

Simultaneous analysis of 23 priority volatile compounds in water by solid-phase microextraction–gas chromatography–mass spectrometry and estimation of the method’s uncertainty

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Most water contaminations with volatile organic compounds (VOCs) are traceable to leaking underground fuel reservoirs, solvent storage vessels, agricultural practices, industrial residues, and deficient wastewater treatment and disposal. In order to perform effective monitoring of such organic micropollutants in a straightforward manner, a multiresidue method for the determination of 23 VOCs (trihalomethanes (THMs), BTEX and chlorinated solvents) in water has been developed using solid-phase microextraction (SPME) and capillary gas chromatography–mass spectrometry (GC–MS). This group includes also methyl-*tert*-butyl ether, epichlorohydrine, and vinyl chloride which present additional analytical difficulties. Three different fibres were assayed: 7- μm polydimethylsiloxane (PDMS), 100- μm PDMS, and 75- μm Carboxen-PDMS, and the extraction conditions were optimized. The best results for the majority of the analytes and mainly for those with the lowest signals were obtained using the Carboxen-PDMS fibre after 15 min of extraction in the headspace mode at a room temperature of $20 \pm 2^\circ\text{C}$. The analytical sensitivity, linearity, precision, accuracy, and uncertainties have been studied for method validation in agreement with the international standard ISO/IEC 17025:2005. The limits of detection achieved with the proposed method ($0.06\text{--}0.17 \mu\text{g L}^{-1}$) are adequate to determine the VOCs at the restrictive levels established by the European legislation. This was a decisive achievement to enable the analysis of all VOCs listed under the drinking-water directive in a single assay. The method exhibits performance capabilities suitable for routine analysis of VOCs in drinking-water by quality-control laboratories as enforced by EU Directives. The method is currently being used for this purpose, and participation in proficiency tests was assessed, with encouraging results.

Keywords: SPME; Water; VOCs; Epichlorohydrine; Vinyl chloride; MTBE; GC-MS; Uncertainty

1. Introduction

Many volatile organic compounds (VOCs) are man-made chemicals mainly used as industrial solvents and cleaning agents, and in the manufacture of paints,

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