19451	100 mg 2-10 ℃	$C_7H_4N_2O_2S$=180.18 CAS: 35272-27-6 Chemical Name: Benzo[1,2,3]thidiazole-7-carboxylic Acid	Slightly yellow, crystalline powder	Acibenzolar-*S*-methyl metabolite	
Cadusafos Std., 98.0+% (cGC)	036-18871	100 mg 2-10 ℃	$C_{10}H_{23}O_2PS_2$=270.39 CAS: 95465-99-9 Chemical Name: *S,S*-Di- *sec*-butyl Ethyl Phosphorodithioate	Colorless clear liquid	Solubility: Water 241 mg/L Freely soluble in organic solvents such as hexane, acetone and methanol. **[Insecticide]**	
Clethodim Std., 90.0+% (HPLC)	030-18651	200 mg -20 ℃	$C_{17}H_{26}ClNO_3S$=359.91 CAS: 99129-21-2 Chemical Name: (±)-2-[(*E*)-1-[(*E*)-3-Chloroallyloxyimino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxycylohex-2-enone	Pale yellow, liquid	Solubility: Water 5.4 g/L Methanol > 900 Chloroform > 900 (g/L) **[Herbicide]**	
Clothianidin Std., 99.0+% (HPLC)	030-18891	200 mg 2-10 ℃	$C_6H_8ClN_5O_2S$=249.68 CAS: 210880-92-5 Chemical Name: (*E*)-1-(2-Chloro-1,3-thiazol-5-ylmethyl)-3-methyl-2-nitroguanidine	White, crystalline powder	Solubility: Water 0.327 g/L Acetone 15.2, Methanol 6.26 (g/L) **[Insecticide]**	
Cyazofamid Std., 99.0+% (HPLC)	033-18881	200 mg 2-10 ℃	$C_{13}H_{13}ClN_4O_2S$=324.79 CAS: 120116-88-3 Chemical Name: 4-Chloro-2-cyano- *N,N*-dimethyl-5- *p*-tolylimidazole-1-sulfonamide	White, crystalline powder	Solubility: Water 0.14 mg/L (25 ℃) Acetone 40.69, Methanol 1.54 (g/L) **[Fungicide]**	
Cyclosulfamuron Std., 99.0+% (HPLC)	033-18901	200 mg 2-10 ℃	$C_{17}H_{19}N_5O_6S$=421.43 CAS: 136849-15-5 Chemical Name: 1-[2-(Cyclopropyl-carbonyl)phenylsulfamoyl]-3-(4,6-dimethoxy-pyrimidin-2-yl)urea	Pale yellowish brown, powder	Solubility: Water 0.34 μg/mL (20 ℃) Acetone 21.5 mg/mL Chloroform 5.0 mg/mL **[Herbicide]**	
Cyflufenamid Std., 98.0+% (cGC)	036-19231	200 mg 2-10 ℃	$C_{20}H_{17}F_5N_2O_2$=412.35 CAS: 180409-60-3 Chemical Name: (*Z*)- N-[α-(Cyclopropyl-methoxyimino)-2,3-difluoro-6-(trifluoromethyl)benzyl]-2-phenylacetamide	White, powder	**[Fungicide]**	
Dimethametryn Std., 99.0+% (cGC)	048-28261	200 mg 2-10 ℃	$C_{11}H_{21}N_5S$=255.38 CAS: 22936-75-0 Chemical Name: N^2-(1,2-Dimethylpropyl)-N^4-ethyl-6-methylthio-1,3,5-triazine-2,4-diamine	White, powder	Solubility: Water 50 mg/L (20 ℃) Acetone 650, Hexane 60, Methanol 700 (g/L, 20 ℃) **[Herbicide]**	
Dimethomorph Std., 98.0+% (HPLC)	049-28671	200 mg 2-10 ℃	$C_{21}H_{22}ClNO_4$=387.86 CAS: 5902-51-2 Chemical Name: 4-[3-(4-Chlorophenyl)-3-(3,4-dimethoxyphenyl) acryloyl]=morpholine	Nearly white, powder	Solubility: Water 0.018 g/L (20 ℃) Acetone 0.018, Methanol 39.0 (g/L, 20 ℃) **[Fungicide]**	
Fenoxanil Std., 98.0+% (cGC)	064-04301	200 mg 2-10 ℃	$C_{15}H_{18}Cl_2N_2O_2$=329.22 CAS: 115852-48-7 Chemical Name: *N*-(1-Cyano-1,2-dimethylpropyl)-2-(2,4-dichlorophenoxy)propion-amide	Pale brown, crystalline powder ~ powder	Solubility: Water 30.7 × 10^{-3} g/L (25 ℃) Hexane 4.7, Acetone > 580 (g/L, 20 ℃) **[Fungicide]**	

