

# Pollution in Icelandic cod (*Gadus morhua*)

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## Aim

To analyse the concentration of PCBs in the edible part of cod (muscle) from Icelandic waters

To investigate the variation in the level of PCBs in cod in relation to age, sex, length and weight

To evaluate the effect of processing on the PCB concentration in the fillet

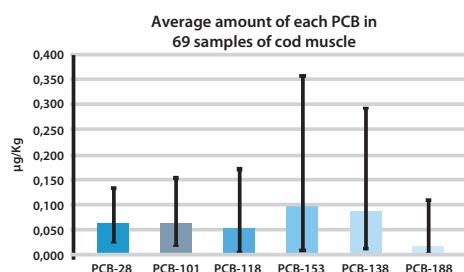


Figure 1. Calculated average of each of the six PCBs in 69 samples

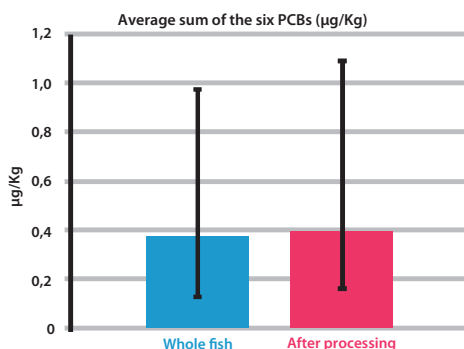


Figure 2. Comparison of the sum of the six PCBs in cod muscle before and after processing

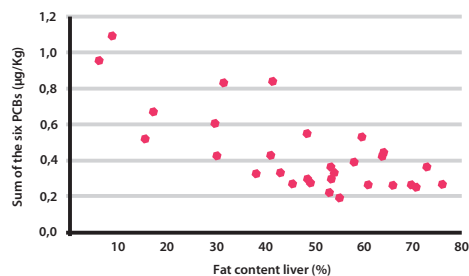


Figure 3. Total sum of the six PCBs compared to the fat content in liver (%)

## Introduction

Polychlorinated biphenyls (PCBs) are man made persistent organic pollutants (POPs) produced from 1930s until in the 1970s when they were banned in most countries.<sup>1</sup> Despite this, PCBs can still be found widely in nature, and are found in all animals and human samples tested.<sup>2</sup> PCBs are very lipid soluble, resulting in an ability to bioaccumulate in organisms and biomagnify up the food chain.<sup>1</sup> From 1929 to 1989 the production of PCBs was about 1,7 million tons and there are many equipments still in use that contain PCBs.<sup>3</sup> When PCBs are released into the environment they are extremely stable and are transported from the sources south and north and finally enter the Arctic and Antarctic environment.<sup>4</sup>

## Materials and Methods

### Extraction of PCBs

To extract the PCBs from the fish an ASE (Accelerated Solvent extraction) is used with n-hexane as a solvent. After the extraction the samples are cleaned further with sulfuric acid to remove all fat from the samples. After clean up the PCBs are analysed with gas chromatography (GC-ECD) with two different columns, DB-5 and DB-1701.

## Results and Discussion

The results reported here are the preliminary results from a research project funded by AVS were the aim is to evaluate the level of PCBs in cod muscle in relation to age, sex, length and weight of the fish.

Altogether 209 PCB congeners exists. In this project the aim was to analyse the so called marker PCBs that have been measured as an indication for total PCB contamination that is PCB-28, 52, 101, 118, 138, 153 and 180. However, since the analyses of PCB-52 was inaccurate probably because another component is co-eluting with PCB-52, therefore only the results for six PCBs are reported here. Figure 1 shows the calculated average amount of each of the six PCBs in 69 cod muscle samples.

### Total PCBs concentration

Figure 2 shows that the sum of the six PCBs ranges from 0,124 µg/kg – 1,089 µg/kg and the average concentration is approximately 0,4 µg/kg both for the processed samples (0,387) and samples from the whole fish (0,401). No significant difference was observed between processed and un-processed samples. The sum of the six PCBs analysed in this project is very low compared to the Icelandic maximum limits set by the Ministry for the Environment which is 160 µg/kg in fish muscle.<sup>5</sup>

### Statistical evaluation

There is no significant difference in sum of the six PCBs in relation to age, sex, weight, and length. As showed in figure 3 there is a linear correlation between PCB concentration and the fat content in the liver of the same individuals. PCB levels decrease with increased fat content of the liver.

## Conclusion

The concentration in the edible part of Icelandic cod is very low and preliminary results shows no variation in the level of PCBs in relation to age, sex, length and weight. There is also no effect caused by processing on the concentration in the muscle. Regarding the correlation between PCB concentration and fat content in the liver, the next step is to analyse PCBs in livers of the same cods to investigate the relationship between the concentration in muscle and liver.

## References

1. Borja, J., et al., Polychlorinated biphenyls and their biodegradation. *Process Biochemistry*, 2005. 40(6): p. 1999-2013.
2. Darras, V.M., Endocrine disrupting polyhalogenated organic pollutants interfere with thyroid hormone signalling in the developing brain. *The Cerebellum*, 2008: p. 26-37.
3. PCBs - Overview. 2009; Available from: <http://chm.pops.int/Programmes/PCBs/Overview/tabid/273/language/en-US/Default.aspx>.
4. Bard, S.M., Global transport of anthropogenic contaminants and the consequences for the Arctic marine ecosystem. *Marine Pollution Bulletin*, 1999. 38(5): p. 356-379.
5. Reglugerð um breytingu á reglugerð nr. 411/2004 um ýmis aðskotaefni í matvællum. nr. 056/2005. 2005.

## Acknowledgement

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