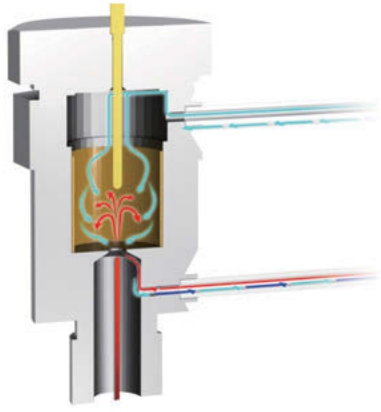
C180-E080

SHIMADZU
Excellence in Science

Electron Capture Detector for GC-2010 Plus

ECD-2010 Exceed



The World's Highest Level of Durability and Performance for a Capillary ECD

Electron Capture Detector

ECD-2010 Exceed

Novel "Contact Free Technology" was incorporated into the design of the ECD-2010 Exceed. This new, proprietary technology protects the source from the damaging effects of matrix contamination often associated with environmental samples. The result is an Electron Capture Detector that will deliver more up-time and, thus, higher productivity for your laboratory.

Electron Capture Detector (ECD)

An ECD is a high-sensitivity detector, which is selective with respect to electrophilic compounds. It can detect the following compounds with extremely high sensitivity.

- Organic halogen compounds (those with F, Cl, Br, or I)
- Organometallic compounds (such as alkyl mercury)
- Compounds with a C=O double bond (such as diketones)

Detectable Concentration Range for the ECD

1000 ppm | 100 ppm | 10 ppm | 1 ppm | 0.1 ppm | 10 ppb | 1 ppb | 0.1 ppb

Note: The detectable concentration range is a reference only. The range will differ depending on the structure of the compounds and the analysis conditions.

Longer Operating Life Significantly improved durability of the ECD cell

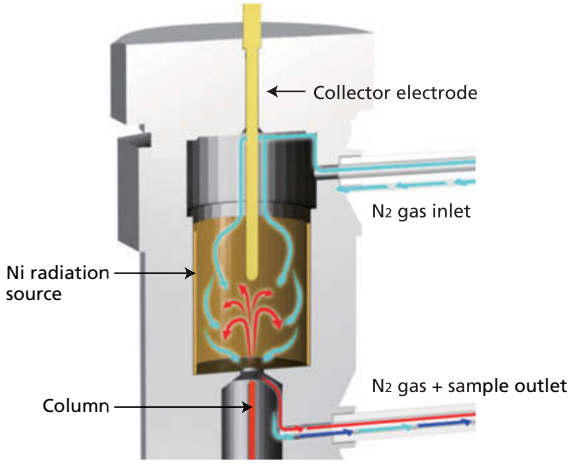
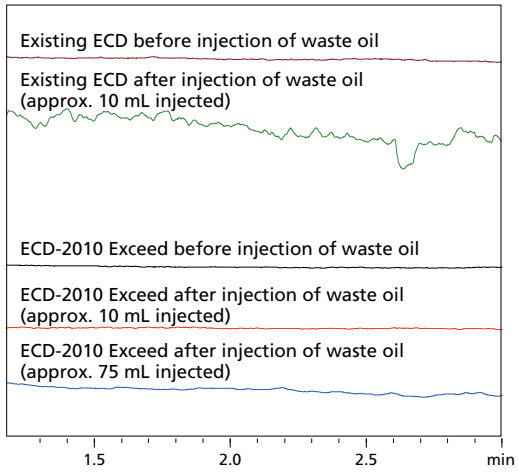


Illustration of Contact-Free Technology

We have developed a cell structure and gas flow pattern in which the analytical sample matrix is diverted away from direct contact with the radiation source and the collector electrode. This design protects the source and the collector electrode from being coated with contamination while maintaining the sensitivity required in today's analytical laboratory.



Change of ECD Baselines Before and After Waste Oil is Injected

(Note: The data after the injection of waste oil are the results for multiple repeated injections.)

