

DETERMINATION OF DIOXIN-LIKE POLYCHLORINATED BIPHENYLS IN VEGETABLE OILS

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Introduction

Polychlorinated biphenyls (PCBs) are environmentally stable, lipophilic chemicals that were widely manufactured for a range of industrial applications between the 1930s and 1970s. Use of PCBs for industrial purposes has been discontinued but these substances may still be realised to the environment during disposal of materials and obsolete equipment. There are 209 theoretically possible PCB congeners, of which 12 non-ortho or mono-ortho compounds exhibit similar biological activity to polychlorinated dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), and are therefore referred to as "dioxin-like PCBs".

The objectives of present study is to define the levels of dioxin-like PCBs in vegetable oils, producible in Ukraine or sold in a trading network, by means of the use for preparation of samples a Power - Prep workstation for automated clean - up (Fluid Management Systems, FMS).

Materials and methods

All solvents were for analysis of dioxins, furans and PCB (Fluka Analytical). Different types of samples was sunflower oil and soya oil. Prior to clean-up the samples were fortified with ¹³C₁₂-labelled PCBs as internal standards. The clean-up were carried out on Power-Prep workstation (Fluid Management Systems, FMS). Dioxin-like PCBs analysis were performed by HRGC/HRMS. For the chromatographic separation of the different dioxin-like PCBs congeners were used Trace GC with column, 60m x 0,25 mm of DB - 5MS. For identification and quantitative determination of the divided congeners of PCBs MAT 95 - XP Thermo Finnigan were used.

Results and discussion

Initially, in 2012, the EU introduced new regulations for the control of dioxin-like PCBs (12 WHO-PCBs) in foods including vegetable oils. In this regard, sensitive and reliable methods must be used to determine congeners dioxin-like PCBs in vegetable oils. In our research for the clean-up of samples of vegetable oils and separation congeners of dioxin-like PCB and dioxins, we used an automated system Power-Prep (FMS). Figures 1 and 2 shows the sequence of operations of the system of the automatic cleaning of vegetable oils for conditioning of column and the separation of dioxins/non-ortho-PCBs (4 coplanar WHO-PCBs) and mono-/di-ortho PCBs (8 non coplanar WHO-PCBs). For cleaning of the samples vegetable oil high capacity disposable silica column, multiplayer silica column, alumina column and carbon column are used.

A process of cleaning passage - ways are practically without intervention from an operator, it eliminates influence of human factor on quality of results, and the use of ready - made columns reduce time of cleaning and helps the increase of degree of reproducibility of results. One module of the system Power-Prep allows to conduct cleaning of two samples in the flow of one working day. Recoveries of dioxin-like PCBs congeners for several kinds of matrices shows in Table. The limit of quantification using this automated dioxin/PCB clean-up system is lower than required by the EU guidelines.

Conclusion

Use of the systems of automatic cleaning allowed:

- to conduct the preparation of samples of different matrices of vegetable oils, containing dioxin-like PCBs ;
- considerably to increase the productivity of work of the Dioxin center at the analysis of these xenobiotics;
- to decrease the consumption of organic solvents;
- to shorten time of teaching of personnel of analysts for implementation of operations of the stages of extraction and cleaning;
- to promote a repeatability and quality of results of analysis due to diminishing of influence of human factor.

