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Active real-time analyzers *vs*. passive/diffusive samplers for hydrogen sulfide (H_2S) in air: a critical comparison

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Hydrogen sulfide (H_2S) is a gas pollutant discharged in air from a large number of natural and anthropogenic sources. Its peculiar rotten-egg smell, causing odor nuisance to neighboring communities, is detectable at concentrations between 0.7 and 42 μg/m^3 (Schiffman & Williams, 2005). High H_2S concentrations could cause eye irritation, damage to the upper respiratory apparatus and loss of smell. The effects of long-term low level (< 2,800 μg/m^3) exposures to H_2S are still matter of debate (Bates et al., 2013). Hence, the development of techniques for accurate measurements of H_2S in air at a wide range of concentrations is a primary issue in environmental monitoring. Two different approaches are currently used: 1) passive samplers and 2) real-time measurements. The latter are generally expensive and require a power supply. On the contrary, passive samplers are low cost and can be deployed in the field with minimal maintenance. Therefore, passive samplers offer an appealing alternative to real-time measurements, especially for regional-scale monitoring. However, the reliability of passive samplers in outdoor applications strongly depends on several environmental factors, such as temperature, humidity and wind speed (Delgado-Saborit & Esteve-Cano, 2006). In this study a comparison between H_2S measurements using diffusive radial-type passive samplers (Radiello) and a real-time gas analyzer (Thermo Scientific Model 450i) based on pulsed fluorescence, is presented. The measurements were carried out in areas affected by both anthropogenic and natural sources using both techniques. The results show substantial differences. The passive samplers systematically produce higher H_2S concentrations than those of the active analyzer. The relative error was up to > 1,000% for concentrations < 7 μg/m^3 and exposure duration ≥ 2 hours. H_2S measurements by Radiello were affected by meteo parameters (wind, rain, humidity, temperature). The efficiency of this method was demonstrated to be also strongly dependent on H_2S concentrations. In addition, passive samplers give an average concentration value for the exposure period, but are not able to detect short-term H_2S increments. These results show that the use of passive samplers for environmental monitoring should thus be limited to preliminary large-scale semi-quantitative assessment. A reliable study on the dispersion dynamics of contaminants in air cannot exclude the acquisition of high-frequency data through active analyzers.

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