When a series of waste oil samples is introduced into a standard ECD, the oil becomes contaminated, resulting in a noisy baseline. In contrast, with the ECD-2010 Exceed, almost no change of baseline could be identified even when approximately 7.5 times the amount of waste oil was analyzed.

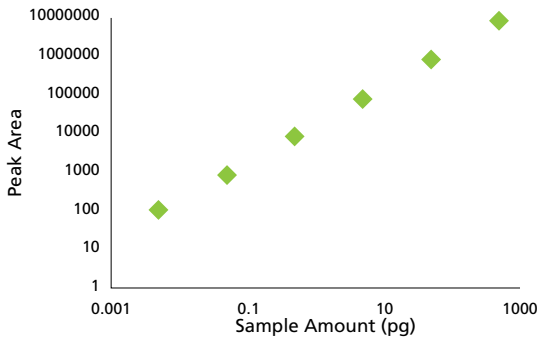
High-Performance Specifications The world's highest level of performance*

By optimizing the ECD cell structure, analytical performance has been improved.

- Minimum detectable quantity: 4.0 fg/s
- Dynamic range: 1×105

(For γ-BHC)

This achieves the world's highest level of ECD performance.



Relationship Between Amount of γ-BHC Introduced and Peak Area

* As of December, 2014, based on Shimadzu research

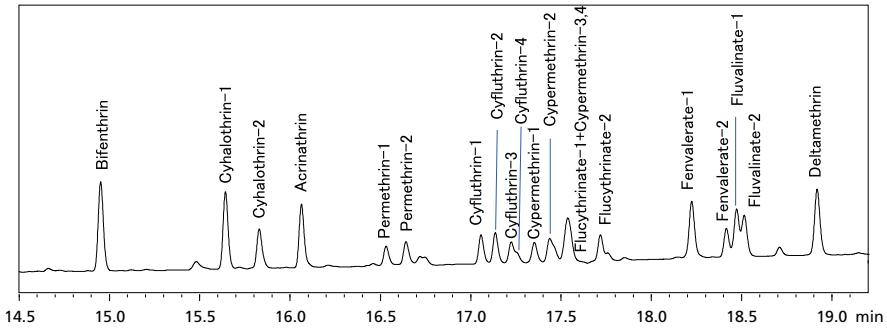
Applications Highly Sensitive and Reliable Analysis by the World's Best ECD

Shown below are analysis examples in the fields of foods and the environment using the ECD-2010 Exceed.

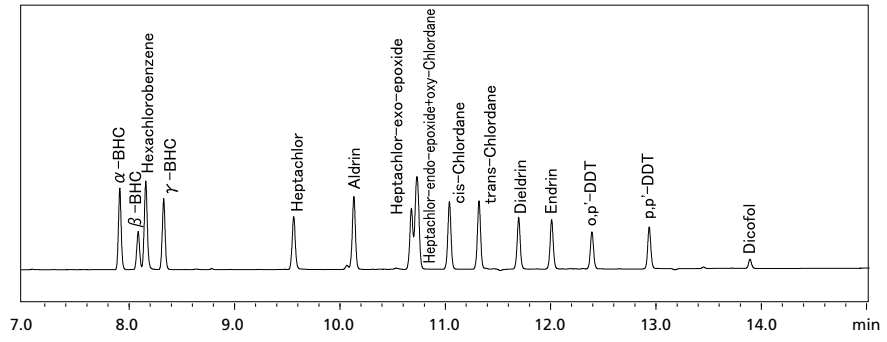
Analysis Content	Field
Analysis of pyrethroid pesticides and chlorinated pesticides	Foods
Analysis of VOC in water	Environment
PCB analysis	Environment and foods
Analysis of vicinal diketone in beer	Foods

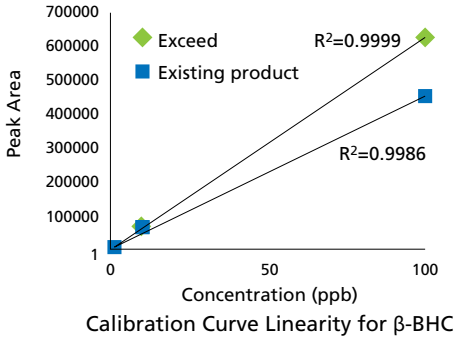
1. Analysis of Pyrethroid Pesticides and Chlorinated Pesticides

The following shows an example analysis of 1 ng/mL (1 ppb) pyrethroid pesticides. Analysis is possible even at concentrations as low as 1 ppb.

