

Recent work on chlorinated paraffins in Switzerland

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Analytical method

Our research presents a general analytical approach suitable for the determination of chlorinated paraffins (CPs) in various matrices (fish, sea birds, sediment, human milk, soil, compost and spruce needle). These matrices are extracted by specific extraction techniques which are followed by a standardised clean-up applicable to all kind of samples.¹⁻³ An overview of the analytical method for all these matrices is described elsewhere.⁴

Electron ionisation tandem mass spectrometry (EI-MS/MS) was used for a fast determination of the total CP amount (sum of short, medium and long chain CPs). Parameters are published in detail elsewhere.⁵

Electron capture negative ion mass spectrometry (ECNI-MS) was employed for the evaluation of congener group pattern (specification of chain length and chlorination degree). Parameters are published in detail elsewhere.^{6,7}

Instrumental analysis using GC-EI-MS/MS and GC-ECNI-MS was performed on a gas chromatograph CP-3800 coupled to a 1200L triple quadrupole mass spectrometer (Varian, Walnut Creek, USA).

Identification of the congener groups was performed by retention time, by the chromatographic signal shape and by the correct isotope ratio according to Reth and Oehme.⁶ The quantification procedure applied was previously described by Reth et al.⁸ Hereby, an accurate quantification can be achieved even if the degree of chlorination of the CPs in the sample is different from the chlorine content of the standard. For this purpose, three short chain CP references (51%, 55%, and 63% Cl) and two medium chain CP references (52% and 57% Cl) from Ehrenstorfer were used.

First results of CP levels in soil and compost and a historical trend of chlorinated paraffins in a sediment core from Lake Thun

Actually, only few data about CP environment levels in Switzerland are available. In 1985, Schmid and Müller reported 5 ng/g ww of medium chain CPs in sediment from Lake Zürich, 200 ng/g ww in human adipose tissue and 30 000 ng/g in sewage sludge from an industrialised region.⁹ Reth (2006) detected between 19 and 42 ng/g ww of total CPs in brown trout samples from the rivers Liechtensteiner Binnenkanal (n = 3) and Necker (n = 3), and 25 ng/g ww in lake trout sample from the alpine lake “Lei da Diavolezza”.¹⁰

For the first time, CPs were determined in soils and composts. Furthermore, one sediment core from Lake Thun was analysed to get a time chart of the CP deposition of the last 120 years.

Swiss soil (NABO; cooperation with André Desaules, Agroscope Reckenholz-Tänikon ART, Switzerland)

The aim of this work was to study the CP distribution in soils from Switzerland. Nine selected soil samples (0-10 cm layer) were collected by the Swiss national soil monitoring network (NABO).¹¹ The major aim of this network is to monitor anthropogenic contaminants into this

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environment. The sites are distributed throughout Switzerland (105 reference sites) including rural/remote areas as well as urban, urban fringe and industrial regions.¹¹

CPs were found in all nine sample sites. Total CP concentrations were between 34 and 151 ng/g dw (median: 45 ng/g dw). The ratio between short chain and medium chain CPs varied between 8 and 51% (median: 37%). The calculated chlorine content was similar for all samples. The mean calculated chlorine content of the short chain and medium chain CPs was 61% (60.1-62.5%) and 55% (53.9-55.6%), respectively.

Compost samples (cooperation with Thomas Kupper, Eawag, Switzerland, and Rahel Brändli, Agroscope Reckenholz-Tänikon ART, Switzerland)

Compost is an important recycling fertiliser which has beneficial effects on physical, chemical and biological parameters of soil. However, compost can contain significant amounts of pollutants that enter via aerial deposition on green waste or via direct contamination to input material.

Three compost samples were analysed to determine CPs. The screened total CP level was between 182-614 ng/g dw. Short and medium chain CP concentrations were 58-138 ng/g dw and 29-248 ng/g dw, respectively. The average calculated chlorine content of the short chain CPs was 62% (61.0-63.3%) and of the medium chain CPs 59% (57.9-59.5%).

Sediment core from Lake Thun (diploma thesis of Claudia Müller, collaboration with Christian Bogdal)

A dated sediment core from Lake Thun was analysed to investigate the historical record of the CP deposition of the last 120 years. In this core CPs started around 1965 (19 ng/g dw) followed by a slow increase. In the 1980s, CP concentrations showed a fast raise. The maximum level which is between 46 and 58 ng/g dw is reached around 1985 and is held till the surface sediment slice (2005). No decrease can be observed in this core. All measurements were performed by EI-MS/MS.

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