

TOXICITY OF PCB TECHNICAL MIXTURES (DELORS) ACCORDING TO UPDATED TEF'S.

Jiří Mitera, Zdeněk Weidenhoffer

Laboratory of Mass Spectrometry, Institute of Public Health, Šrobarova 48, Prague 10, Czech Republic.

INTRODUCTION

Delor is trade name for PCB technical mixtures (Delor 103, Delor 104, Delor 105 and Delor 106) which were in production in Czechoslovakia until 1984. Substantial amounts of Delors are still stored in some products like capacitors, paints, hydraulic oils etc. and as contaminants are widely spread in the environment and biological chain mainly in the Czech and Slovak Republics but also in other Central and Eastern European Countries. In recent years, after the decline in communist regimes in this region of Europe substantial efforts were devoted to estimate damages by Delors in the environment and human health. Up to date, however, most of those activities involved detection and determination of Delors in various matrices as total PCBs or concentration of selected congener (IUPAC Nos. 28, 52, 101, 138 and 180) without taking into account:

1. differences in composition of Delors and Aroclors, Clophens etc.
2. the content of toxic congeners in various Delors

For the purpose of risk assessment the knowledge of TEQ or PCB contaminated samples is essential. In this paper we use WHO/IPCS recommended TEFs¹⁾ for PCB IUPAC Nos. 77, 126, 169, 105, 114, 118, 123, 156, 157, 167, 189, 170 and 180.

The determination of TEQ for every single sample is rather expensive and time consuming. The clean up procedure using carbon columns or sophisticated LC methods and HRGC-HRMS determination is necessary. In cases of very low concentrations of Delors in the sample such a determination of TEQ is impossible.

This paper suggests a simple and low cost method for estimation of TEQ for Delor contaminated samples, provided the original Delor composition (Fig. 1) is conserved. The method is not applicable to samples which are biologically, or chemically degraded or changed in composition from original Delors.

EXPERIMENTAL

Delors studied were official reference materials No. 10-2-06 of Czechoslovak Metrological Institute, Bratislava (1991).

Clean up for determination of toxic congeners was performed on the glass column ID 2 mm, length 7 cm filled with 300 mg AX21 carbon on Celite 512. The amount of 25 µg of Delor spiked with ¹³C internal standards PCB 77, 126, 169, 105, 118, 156, 189 and 180 (CIL) was injected on top of the column.

Column was eluted (2 ml/min) consecutively with 30 ml of hexane (Romil, pesticide grade) - Fraction I, 30 ml of hexane/DCM 50% - Fraction II and after reversion of the flow with 30 ml of toluol (phthalate free) - Fraction III. Fractions II and III were analyzed after evaporation and addition of recovery standard PCB 80¹³C by GC-MS.

VG Trio 1000 in EI mode was used for the detection and quantification of GC separated PCB's. We have used on column injection to 60m fused silica capillary column 0.25mm ID, with 0.25 µm DB 5. Temperature program of 10°C/min from 80°C to 190°C and 3°C/min to 290°C.

RESULTS

We have measured the concentrations of toxic PCB's in Delor 103, 104, 105 and 106 and determined their TEQ's (Table I.) using WHO/IPCS TEF's. Concentrations of PCB IUPAC Nos. 114 and 123 are calculated using PCB 105¹³C as an internal standard, for Nos. 157 and 167 the internal standard was PCB 156¹³C and for PCB 170 and IS was PCB 180¹³C.

Table I. TEQ_d for Delors.

Delor	TEQ _d (µg/g)
103	9.21
104	5.62
105	33.59
106	21.24

The TEQ_s (µg/weight) for the sample are calculated by multiplication of the concentration (c) of appropriate Delor in grams per weight of the contaminated sample by the appropriate TEQ_d.

$$TEQ_s = C \cdot TEQ_d$$

Similar procedures are applicable for Aroclors, Clophens and other technical PCB mixtures, on the condition that their TEQ's are known.

REFERENCES

- 1) Ahlborg U.G., Becking G.C., Birnbaum L.S., Brouwer A., Derks H.J.G.M., Feeley M., Golor G., Hanberg A., Larsen J.C., Liem A.K.D., Safe S.H., Schlatter C., Waern F., Younes M., Yrjanheikki E. (1994): Toxic Equivalency Factors for Dioxin-like PCBs. *Chemosphere* 28, 1049-1067.

