# DETERMINATION OF DIOXINS AND DIOXIN-LIKE PCBs IN FOOD PRODUCTS IN ACCORDANCE WITH NORMS OF EUROPEAN COMMUNITY

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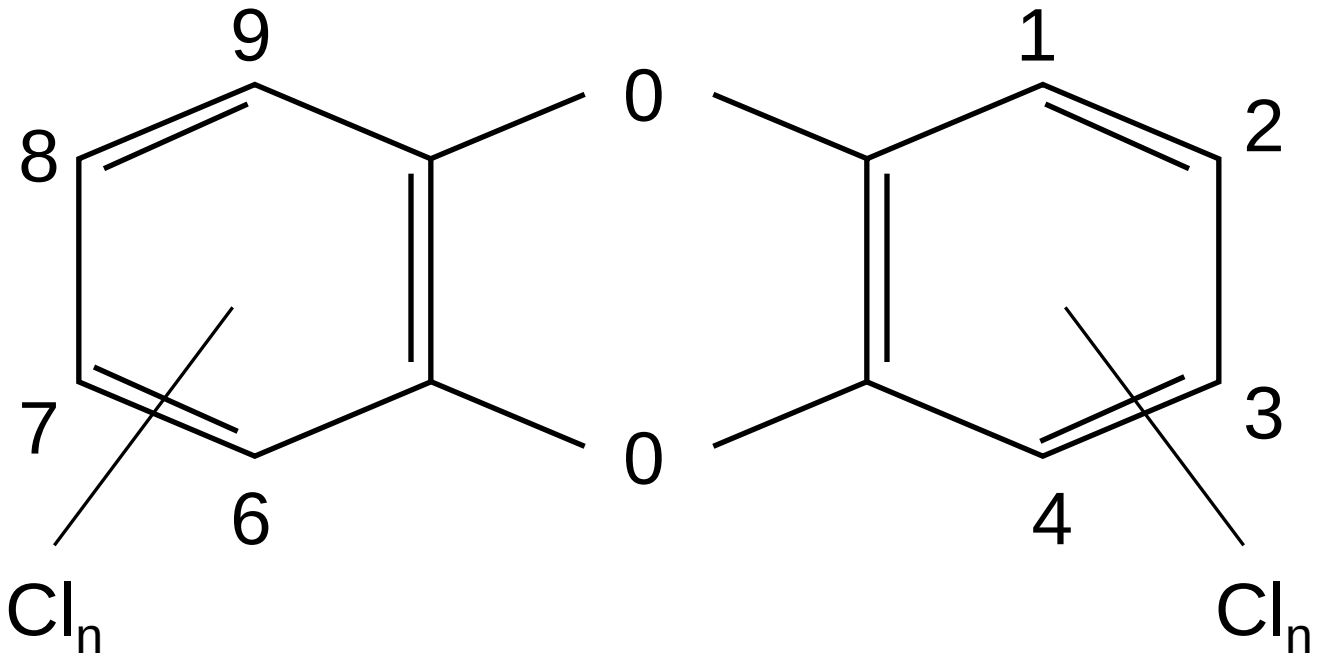
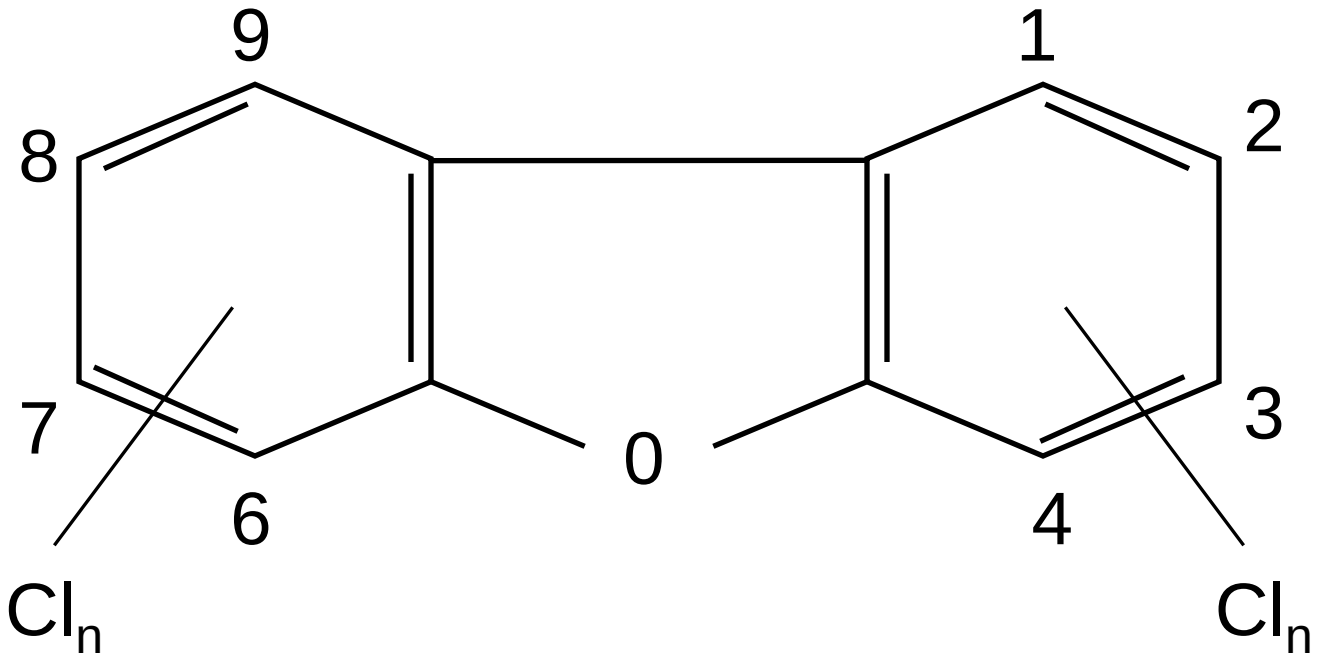



