

# Dioxin '97, Indianapolis, Indiana, USA

## PCB in Cod Liver - Time Trend Study and Correlation between Total PCB (Aroclor 1260) and CB Congeners.

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### **Abstract**

PCB in cod liver from Danish waters has been monitored as total PCB (Aroclor 1260) since 1973. The levels have decreased during the seventies, eighties and nineties. To get a more specific and sensitive method PCB is now determined as CB congeners. To minimize problems with discontinuities in time trend studies both total PCB and CB congeners were determined during a three years period (1994-96). A good correlation between total PCB and CB congeners was found.

### **Introduction**

In several countries PCB has been analyzed on packed columns using a technical mixture of PCB (e.g. Aroclor 1260) as a reference standard. This old technique gives only "total PCB" and no information on the composition of PCB. Today PCB is most often quantified as individual CB congeners using capillary GC technique. A comparison of the two methods is needed to continue time trend studies across a method change.

In this study samples of cod liver from Danish waters have been analyzed for total PCB since 1973<sup>1,2)</sup> and for both total PCB and CB congeners during a three years period (1994-96).

### **Analytical methods**

The samples of cod liver were comminuted and homogenised before soxhlet extraction for three hours with n-pentane. The clean-up was carried out on standardised florisil, which was eluted with dichloromethane:pentane (1:4). PCB was separated from most pesticides on a silica column, which was first eluted with n-pentane then with diethylether:n-pentane (1:9). Determination of CB congeners was carried out by HRGC-ECD on two capillary columns in parallel, while total PCB was determined by GC-ECD on a packed column, using Aroclor 1260 as a standard. The following CB congeners were quantified: IUPAC No. 28, 52, 101, 105, 118, 138, 153, 156, 170 and 180. Clean-up and determination of total PCB are based on the method described by Stijve and Cardinale<sup>3)</sup> and Collins et al.<sup>4)</sup>, while determination of CB congeners has been described by Bennetzen<sup>5)</sup>.

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## Results and Discussion

The PCB content in cod liver from Danish waters has decreased during the seventies, eighties and nineties with some differences between the individual waters (*Figure 1*).

Results from a comparison between total PCB and CB congeners are shown in *Figures 2-3*.

CB153 is generally found in different types of biological samples in relative high concentrations and is sometimes used as an indicator for the PCB content<sup>6)</sup>. In *Figure 2* total PCB is plotted against CB153 and a correlation ( $r^2=0.904$ ) is found. The correlation is better when total PCB is compared to the sum of CB congeners ( $r^2=0.952$ , *Figure 3*), indicating some differences in PCB composition between the samples.

The sum of CB congeners is about three times the concentration of CB153. This is consistent with the ratio between CB153 and the sum of congeners in a number of fish species analysed by Atuma et al.<sup>6)</sup>.

The ratio between total PCB and the sum of CB congeners is by a linear regression found to be 1.09 (*Figure 3*). Some authors find relative higher results for total PCB compared to CB congeners<sup>6,7)</sup>. This difference might be due to different types of samples or different methods for determination of total PCB. While results for CB congeners in principle are independent of the method used, results for total PCB relate to the method. The reference standard used in this study (Aroclor 1260) is one of the more chlorinated technical mixtures. As most samples are less chlorinated than the reference standard, the results for total PCB get relative lower due to a lower ECD response for less chlorinated compounds.