This work is part of Grant No. IGA MZ ČR 1856-2

TOX

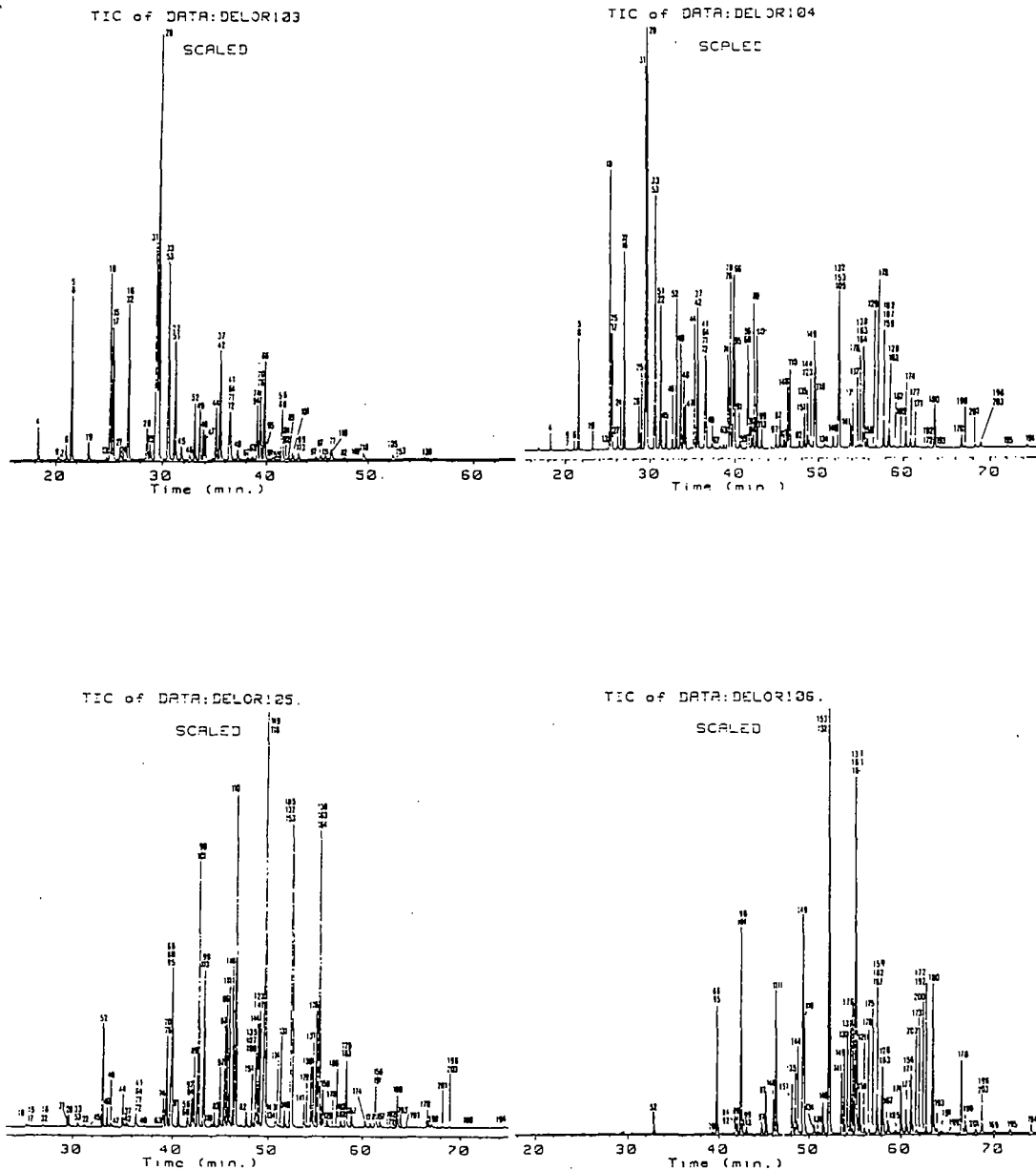


Fig.1. GC-MS data for DELOR 103, 104, 105 and 106.