$C_{12}H_{(8-n)}Cl_nO_2$

**PCDD**

**75 congeners, 7 toxic**

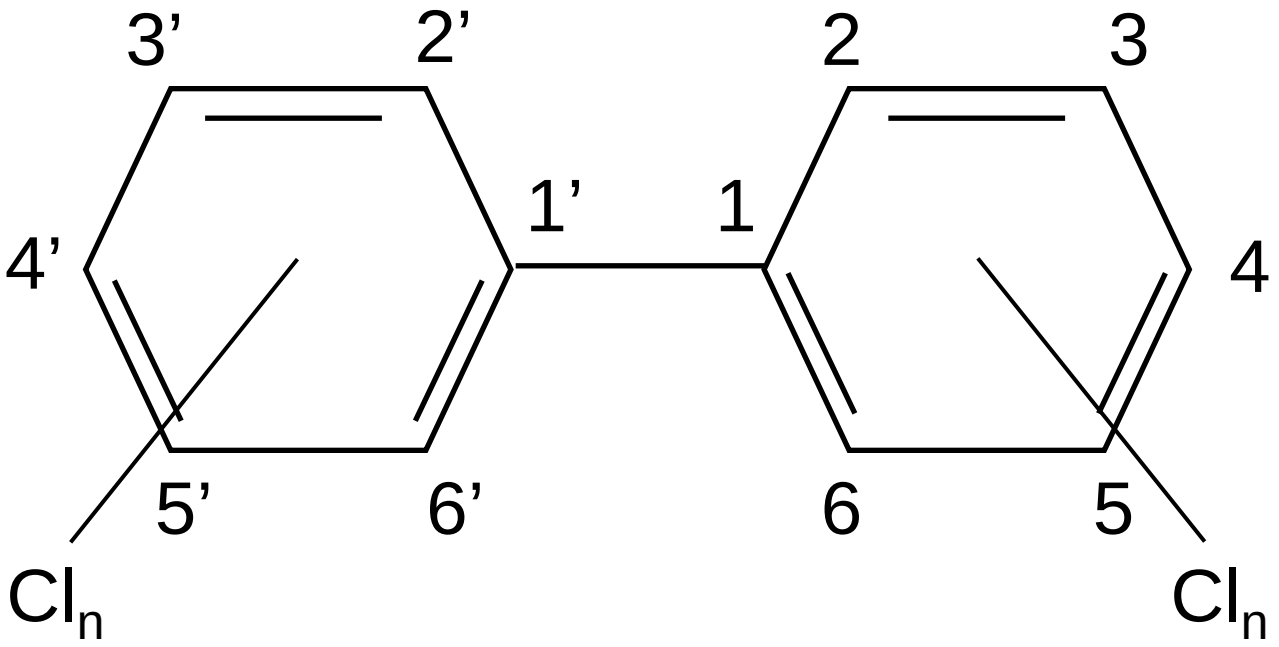
ECOHYNTOX




$C_{12}H_{(8-n)}\,Cl_nO$

**PCDF**

**135 congeners, 10 toxic**




$C_{12}H_{(10-n)}\ Cl_n$

**PCB**

**209 congeners, 12 toxic**

Thus from a general amount 419 PCDDs, PCDFs and PCBs only 29 are toxicologically meaningful and exactly these connections are subject control in agricultural and food raw material, food products and animal feed.

PCDDs, PCDFs and PCBs have a strong thermal stability and are chemical inert. These compounds are lipophylic,possess low volatility, extremely low solubility in water (0,002-470 ng/l), moderate solubility in organic solvents and ability strongly adsorb to soil.

Chemical stability and lipophilic behavior gives to these compounds the property of bioaccumulation and biomagnification in living organisms and carried on large distances with atmospheric air  with the subsequent precipitation and in this connection can cause considerable negative consequences for the health of man and environment.

# The sources of dioxins

## Natural

- Forest fire
- Volcano eruptions
- Enzymatic reactions of natural substances
- Photolytic reactions jf natural substances

# The sources of dioxins

## Anthropogenic

**Combustion processes. “De novo” synthesis**

- Urban, industrial and hospital solid waste incinerators
- Thermic powerhouse
- Combustion engines
- Domestic heating system
- Cement kilns
- Cigarettes combustion

# The sources of dioxins

## Anthropogenic

**Industrial and chemical processes**

- Organochlorinated compounds manufactoring (PCP, pesticides, etc.)
- Metal manufactuing and recycling
- Chlorine water whitening
- Electrochemical chlorine productions with graphite electrodes
- Fire retardants manufacturing
- Textile industry
- Compositing of organic matter
- Recycling

# The sources of dioxins

## Anthropogenic

### Wastes

- Sludges from water work plants and waste water treatment plants
- Dumping site lixiviates
- Domestic waste waters
- Flying ashes and slags

### Incidents

- Building and similar fires

By the unique possible and real source of contamination the dioxines **of vegetable agricultural and food raw material and vegetable food products** on territories of their growth is precipitation from atmospheric air, solid particles, containing dioxines, on the surface of vegetable objects.

The basic source of contamination the dioxines **of food raw material and food products of animal origin** are feed of agricultural (domestic) animals and freshwater fish, containing these compounds. In basis of the phenomenon of the Belgian «dioxine» chickens and pigs was feeding of animal of the mixed fodders, in which added vegetable oil, repeatedly utillized for preparation of potato chips, which contained the fars of dioxines.

Contamination of food product with dioxines can take place because of two principal reasons:

1) use for the production of this product of muddy food raw material;

2) application for processing of food raw material of materials and technologies, containing or formative dioxines.