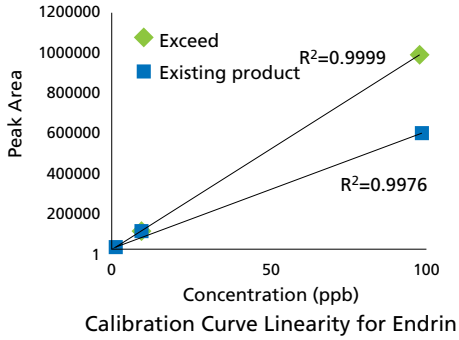


This example is an analysis of a set of 10 ng/mL (10 ppb) organochlorine pesticides. Comparing calibration curves (1 ppb to 100 ppb) with a conventional ECD for β-BHC and Endrin reveals that a very favorable linearity was obtained with the ECD-2010 Exceed.





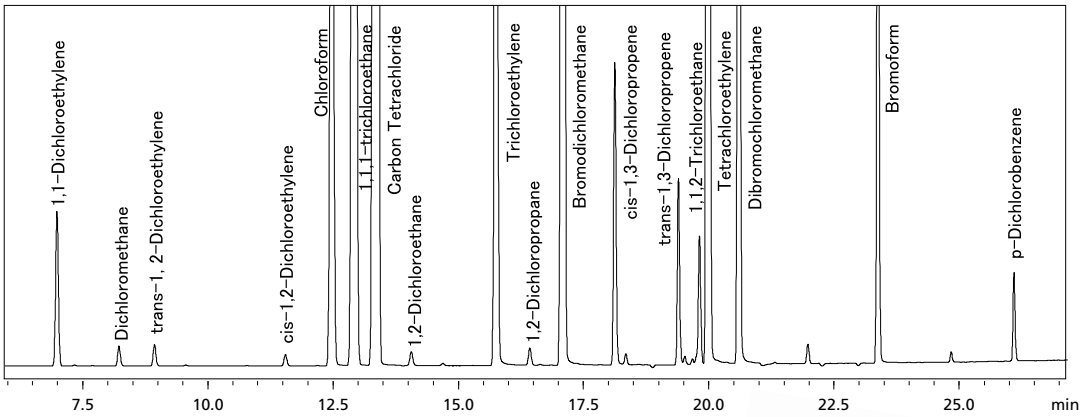
Calibration Curve Linearity for β-BHC



Calibration Curve Linearity for Endrin

2. Analysis of VOC in Water (Headspace GC System)

This example shows an analysis of each 10 µg/L (10 ppb) VOC in water using headspace GC. Favorable repeatability was obtained for dichloromethane, chloroform, 1,2 - dichloroethane, and 1,1,2 - trichloroethane.