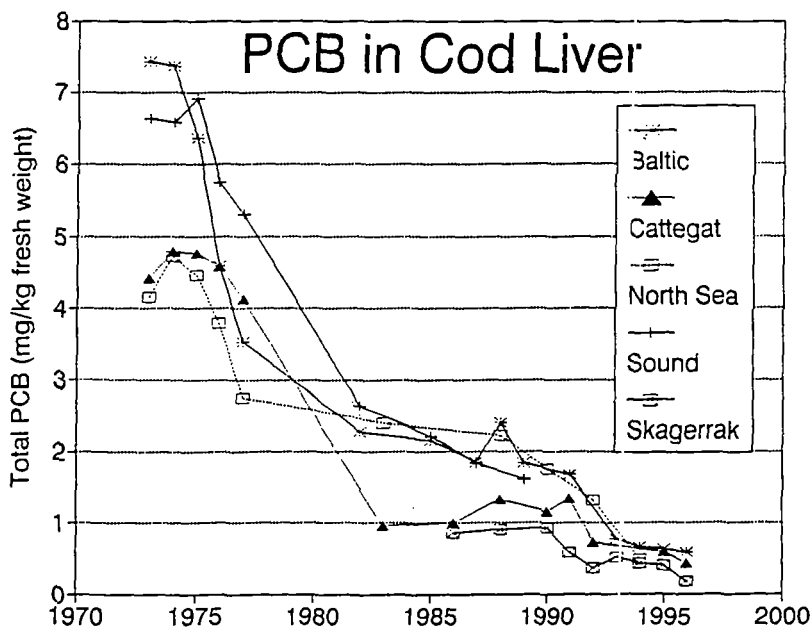
The correlation between total PCB and CB congeners makes it possible to continue the time trend study by determination of CB congeners only. Because PCB composition can change during time, the correlation between total PCB and CB congeners might not be valid for the whole period from 1973 until now. For future determinations of CB congeners it will be possible to study potential changes in PCB composition.

## Literature Cited

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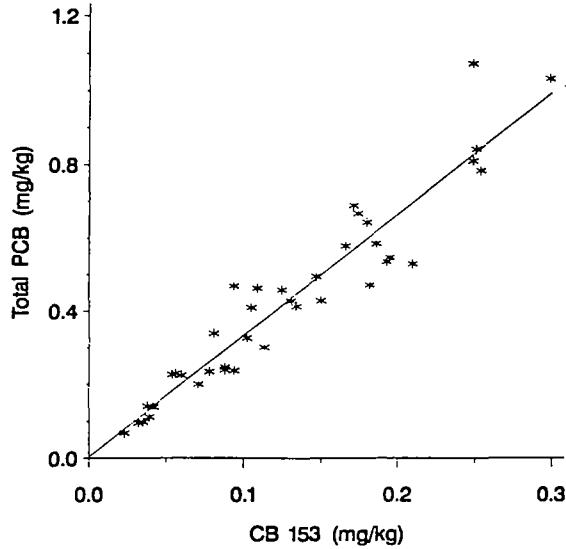
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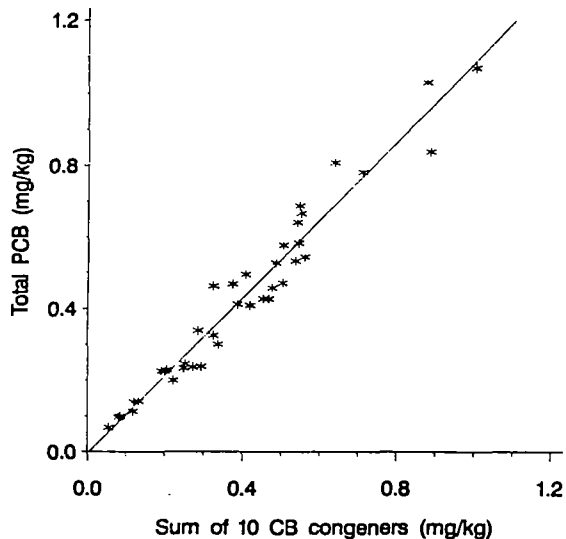


**Figure 1.** Total PCB (Aroclor 1260) in cod liver from different Danish waters. Time trend study from 1973 to 1996. The curves are made as sliding means (over three points) weighted according to the number of observations.

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**Figure 2.** PCB in cod liver from Danish waters (mg/kg fresh weight). Total PCB (Aroclor 1260) plotted against CB153. Regression line: Total PCB = 3.3 \* CB153,  $r^2=0.904$ .



**Figure 3.** PCB in cod liver from Danish waters (mg/kg fresh weight). Total PCB (Aroclor 1260) plotted against the sum of CB congeners (IUPAC No. 28, 52, 101, 105, 118, 138, 153, 156, 170 and 180). Regression line: Total PCB = 1.09 \* sum of CB congeners,  $r^2=0.952$ .