# Flow chart of the production chain of sunflower oil products for food application in European Union

**CULTIVATION OF SUNFLOWER SEEDS**

↓

**DRYING OF SUNFLOWER SEEDS**

↓

**CRUSHING OF SUNFLOWER SEEDS**
**Production of crude oil**

↓

**REFINING**

↓

**MODIFICATION (GENERAL)**
**Hydrogenation**
**Interesterification**

# Dioxins and PCBs

| Foodstuffs | | Maximum levels | |
|---|---|---|---|
| | | Sum of dioxins (WHO-PCDD/F-TEQ) | Sum of dioxins and dioxin-like PCBs (WHO-PCDD/F-PCB-TEQ) |
| 5.1 | Meat and meat products (excluding edible offal) of the following animals | | |
| | — bovine animals and sheep | 3,0 pg/g fat | 4,5 pg/g fat |
| | — poultry | 2,0pg/g fat | 4,0 pg/g fat |
| | — pigs | 1,0 pg/g fat | 1,5 pg/g fat |
| 5.2 | Liver of terrestrial animals referred to in 5.1, and derived products thereof | 6,0 pg/g fat | 12,0 pg/g fat |
| 5.3 | Muscle meat of fish and fishery products and products thereof, excluding eel. The maximum level applies to crus-taceans, excluding the brown meat of crab and excluding head and thorax meat of lobster and similar large crustaceans (Nephropidae and Palinuridae) | 4,0 pg/g wet weight | 8,0 pg/g wet weight |
| 5.4 | Muscle meat of eel (Anguilla anguilla) and products thereof | 4,0 pg/g wet weight | 12,0 pg/g wet weight |
| 5.5 | Raw milkand dairy products, including butterfat | 3,0 pg/g fat | 6,0 pg/g fat |
| 5.6 | Hen eggs and egg products | 3,0 pg/g fat | 6,0 pg/g fat |
| 5.7 | Fat of the following animals: | | |
| | — bovine animals and sheep | 3,0 pg/g fat | 4,5 pg/g fat |
| | — poultry | 2,0 pg/g fat | 4,0 pg/g fat |
| | — pigs | 1,0 pg/g fat | 1,5 pg/g fat |
| 5.8 | Mixed animal fats | 2,0 pg/g fat | 3,0 pg/g fat |
| 5.9 | Vegetable oils and fats | 0,75 pg/g fat | 1,5 pg/g fat |
| 5.10 | Marine oils (fish body oil, fish liver oil and oils of other marine organisms intended for human consumption) | 2,0 pg/g fat | 10,0 pg/g fat |

# Point 27 in Annex I to Directive 2002/32/EC is replaced by the following:

| Undesirable substances | Products intended for animal feed | Maximum content relative to a feedingstuff with a moisture content of 12 % |
|---|---|---|
| '27a. Dioxins (sum of polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) expressed in World Health Organisation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 1997 (*) | (a) Feed materials of plant origin with the exception of vegetable oils and their by-products | 0,75 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (b) Vegetable oils and their by-products | 0,75 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (c) Feed materials of mineral origin | 1,0 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (d) Animal fat, including milk fat and egg fat | 2,0 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (e) Other land animal products including milk and milk products and eggs and egg products | 0,75 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (f) Fish oil | 6,0 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (g) Fish, other aquatic animals, their products and by-products with the exception of fish oil and fish protein hydrolysates containing more than 20 % fat (****) | 1,25 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (h) Fish protein hydrolysates containing more than 20 % fat | 2,25 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (i) The additives kaolinitic clay, calcium sulphate dihydrate, vermiculite, natrolite-phonolite, synthetic calcium aluminates and clinoptilolite of sedimentary origin belonging to the functional groups of binders and anti-caking agents | 0,75 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (j) Additives belonging to the functional group of compounds of trace elements | 1,0 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (k) Premixtures | 1,0 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (l) Compound feedingstuffs, with the exception of feed for fur animals, pet foods and feed for fish | 0,75 ng WHO-PCDD/F-TEQ/kg (**) (***) |
| | (m) Feed for fish. Pet foods | 2,25 ng WHO-PCDD/F-TEQ/kg (**) (***) |