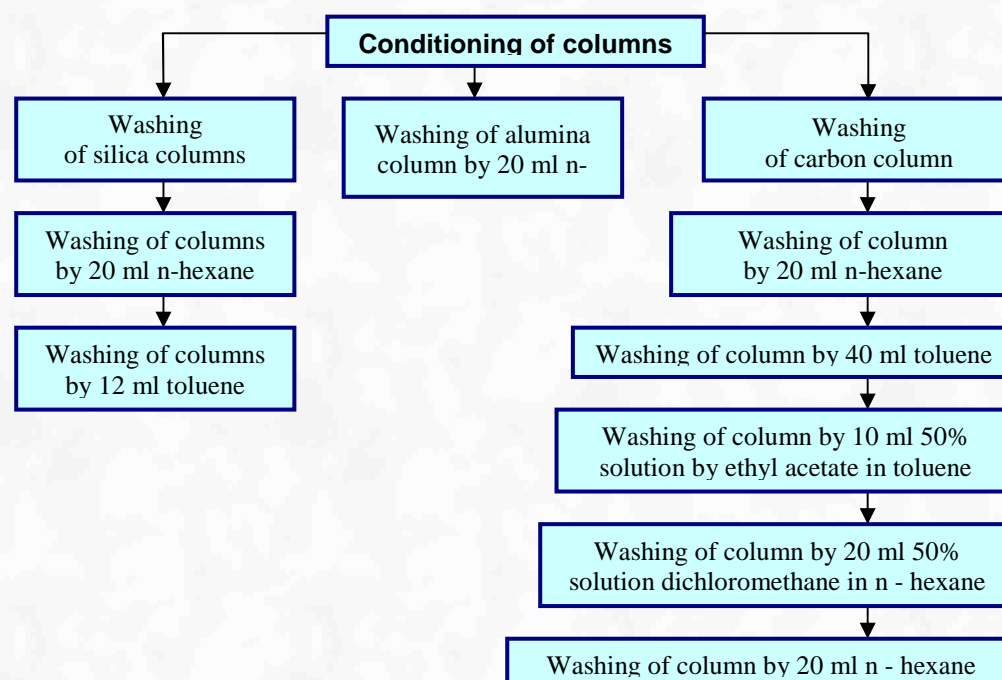


Fig. 1. Conditioning of columns

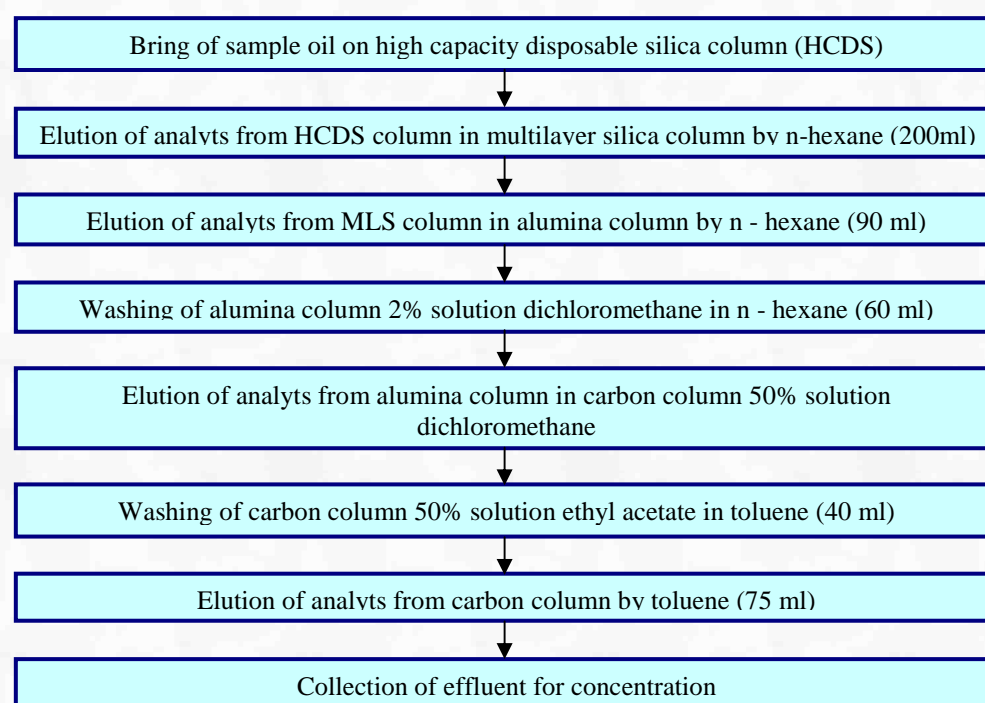


Fig. 2. Clean-up and separation of dioxins/non-ortho-PCBs and mono-/di-ortho PCBs

Table

Recovery for Dioxin-like PCBs

Matrix	Weight, g	Action level, pg/g	Maximum level, pg/g	Recovery, %	LOQ, pg/g
Sunflower oil	3,5	0,5	0,75	78-115	0,1
Soya oil	3,5	0,5	0,75	80-110	0,1