# PARTITIONING BEHAVIOR OF VOCS BETWEEN DUST AND AIR

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Intensive agricultural activities are the source of multiple air pollutants including inorganic gases ($NH_3$), volatile organic compounds (VOCs) and airborne particulate matter (PM). Next to their effects on the acidification ($NH_3$) of the environment, local residents can suffer from severe odour nuisance caused by these emissions, particularly in areas with high population densities. Odorous compounds are not only present in the free gas phase but undergo a partitioning between the gas phase and particulate matter making particles possible odour carriers. This partitioning behaviour has been scarcely investigated. Therefore, in order to investigate this partitioning behaviour, an advanced analytical method was developed using selected ion flow tube mass spectrometry (SIFT-MS).

Selected Ion Flow Tube Mass Spectrometry or SIFT-MS is a relatively new analytical technique for the real-time measurement of trace-gases and Volatile Organic Compounds (VOCs) concentrations. With this technique, target molecules are ionized by chemical ionization using $H_3O^+$, $NO^+$ and $O_2^+$ precursor ions, produced by a microwave discharge source. Product ions and unreacted precursor ions are formed and are analyzed by a downstream quadrupole mass filter. Concentrations of the target compounds can be calculated using the reaction rate constants, and detection limits in the order of 1 ppb can be obtained. The SIFT-MS real-time measurement offers unique and new opportunities to characterize materials and to study the interaction of VOCs with materials.

The developed method was used to determine the particle-to-air partitioning coefficients of 4 important organic odorants (acetic acid, butanoic acid, phenol and dimethyl disulphide) having different physical chemical properties. The method makes use of inverse frontal chromatography. The column is packed with the material under study. In this case, particles with an aerodynamic diameter less than 10 µm ($PM_{10}$), collected from a pig stable using high volume sampling (PM10 head, 500L/min, several days of sampling). A constant air stream with a constant VOC concentration (containing the target compounds) was generated in a home-made system and was injected as a step function onto the chromatographic column. The response of the step experiment was monitored by the SIFT-MS and resulted in breakthrough curves. From these registered breakthrough curves, dimensionless particle-to-air partitioning coefficients can be calculated. They ranged from $13 \times 10^3 \pm 3.1 \times 10^3$ for dimethyl disulphide to $16 \times 10^5 \pm 1.7 \times 10^5$ for phenol. Partitioning coefficients can be estimated using octanol-air partitioning coefficients available from the literature ($r^2 = 0.94$). The results show that particles were enriched in VOC but the fraction of sorbed volatiles was low (<0.11%) at a $PM_{10}$ concentration of 1 mg $m^{-3}$.