# Point 27 in Annex I to Directive 2002/32/EC is replaced by the following (continued):

| Undesirable substances | Products intended for animal feed | Maximum content relative to a feedingstuff with a moisture content of 12 % |
|---|---|---|
| 27b. Sum of dioxins and dioxin-like PCBs (sum of polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs) and polychlorinated biphenyls (PCBs) expressed in World Health Organi-sation (WHO) toxic equivalents, using the WHO-TEFs (toxic equivalency factors, 1997 (*) | (a) Feed materials of plant origin with the exception of vegetable oils and their by-products | 1,25 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (b) Vegetable oils and their by-products | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (c) Feed materials of mineral origin | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (d) Animal fat, including milk fat and egg fat | 3,0 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (e) Other land animal products including milk and milk products and eggs and egg products | 1,25 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (f) Fish oil | 24,0 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (g) Fish, other aquatic animals, their products and by-products with the exception of fish oil and fish protein hydrolysates containing more than 20 % fat (****) | 4,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (h) Fish protein hydrolysates containing more than 20 % fat | 11,0 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (i) Additives belonging to the functional groups of binders and anti-caking agents | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (j) Additives belonging to the functional group of compounds of trace elements | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (k) Premixtures | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (l) Compound feedingstuffs, with the exception of feed for fur animals, pet foods and feed for fish | 1,5 ng WHO-PCDD/F-PCB-TEQ/kg (**) |
| | (m) Feed for fish. Pet foods | 7,0 ng WHO-PCDD/F-PCB-TEQ/kg (**) |

| Congener | TEF value |
|---|---|
| ***Dibenzo-p-dioxins (PCDDs)*** | |
| 2,3,7,8-TCDD | 1 |
| 1,2,3,7,8-PeCDD | 1 |
| 1,2,3,4,7,8-HxCDD | 0,1 |
| 1,2,3,6,7,8-HxCDD | 0,1 |
| 1,2,3,7,8,9-HxCDD | 0,1 |
| 1,2,3,4,6,7,8-HpCDD | 0,01 |
| OCDD | 0,0001 |
| ***Dibenzofurans (PCDFs)*** | |
| 2,3,7,8-TCDF | 0,1 |
| 1,2,3,7,8-PeCDF | 0,05 |
| 2,3,4,7,8-PeCDF | 0,5 |
| 1,2,3,4,7,8-HxCDF | 0,1 |
| 1,2,3,6,7,8-HxCDF | 0,1 |
| 1,2,3,7,8,9-HxCDF | 0,1 |
| 2,3,4,6,7,8-HxCDF | 0,1 |
| 1,2,3,4,6,7,8-HpCDF | 0,01 |
| 1,2,3,4,7,8,9-HpCDF | 0,01 |
| OCDF | 0,0001 |

| Congener | TEF value |
|---|---|
| *"Dioxin-like" PCBs* | |
| ***Non-ortho PCBs + Mono-ortho PCBs*** | |
| ***Non-ortho PCBs*** | |
| PCB 77 | 0,0001 |
| PCB 81 | 0,0001 |
| PCB 126 | 0,1 |
| PCB 169 | 0,01 |
| ***Mono-ortho PCBs*** | |
| PCB 105 | 0,0001 |
| PCB 114 | 0,0005 |
| PCB 118 | 0,0001 |
| PCB 123 | 0,0001 |
| PCB 156 | 0,0005 |
| PCB 157 | 0,0005 |
| PCB 167 | 0,00001 |
| PCB 189 | 0,0001 |

Abbreviations used: "T" = tetra; "Pe" = penta; "Hx" = hexa; "Hp" = hepta; "O" = octa; "CDD" = chlorodibenzodioxin; "CDF" = chlorodibenzofuran; "CB" = chlorobiphenyl.

