

# Quantification of volatile organics silicon compounds (VOCSi) in different atmospheres by TD-GC-MS

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## Introduction

Nowadays VOCSi (volatile organic silicon compounds) are widely used in many consumer products: in cosmetic products (fragrances, skin lotion etc), in packaging, in painting, in adhesive etc. These compounds can be found therefore in ambient air in houses and also next to industrial sites. Moreover, they are present in biogas: gas produced by waste fermentation. This biogas can be used for the production of thermal or electrical energy, however during the biogas combustion, VOCSi are converted in crystalline silica causing damages to engines.

Therefore, it is necessary to have a reliable analytical method for the concentration measurement of VOCSi which can be found at trace level in air.

The sampling consists in VOCSi preconcentration on appropriated solids sorbents contained in a stainless steel tube. The trapped pollutants are thermally desorbed using a thermal desorption apparatus directly coupled to a gas chromatograph with mass spectrometry detection (TD-GC-MS).

## Material and method

The studied VOCSi were linear siloxanes (L2, L3, L4, L5) and cyclic siloxanes (D3, D4, D5, D6)

Several sorbents were tested: Tenax TA, Chromosorb 106, association of graphitized carbon with carbon molecular sieve. Samplings were performed using a pump with controlled flow (SKC pump). The analytical instrument is a Markes thermodesorber coupled with an Agilent GC-MS.

Primary desorption conditions: Desorption time: 10 min; desorption temperature: 280°C (except for chromosorb 106: 230°C), desorb flow: 10 mL min<sup>-1</sup>; Trap temperature: -10°C

Secondary desorption conditions: Trap desorption temperature: 300 °C; Desorption time: 3 min; Desorb flow: 40 mL min<sup>-1</sup>.

GC method: capillary column: Select silane (60 m; 0.320 mm; 1.80 µm), constant flow: 1.4 mL min<sup>-1</sup>, Oven temperature: 50°C (5 min), 10°C.min<sup>-1</sup> to 220°C (1 min).

## Results and discussion

Samples of air were collected in an industrial area next to a treatment plant and a silicone factory. Sampling was done during one hour at 30 mL min<sup>-1</sup>. During this field campaign, adsorption capacities of the sorbents were compared, several sorbents were tested in particular Tenax TA and the association with Carbotrap C, Carbotrap and Carboxen 1000 (called C1000 cartridge). An example of the obtained chromatogram is shown in Figure 1. Daily evolution of the concentrations of VOCSi is presented in Figure 2. The main VOCSi identified in this site are D3, D4 and D5. Their concentrations are much higher than those reported in the literature by Michael and al. (2009), measured on a rural site. On this industrial area, the concentrations of VOCSi are also much higher than those of classical pollutants like toluene, which confirms the presence of a local source of siloxanes pollutants.

Figure 1: Chromatogram after desorption of a cartridge C1000 (industrial area sampling)

Figure 2: Histograms showing concentrations of VOCSi during one day of sampling on adsorbent C1000

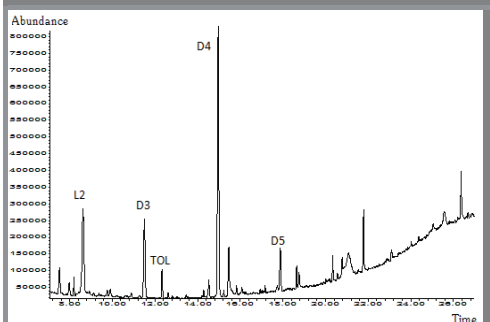


Figure 1

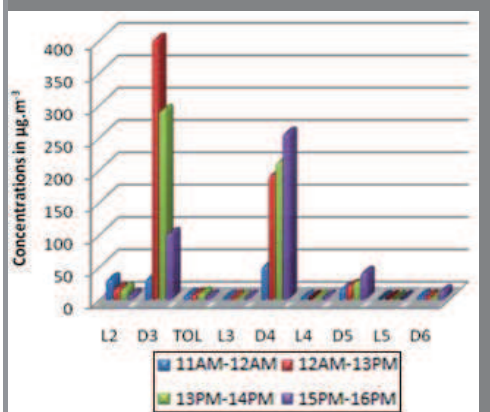


Figure 2

## Conclusion

This field campaign confirms the presence of VOCSi in ambient air. Due to the presence of VOCSi in many consumer products, it would be interesting to determine the siloxanes concentrations in indoor air (bathroom, living-room, offices etc).



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