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DEVELOPMENT OF ON-LINE AND FIELD TD-GC-FID FOR AUTOMATIC AND CONTINUOUS MONITORING OF VOCs IN WATER

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The monitoring of Volatile and Semi-Volatile Organic Compounds (VOCs and sVOCs) dissolved in water is crucial to prevent adverse effects on human health and environmental pollutions. Some of these molecules can be toxic at low concentrations, necessitating the use of sensitive systems capable of analyzing concentrations ranging from parts per trillion (ppt) to percentage (%). Given that VOCs and sVOCs are frequently byproducts of industrial processes, accurately quantifying specific molecules becomes challenging due to the numerous potential interferences. This complexity makes it difficult to achieve precise quantification of all compounds using cost-effective sensors. Typically, laboratory gas chromatographs, involving off-line sampling, are employed for the identification and quantification of molecules in complex mixtures. However, these devices require trained operators and are not designed to perform continuous on-line monitoring. To enhance result accessibility and minimize the risk of losing sample information during transport, there is a pressing need for user-friendly, continuous, on-site monitoring systems. In this work, we present three different analytical systems for the continuous measurement of VOCs and sVOCs in water, including sulfur, alkanes, chlorinated and oxygenated compounds (OVOCs). These three systems are designed to measure from low ng/L up to 50,000 mg/L of dissolved VOCs in water. For low VOC concentrations in water, an automated Purge and Trap system is used for quantification of molecules listed in the EPA method 502.2. The system allows identification and quantification down to ng/L up to µg/L. This system can be optimized to perform the analysis of OVOCs in water such as acetone or isopropanol. For VOCs at higher concentrations (mg/L), a specific dilution system has been designed and implemented to the Purge and Trap system. For this application, we have validated the system using BTEX liquid standard solutions. Finally, for the analysis of liquids with very high VOCs concentrations, a continuous headspace system has been designed and evaluated.

Keywords: Gas Chromatography, Odorous Volatile Organic Compounds, On-line Monitoring, Water Analysis