

Have plasticizers already reached our marine environment?

Huysman Steve¹, Van Meulebroek Lieven¹, Vanryckeghem Francis², Van Langenhove Herman², Demeestere Kristof² and Vanhaecke Lynn²

¹ Department of Veterinary Public Health and Food Safety, Laboratory of Chemical Analysis (LCA), Salisburylaan 133, Merelbeke, Belgium
E-mail: steve.huysman@ugent.be

² Department of Green Chemistry and Technology, Research Group Environmental Organic Chemistry and Technology (EnVOC), Coupure links 653, Ghent, Belgium

Yearly, 4.8 to 12.7 million tons of plastic waste enter our oceans and this amount is expected to increase by an order of magnitude by 2025 [1,2]. As a result of this widespread global contamination, plasticizers can extensively enter our aquatic ecosystem [3]. Furthermore, the abundance of plasticizers has recently prompted significant public and mass media interest due to severe known and unknown adverse ecological effects [4,5].

Therefore, this study engaged in the analysis of plasticizers in seawater samples dispersed in the Belgian Part of the North Sea (4 locations) during different seasons (2016-2017). The seawater samples were analyzed using an in-house developed and validated ultra-high-performance liquid chromatographic high-resolution mass spectrometric (UHPLC-HRMS) platform (Huysman et. Al, 2018, submitted in journal of Analytical Chemistry). This platform covered 3 different approaches, i.e. targeted, suspected and untargeted analysis. The targeted analysis aims at the quantification of a predefined list of 27 common plasticizers. Following this targeted analysis, 16 plasticizers were ubiquitously detected with concentrations ranging from 20 to 8000 ng L⁻¹. Different conjugates (i.e. transformation and degradation products) of the target plasticizers were screened during suspected analysis based on an in-house database (n=289), thereby using information about the accurate mass, isotopic profile and fragmentation spectrum. As a result, 6 additional suspected plasticizers were identified. Subsequently, untargeted analysis revealed 420 different unknown compounds including 9 with a backbone structure related to the target plasticizers as being verified based on characteristic product ions and neutral loss fragments.

In conclusion, our work suggests that different known, suspected and unknown plasticizers have reached our aquatic ecosystem and may contribute to adverse ecological effects threatening the aquatic ecosystem. Moreover, plasticizers are recently recognized as sensitive biomarkers for obtaining epidemiological information [6], which can now be evaluated by our newly developed platform. Finally, this work also stresses the urgency of investigating the unknown potential effects of plasticizers in the marine environment.

References

- [1] J.R. Jambeck, Plastic waste inputs from land into the ocean, *Clim. Chang. 2014 Impacts, Adapt. Vulnerability*. 347 (2015) 1655–1732. doi:10.1017/CBO9781107415386.010.
- [2] Erik, Sebille, *Environmental Research Letters A global inventory of small floating plastic debris*, *Environ. Res. Lett.* 10 (2015). <http://iopscience.iop.org/article/10.1088/1748-9326/10/12/124006/pdf> (accessed November 23, 2017).
- [3] Lind, *Circulating Levels of Phthalate Metabolites Are Associated With Prevalent Diabetes in the Elderly*, 35 (2012) 1519–1524. doi:10.2337/dc11-2396.
- [4] L. Canesi, E. Fabbri, *Environmental effects of BPA: Focus on aquatic species, Dose-Response*. 13 (2015) 155932581559830. doi:10.1177/1559325815598304.
- [5] C. Guerranti, E. Grazioli, S. Focardi, M. Renzi, G. Perra, *Levels of chemicals in two fish species from four Italian fishing areas*, *Mar. Pollut. Bull.* 111 (2016) 449–452. doi:10.1016/j.marpolbul.2016.07.002.
- [6] E. Gracia-Lor, S. Castiglioni, R. Bade, F. Been, E. Castrignanò, A. Covaci, et al., *Measuring biomarkers in wastewater as a new source of epidemiological information: Current state and future perspectives*, *Environ. Int.* 99 (2017) 131–150. doi:10.1016/j.envint.2016.12.016.

Keywords: plasticizers; Belgian Part of the North Sea; screening; UHPLC-HRMS