Description	Catalog No.	Package, Storage	Physical Data	Appearance	Note	Chemical Structure
Fluacrypyrim Std., 98.0+% (GC)	066-04481	200 mg 2-10 ℃	$C_{20}H_{21}F_3N_2O_5$=426.39 CAS: 178813-81-5 Chemical Name: Methyl(*E*)-2-[α-[2-Isopropoxy-6-(trifluoromethyl)pyrimidine-4-yloxy]-*o*-tolyl]-3-methoxyacrylate	White, powder	Solubility: Water 0.344 mg/L (20 ℃) Acetone 278, Methanol 27.1, Ethanol 15.1 (g/L, 20 ℃) **[Acaricide]**	
Fluthiacet-methyl Std., 99.0+% (cGC)	062-04461	200 mg 2-10 ℃	$C_{15}H_{15}ClFN_3O_3S_2$=403.88 CAS: 117337-19-6 Chemical Name: Methyl [[2-Chloro-4-fluoro-5-[(5,6,7,8-tetrahydro-3-oxo-1*H*,3*H*-[1,3,4]thiadiazolo[3,4-a]pyridazin-1-ylidene) amino]phenyl]thio]acetate	White, crystalline powder	Solubility: Water 0.85 mg/L (25 ℃) *n*-Hexane 0.232, Toluene 84.0 (g/L, 25 ℃) **[Herbicide]**	
Halosulfuron-methyl Rearrangement Std., 99.0+% (HPLC)	089-07991	200 mg 2-10 ℃	$C_{12}H_{14}ClN_5O_4$=327.72 CAS: – Chemical Name: Methyl 3-Chloro-5-(4,6-dimethoxypyrimidin-2-ylamino)-1-methylpyrazole-4-carboxylate	White, crystalline powder	Halosulfuron-methyl metabolite	
Indoxacarb-MP Std., 99.0+% (HPLC)	099-04991	200 mg 2-10 ℃	$C_{22}H_{17}ClF_3N_3O_7$=527.83 CAS: 144171-61-9 Chemical Name: Methyl (*RS*)-7-Chloro-2,3,4a,5-tetrahydro-2-[methoxycarbonyl(4-trifluoromethoxyphenyl) =carbamoyl]indeno[1,2-e][1,3,4]oxadiazine-4a-carboxylate	White, powder	Solubility: Water 13.6 ppb (20 ℃) **[Insecticide]**	
Methyl Dimethyldithio-carbamate Std., 98.0+% (HPLC)	131-14371	100 mg 2-10 ℃	$C_4H_9NS_2$=135.25 CAS: 3735-92-0	Nearly white, crystals ~ powder	for Polycarbamate analysis	
Simeconazole Std., 99.0+% (cGC)	196-12781	200 mg 2-10 ℃	$C_{14}H_{20}FN_3OSi$=293.41 CAS: 149508-90-7 Chemical Name: (*RS*)-2-(4-Fluorophenyl)-1-(1*H*-1,2,4-triazole-1-yl)-3-trimethylsilylpropane-2-ol	White, powder	Solubility: Water 57 mg/L (20 ℃) Acetone 219, Ethanol 161 (g/L) **[Fungicide]**	
Thiacloprid-amide Std., 98.0+% (HPLC)	204-15771	50 mg 2-10 ℃	$C_{10}H_{11}ClN_4OS$=270.74 CAS: – Chemical Name: 3-(6-Chloro-3-pyridylmethyl)-1,3-thiazolidin-2-ylidene-aminocarboxamide	Nearly white, crystalline powder ~ powder	Thiacloprid metabolite	
Thiacloprid Std., 98.0+% (HPLC)	207-15761	200 mg 2-10 ℃	$C_{10}H_9ClN_4S$=252.72 CAS: 111988-49-9 Chemical Name: 3-(6-Chloro-3-pyridylmethyl)-1,3-thiazolidin-2-ylidenecyanamide	White, crystalline powder ~ powder	Solubility: Water 0.185 g/L (20 ℃) **[Insecticide]**	
Thiamethoxam Std., 99.0+% (HPLC)	204-15651	200 mg 2-10 ℃	$C_8H_{10}ClN_5O_3S$=291.71 CAS: 153719-23-4 Chemical Name: 3-(2-Chloro-1,3-thiazol-5-ylmethyl)-5-methyl-1,3,5-oxadiazinan-4-ylidene(nitro)amine	White, crystalline powder	Solubility: Water 4.1 g/L (25 ℃) Acetone 48 g/L (25 ℃) **[Insecticide]**	
Trifloxystrobin Std., 99.0+% (HPLC)	201-15781	200 mg 2-10 ℃	$C_{20}H_{19}F_3N_2O_4$=408.37 CAS: 141517-21-7 Chemical Name: Methyl(*E*)-Methoxyimino-[(*E*)-α-[1-α,α,α-trifluoro-*m*-tolyl]ethylideneaminooxy]-*o*-tolyl]acetate	White, crystalline powder	Solubility: Water 610 μg/L **[Fungicide]**	

