

Environmental screening of organic micropollutants in seawater by coupling a divinylbenzene passive sampling device and high resolution mass spectrometry.

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Abstract

The abundance of organic micropollutants in water can be detrimental to the aquatic environment and its ecological health, resulting in severe consequences such as loss of animal habitats, reduction in biodiversity and intoxication - both acute and chronic - of organisms. Up to now, studies mainly report on the occurrence of organic micropollutants in freshwater environments, whereas data for marine environments are relatively scarce.

Therefore, the aim of this study was to sequester polar to non-polar emerging organic micropollutants in the marine environment (harbour of Zeebrugge, harbour of Oostende and open sea; all located in the Belgian Part of the North Sea) by using a divinylbenzene (DVB) passive sampler of which the extracts are analysed by two in-house validated high-end ultra-high-performance liquid chromatography and high resolution mass spectrometry (UHPLC-HMRS) methods. The analyses of the samples were processed in three approaches, i.e. target, suspect and non-target screening. The target screening was based on the preselection of 145 micropollutants in the UHPLC-HRMS method, including pharmaceuticals, personal care products, pesticides, natural and synthetic hormones. The suspect screening, using a scientific database compiled by scientific literature data, enables the identification of 380 micropollutants, including the same therapeutic classes as the target analysis. The non-target screening combines multi-variate analysis and online databases for the identification of unknown micropollutants. The DVB passive sampler coupled to UHPLC-HRMS methods has shown promising results for target, suspect and non-target screening. The three screening approaches have contributed to a specific molecular print for the sites in the marine environment.

The future perspective is the continuous improvement of the molecular fingerprinting. This can be realised by deploying and monitoring the passive samplers during different periods, and comparing them with previous molecular data. Thereby, analysing the DVB passive samplers with other UHPLC-HRMS methods will enable other new target, suspect and non-target compounds. Finally, this work is an important step towards the improvement of environmental monitoring and related programs to acquire a correct view on the healthy status of the marine environment.

Keywords

Screening; Targeted, Suspected, Untargeted; High resolution mass spectrometry, Marine

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