

## SOLID-PHASE MICROEXTRACTION (SPME) FOR THE ANALYSIS AND THE IDENTIFICATION OF VOC SOURCES IN INDOOR AIR.

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Recently, indoor air quality has been suspected to be a possible cause of non specific medical disorders (headaches, nausea,...) observed in french schools. The few French studies undertaken on the subject have highlighted considerable levels of indoor pollutant concentrations in the schools investigated. It can be also pointed out that contrary to the biological agents, chemical pollution, including Volatile Organic Compounds (VOC), definitely is studied. The concentrations measured are in the  $\mu\text{g.m}^{-3}$  order and were shown to be similar than those observed in residential buildings [1-4].

For the individual analysis of VOCs in indoor atmospheres, classical methods involve sampling on an adsorbent bed [5-7] generally followed by thermal desorption on line with gas chromatography (GC). As these techniques require the use of specific and expensive analytical equipments (*i.e.* automated thermal desorber), Solid-Phase Microextraction (SPME) [8-11] was studied as an alternative method. The interest of this sampling tool consists of its easiness of use and its direct thermal desorption in classic split/splitless GC injection port. In a previous work [12], it was shown that the adsorptive PDMS (polydimethylsiloxane)/Carboxen fibre was the most effective for extraction of VOCs at trace levels. However, competitive adsorptions, leading to inaccurate quantification, were observed [13,14]. To overcome this drawback, two analytical methodologies were developed in our laboratory to determine co-adsorption conditions of VOCs on adsorptive coatings [13,15,16]. They involve respectively non-equilibrium and equilibrium static extraction. For the first approach, the co-adsorption domain for which a reliable quantification would be possible was determined by using the first order Fick's diffusion law. An advantage of this analytical procedure is that the analyst can select the extraction time according to the concentration range studied. This methodology was applied to the static analysis of air samples previously enclosed in 1L glass bulb. The second approach envisaged for the quantitative analysis of VOCs with PDMS/Car fibre was based on static extraction at adsorption equilibrium [15]. Adsorption kinetics were used to determine the equilibrium adsorption times for different sample volumes: 3 h extraction in a 250 mL glass bulb was selected as the best compromise between the sensitivity required and the extraction duration. The limits of detection (LOD) for GC/MS analysis are below  $0.5 \mu\text{g.m}^{-3}$ . For the non-equilibrium method, LOD are higher (about  $2 \mu\text{g m}^{-3}$ ), but the sampling time is considerably lower (4 min).

For both methodologies, co-adsorption conditions were determined for isolated model compounds and compounds in mixture and GC/MS performance will be described in the following.

Advantages and drawbacks of these two SPME methods will be discussed through a floor cleaning application. The most sensitive method will then be applied to the measurement of background levels of VOCs in different classrooms of two nursery schools built according to classical rules of design and to the "HQE" (High Environmental Quality) approach.