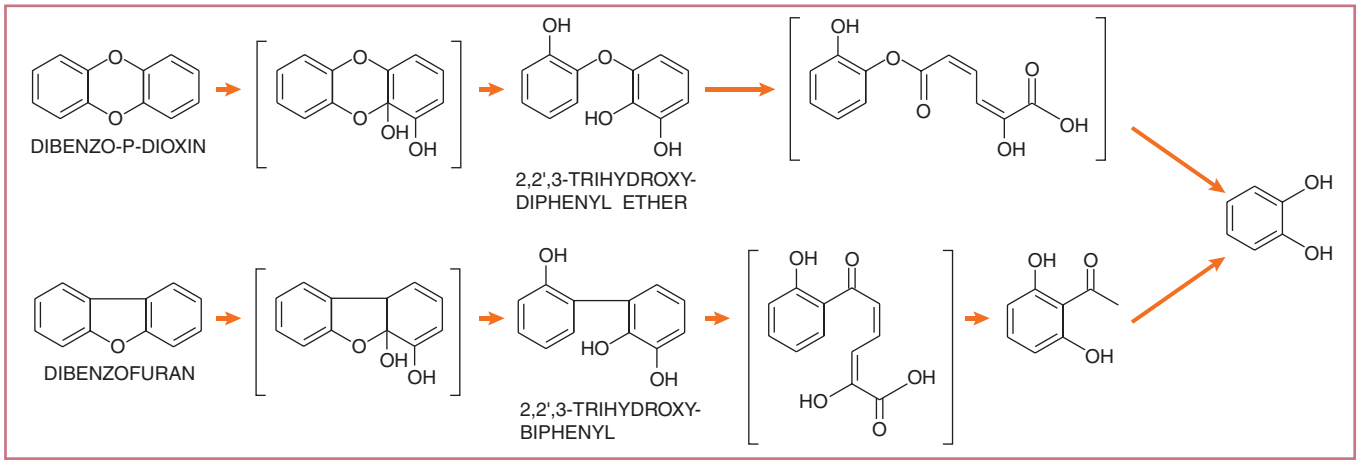
D. Environmental Analysis

Dioxins Research

2,2',3-Trihydroxybiphenyl
2,2',3-Trihydroxydiphenyl Ether

Environmental pollution caused by dioxins has spread worldwide and has become a serious social issue.
Environmental dioxins can be degraded by heat or chemical treatments, but there is a demerit because the treatment of dioxins in soil or river sludge is very expensive.
Recently, degradation using microorganisms has been investigated as one of the dioxin treatments and the search for microorganisms using dioxins as a carbon source is being carried out.
These products are used for substrates of dioxin-degrading microorganisms.

Reaction pathway



[Product List]

Description	Grade	Catalog No.	Package Size
2,2',3-Trihydroxybiphenyl Standard	for Environment Analysis	208-15551	100 mg
2,2',3-Trihydroxydiphenyl Ether Standard	for Environment Analysis	201-15541	100 mg

Wako Pure Chemical Industries, Ltd.
http://www.wako-chem.co.jp
1-2, Doshomachi 3-Chome
Chuo-Ku, Osaka 540-8605, Japan
Tel: 81-6-6203-3741
Fax: 81-6-6201-5964
Online Cat.:
http://search.wako-chem.com

Wako Chemicals USA, Inc.
http://www.wakousa. com
Head Office:
1600 Bellwood Road, Richmond, VA 23237
Toll-Free (U.S. only): 1-877-714-1920
Tel: 1-804-714-1920/ Fax: 1-804-271-7791
Los Angeles Sales Office:
15625 Alton Parkway, Suite D, Irvine, CA 92618
Tel: 1-949-679-1700/ Fax: 1-949-679-1701

Wako Chemicals GmbH
http://www.wako-chemicals.de
European Office:
Nissanstraße 2, D-41468
Neuss, Germany
Tel: 49-2131-311-0
Fax: 49-2131-311100