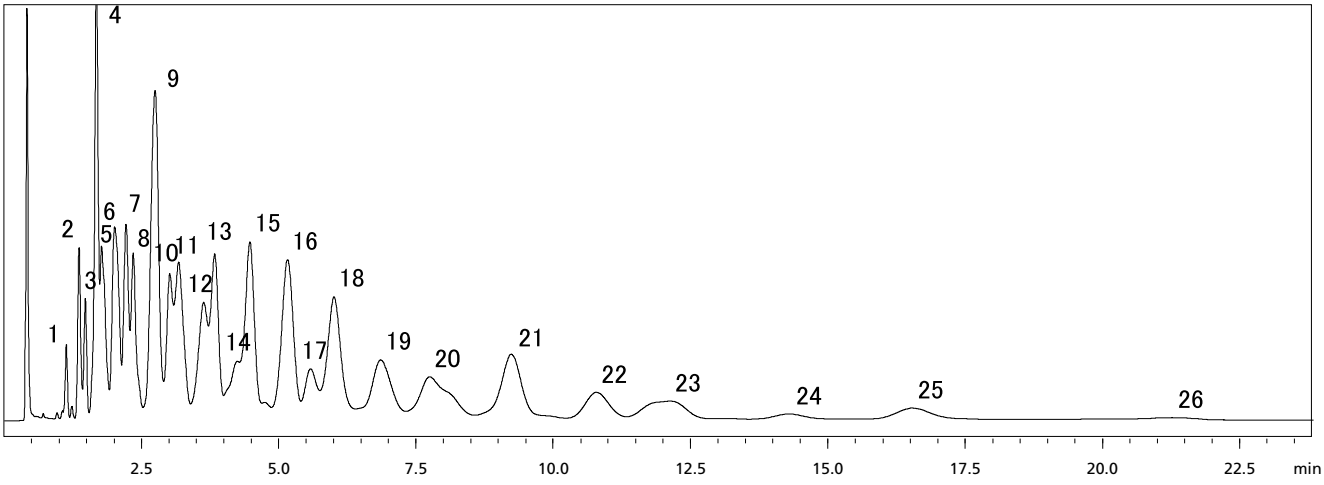


Repeatability of Peak Area

	Dichloromethane	Chloroform	1,2-Dichloroethane	1,1,2-Trichloroethane
1	43,942	2,555,777	38,906	267,118
2	44,415	2,579,129	40,157	266,870
3	45,431	2,635,432	40,950	271,694
4	43,718	2,567,936	40,136	267,827
5	44,445	2,581,827	40,991	278,428
AVE.	44,390	2,584,020	40,228	270,388
RSD%	1.486	1.181	2.104	1.812

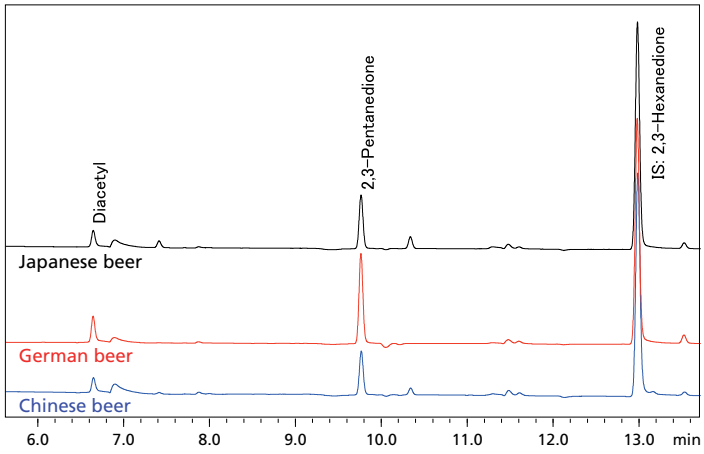
3. PCB Analysis

This is an example of the analysis of a PCB standard (KC-300:400:500:600 = 1:1:1:1) using a wide bore column.
(With the Japanese official analytical method, 26 peaks must be confirmed in the analysis of a PCB standard.)



4. Analysis of Diacetyl and 2,3-Pentadiene in Beer (Headspace GC System)

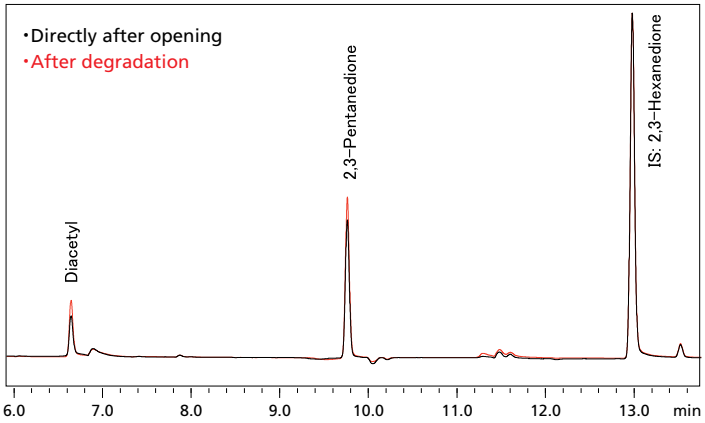
This is an example of an analysis of diacetyl and 2,3-pentadiene in beer using headspace GC. Diacetyl and 2,3-pentadiene are produced during the beer fermentation process. Since these components have an effect on the aroma and flavor of beer, their quantities are kept below a certain level. They are referred to by the term vicinal diketone (VDK). The quantitation results of VDK, as well as evaluative results for aroma and flavor, are shown below for beers from three countries.



