
Arrow solid-phase microextraction-gas chromatography-tandem mass spectrometry for the analysis of plastic additives from seawater

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Abstract

The presence of plastic additives in the marine water, some of them classified as toxic substances and included in REACH, has gained concern in the last decades. Plastic additives include a wide range of substances with different physical-chemical characteristics, including substances that acts as plasticizers, ignifugants, antioxidants, UV filters, or antimicrobials. The development of an automatic, sensitive robust and reliable analytical method for the analysis of these kind of substance becomes essential for the marine water quality monitoring.

In this work, an arrow solid-phase microextraction method with gas chromatography and tandem mass spectrometry determination, was optimized for the analysis of 48 plastic additives comprising phthalates, organophosphate flame retardants, benzotriazoles, benzophenones, bisphenols, adipates, etc... Univariate and multivariate approaches were used in order to optimize the parameters: desorption time, percentage of organic modifier, split vent time and flow, extraction time and temperature. Other parameters were fixed previous to the optimization (fibre, incubation time, desorption temperature, sample salinity...).

Once all the parameters were optimized, the analytical performance characteristics of the method were calculated for all the compounds. The sensitivity was different depending on the compounds, varying the quantification limit between 0.0017 $\mu\text{g L}^{-1}$ (DiBP) and 81 $\mu\text{g L}^{-1}$ (TCEP). Good recoveries, between 70 and 130% for all the analytes except vitamin E (57%), with a good precision (relative standard deviation < 20% for almost all compounds) were achieved.

The optimized method supposes an improvement to the typical ones, regarding to analytical performance characteristics, and green analytical chemistry principles.

Support: The Spanish Ministry of Science and Innovation through JPI.Oceans 2019 MicroplastiX (PCI2020-112145) and the European Union "Next Generation EU"/PRTR". Agencia Estatal de Investigación through CHEMPLAS (Grant PID2019- 108857RB-C31/AEI/10.13039/501100011033) and LABPLAS (Grant H2020- 101003954). Program of Consolidation and Structuring of Units of Competitive Investigation SUG (Xunta de Galicia) cofinanced by ERDF-Operative Program of Galicia 2021-2024 (ED431C 2021/56).

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Keywords: SPME, ARROW, plastic additives, seawater, methodology