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Abstract

A Novel Microfluidic Formaldehyde Microanalyser for Continuous Real-Time Monitoring in Indoor Air: Analytical Development and Validation †

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Formaldehyde is a major and harmful pollutant of indoor air due to its multiple sources and its carcinogenic effect. This work reports the development of a novel analytical method based on microfluidic technologies for the detection of low airborne Formaldehyde concentrations, representative of those found in indoor air, i.e., 10–100 μg m^{-3}. The new analytical technique operates as follows: (1) gas sampling; (2) gaseous Formaldehyde uptake into the aqueous solution using an annular gas/liquid flow at room temperature; (3) derivatization reaction with acetylacetone solution at 65 °C producing 3,5-Diacetyl-1,4-dihydrolutidine (DDL) and (4) fluorimetric DDL detection.

Laboratory experiments were performed to determine the experimental conditions permitting to obtain a stable annular flow, i.e., gas to liquid flow rate ratios greater than 1000. From liquid and gas calibrations, an uptake yield of 100% and a detection limit of 1 μg m^{-3} were determined. Finally, our portable instrument is fully controlled by homemade software and has a response time of 10 min, a temporal resolution of 2 s and an autonomy of 100 h with 100 mL reagent. Finally, this formaldehyde microanalyser was then deployed during several field campaigns and compared with the ISO 16000-3 reference method, i.e., the active sampling on DNPH cartridges.