Quantitative Results for VDK

Type of Beer	Diacetyl	2,3-Pentanedione	Aroma	Flavor
Japanese beer	0.031 mg/L	0.035 mg/L	Normal	Normal
German beer	0.054 mg/L	0.086 mg/L	Strong	Strong
Chinese beer	0.026 mg/L	0.032 mg/L	Normal	Normal

In order to measure the total quantity of VDK including biological precursors, the German beer sample was degraded by heating after to exposure to air and then analyzed. The evaluative results for German beer before and after degradation are shown below.



Comparative Quantitative Results for VDK Before and After Degradation of German Beer

	Diacetyl	2,3-Pentanedione
Directly after opening	0.054 mg/L	0.086 mg/L
After degradation	0.085 mg/L	0.103 mg/L

Note: In the chromatograms above, the sensitivity was corrected to ensure that the same peak size was obtained for the internal standard substance (2,3-hexandione).

Options and Application Systems

Oxygen Trap

In order to obtain a stable baseline with an ECD, it is necessary to remove oxygen from the gas supply (particularly nitrogen). The optional oxygen trap, placed into the gas line, makes it possible to remove oxygen in the gas supply down to the 0.1 ppm level. This trap has the capacity to absorb approximately 2.5 L of oxygen. When the trap becomes saturated, it can be regenerated by heating it in a hydrogen flow, allowing it to be used repeatedly. If the trap is used in the carrier gas line, it effectively prevents oxygen from degrading the column. It is even more effective if a gas filter is connected upstream of the oxygen trap.

Gas Filter

This raises the purity of a gas by absorbing organic substances and moisture from the gas. The tube (containing a 5A molecular sieve, approx. 200 mL) is metallic. Therefore, when it becomes saturated, it can easily be regenerated by placing it as is in an oven. The noise level can be further reduced by using this filter with the oxygen trap.

ECD Bypass Kit (For ECD-2010 Exceed)

With the GC-2010 Plus, all gases are electronically controlled. Therefore, when the main power to the GC system is turned OFF, the supply of all gases stops. Since an ECD is a high-sensitivity detector, it takes a long time to stabilize in the high-sensitivity region after the detector gas is stopped. An effective way to shorten the stabilization time after startup is to supply nitrogen gas to the ECD even when the power is turned OFF. If the ECD bypass kit is installed, the detector gas will continue to flow even when the power is turned OFF, so the baseline can be stabilized quickly at instrument startup. This can also prevent degradation of the ECD cell by continuing the flow of detector gas even if there is a sudden power outage.

Headspace GC System (GC-2010 Plus + HS-20 Headspace Sampler)

- The headspace sampler maintains the sample at a set temperature, samples a set quantity of the gas phase, and injects it into the GC.
- It is used to qualify and quantify the volatile components of solid and liquid samples.

Specifications

ECD-2010 Exceed

Minimum Detectable Quantity	4.0 fg/s(γ-BHC)
Dynamic Range	1×10^5(γ-BHC)
Temperature Range	Max. 400 °C
Radiation Source	^{63}Ni 370 MBq
Compatible Models	GC-2010 Plus

Notes:
- It is recommended that nitrogen with a purity greater than 99.9999 % be used as the detector gas.
- It is recommended that helium and nitrogen with a purity greater than 99.9999 % be used as the carrier gases. (Usable if greater than 99.999 %)

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