ECOHYNTOX

**TEST REPORT**

**Sample no. 63**

**Sample acceptance 20.04.2010**

**Sample cod Sunflower- seed oil 04-01**

**Sample packing glas jar**

**Polychlorinated Dibenzo-*p*- dioxines and Dibenzofuranes**

| ***Name of compound*** | ***Units*** | ***Result Declaration,TEQ*** |
|---|---|---|
| 2,3,7,8-TetraCDD | pg/g | <0,01 |
| 1,2,3,7,8-PentaCDD | pg/g | **<0,01** |
| 1,2,3,4,7,8-HexaCDD | pg/g | **<0,005** |
| 1,2,3,6,7,8-HexaCDD | pg/g | **<0,005** |
| 1,2,3,7,8,9-HexaCDD | pg/g | <0,005 |
| 1,2,3,4,6,7,8-HeptaCDD | pg/g | **<0,001** |
| OctaCDD | pg/g | **<0,0001** |
| 2,3,7,8-TetraCDF | pg/g | <0,005 |
| 1,2,3,7,8-PentaCDF | pg/g | <0,002 |
| 2,3,4,7,8-PentaCDF | pg/g | **<0,01** |
| 1,2,3,4,7,8-HexaCDF | pg/g | **<0,005** |
| 1,2,3,6,7,8-HexaCDF | pg/g | <0,005 |
| 1,2,3,7,8,9-HexaCDF | pg/g | **<0,005** |
| 2,3,4,6,7,8-HexaCDF | pg/g | **<0,005** |
| 1,2,3,4,6,7,8-HeptaCDF | pg/g | **<0,001** |
| 1,2,3,4,7,8,9-HeptaCDF | pg/g | **<0,001** |
| OctaCDF | pg/g | **<0,0001** |
| **∑ WHO-TEQ** | pg/g | 0,075 |

**TEST REPORT**

**Sample no. 61**

**Sample acceptance 22.04.2010**

**Sample cod Sunflower meal pellets 04-02**

**Sample packing plastic bag**

**Polychlorinated Dibenzo-*p*- dioxines and Dibenzofuranes**

| ***Name of compound*** | ***Units*** | ***Result Declaration,TEQ*** |
|---|---|---|
| 2,3,7,8-TetraCDD | ng/kg | <0,01 |
| 1,2,3,7,8-PentaCDD | ng/kg | < 0,01 |
| 1,2,3,4,7,8-HexaCDD | ng/kg | < 0,004 |
| 1,2,3,6,7,8-HexaCDD | ng/k | < 0,004 |
| 1,2,3,7,8,9-HexaCDD | ng/kg | < 0,004 |
| 1,2,3,4,6,7,8-HeptaCDD | ng/kg | **<0,001** |
| OctaCDD | ng/kg | **<0,0001** |
| 2,3,7,8-TetraCDF | ng/kg | <0,005 |
| 1,2,3,7,8-PentaCDF | ng/kg | **<0,002** |
| 2,3,4,7,8-PentaCDF | ng/kg | **<0,01** |
| 1,2,3,4,7,8-HexaCDF | ng/kg | **<0,005** |
| 1,2,3,6,7,8-HexaCDF | ng/kg | <0,005 |
| 1,2,3,7,8,9-HexaCDF | ng/kg | **<0,005** |
| 2,3,4,6,7,8-HexaCDF | ng/kg | **<0,005** |
| 1,2,3,4,6,7,8-HeptaCDF | ng/kg | **<0,002** |
| 1,2,3,4,7,8,9-HeptaCDF | ng/kg | **<0,002** |
| OctaCDF | ng/kg | **<0,0002** |
| **∑WHO-TEQ** | ng/kg | 0,045 |

# THANK YOU
# FOR ATTENTION!