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DEVELOPMENT OF ON-LINE AND FIELD DUAL TD-GC-FID/MS FOR AUTOMATIC AND CONTINUOUS ODOROUS VOCS MONITORING IN AMBIENT AIR

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Odorous compounds, such as sulfur or carbonyl substances, play a major role in ambient air pollution. Monitoring these odorous VOCs is important because some of them have adverse effects on human health, on the environment and might be responsible for unpleasant smells. In addition, some of these molecules have an extremely low odor detection threshold which requires the use of sensitive systems capable of analyzing a wide range of concentrations from ppt to ppm levels. As odorous compounds are often generated from industrial processes, the specific quantification of molecule is difficult due to the large number of potential interferences. Therefore, it is difficult to quantify precisely all compounds using low cost sensors. Usually, laboratory gas chromatographs are used to perform identification and quantification of molecules in complex mixtures. Nevertheless, these devices require trained operators and do not allow continuous monitoring (off-line sampling). To improve the accessibility of results and to avoid the risk of losing sample information during transport, there is a need for easy-to-use continuous on-site monitoring systems.
The goal of this study is to perform automatic and continuous identification and quantification of odorous VOCs using two different Thermal-Desorption Gas Chromatographs equipped with two Flame Ionization Detectors (FID) and one Mass Spectrometer (MS). Each system is designed with its specific analytical conditions, one for monitoring light compounds and the other for heavier compounds. The coupling of two different TD-GC-FIDs to a Quadrupole MS, allows identification and quantification of analyzed molecules using both detectors. An algorithm has been developed in the software to select the more accurate result between this dual detection and to provide validated results to the user. To achieve this automatic reprocessing, the implementation of validation parameters was developed for each identified compound, while remaining adaptable and verifiable if necessary. The results obtained with this specific method have been compared to results obtained after careful analysis by a GCMS expert. Data analysis of mixture of synthetic gas and ambient air measurement has shown very good correlation between manual and automatic reprocessing. These results show that the fully automatic system we have developed allows non-specialist operators to access expertise level results.

Keywords: Gas Chromatography, Mass spectroscopy, Odorous Volatile Organic Compounds, On-line Monitoring