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Analytical Systems for Continuous Monitoring of ppt- to ppm-levels of Formaldehyde in Air

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Among indoor air pollutants, aldehydes are of particular interest due to their potential impact on human health. Formaldehyde is often the most abundant aldehyde in the air and also the most studied due to its potential role in allergenic diseases and its carcinogenic properties. The increased prevalence of childhood asthma in the last decades emphasize the eventual impact of outdoor and indoor pollutants. As formaldehyde may contribute to this disease, it is of significant importance to be able to quantify this molecule in indoor and outdoor ambient air. In this work, we describe the developments and the results obtained by three different systems: an Automatic Gas 2D-chromatograph equipped with a thermodesorption unit and flame ionization detector (auto-TD-GC-FID), a transportable microdevice based on the derivatization of formaldehyde for continuous fluorimetric detection and a transportable high-performance liquid chromatography (HPLC) system using 2,4-dinitrophenylhydrazine (DNPH) sampling tubes. The auto-TD-GC-FID can continuously quantify formaldehyde from ppb to ppm levels within 15 minutes. The system only requires a power supply and water tank when it is equipped with gas generators. The transportable microdevice quantifies formaldehyde without interference down to ppt levels with cycle times ranging from a few minutes to one hour, depending on the required detection limits. The compact and highly portable (4 kg) microdevice permits the accurate monitoring of formaldehyde concentrations over a long period of time without a power supply. This transportable HPLC-DNPH system (two suitcases of less than 18 kg), is designed to satisfy the requirements of the conventional reference method ISO16000-3, based on sampling with active DNPH tubes. This method allows for the quantification of aldehydes down to low ppt levels.

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