

REVISITING GC \times GC-(HR)TOFMS FOR DIOXINS ANALYSIS. WHERE ARE WE NOW?

Pierre-Hugues Stefanuto¹; Lena Dubois¹; Delphine Zanella¹; Jean-François Focant¹

¹ Organic and Biological Analytical Chemistry Group, MolSys, University of Liège, Belgium

Abstract

Dioxins and dioxin-like compounds are highly toxic compounds part of the persistent organic pollutants (POPs) family. In Europe, since food crisis in the early 2000, screening and monitoring these compounds has been a high priority for national food and health protection agencies [1]. Nevertheless, the toxicity at low concentration of dioxins requires sensitive analytical procedure with a limit of detection at the femtogram level. The actual analytical gold standard is based on extensive clean-up and concentration steps, and gas chromatography coupled to high-resolution magnetic sector instrument (GC-HRMS) [2].

In the last years, instrumental developments of MS analyzers have opened new perspectives to reconsider existing methods. In Europe, the use of triple quadrupoles was validated for the official food and feed control as it demonstrated to offer similar performances to GC-HRMS [3]. It is now an official tool for confirmatory methods [4,5].

Comprehensive gas chromatography coupled to time-of-flight MS (GC \times GC-TOFMS) has also previously been investigated for dioxin analyses [6] but suffered from limited sensitivity by then. Attempts to further enhance the cryogenic zone compression effect helped to reach attogram sensitivity level but not on a routine basis [7]. New generations of TOFMS analyzers offers now better sensitivity and mass accuracy so that revisiting dioxin measurements using GC \times GC-(HR)TOFMS makes sense. Keeping in mind that classical sector HRMS and QQQ analyzers perform in selected ion monitoring (SIM) mode, although full scan data are acquired by TOFMS, expanding the field of possibilities in terms of non-target screening of emerging contaminants at ultra-trace level.

This study aims, as a first step, to evaluate the potential of a new GC \times GC-TOFMS system for the target screening of the 21 EU regulated dioxins and dioxin-like compounds by combining the sensitive TOF instrumentation and cryogenic zone compression [7].

References

- [1] Commission Regulation (EC) Off. J. Eur. Communities. L158/7-49 (2004).
- [2] R. Malisch *et al.* *Organohalogen Compd.* 50 (2001) 59–63.
- [3] B. L'Homme *et al.* *J. Chromatogr. A.* 1376 (2015) 149–158.
- [4] Commission Regulation (EC) Off. J. Eur. Union. 2006 (2014) 18–40.
- [5] Commission Regulation (EC) Off. J. Eur. Union. (2014) L 188/1-L 188/18.
- [6] J.F. Focan *et al.* *J. Chromatogr. A.* 1086 (2005) 45–60.
- [7] D.G. Patterson Jr *et al.* *J. Chromatogr. a.* 1218 (2011) 3274–3281.