

Highlights of Analytical Sciences in Switzerland

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Volatile Sulphur Compounds in Cheeses – An Odorous Analytical Challenge

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Cheese flavour is mainly the result of bacterial metabolic activities. Not only the starter culture, but also the non-starter lactic acid bacteria used to manufacture cheeses contribute to flavour formation, and cheese flavour is primarily determined by degradation of proteins to peptides and free amino acids, degradation of milk fat, and degradation of lactate and citrate.

Volatile sulphur compounds (VSCs) contribute essentially to the characteristic flavour of many foods, and in numerous cheeses, VSCs such as methanethiol, hydrogen sulphide, and methylsulphides (which are mainly derived from the decomposition of the sulphur-containing amino acids cysteine and methionine) are amongst the key flavour compounds. Due to their frequent low odour thresholds, their presence and sensory properties can significantly influence cheese flavour even when present at low quantities. As a consequence, a variation in VSC concentration can profoundly change cheese flavour. Since VSCs are highly volatile and reactive compounds, their analysis, mostly by gas chromatography (GC), remains an analytical challenge. Carefully chosen and state-of-the-art analytical tools in sampling, extraction, analysis and detection are needed.

In addition to universal physical detectors such as the mass selective detector (MSD) which allow the structural identification of chemicals, specific detectors targeting heteroatomic compounds are used to increase sensitivity. Pulsed-flame photometric detection (GC/PFPD) can be used for the detection of sulphur and various other heteroatoms; the detection being based on the combustion of compounds eluting from the GC in a hydrogen-rich flame leading to the generation of excited species and consequently photomultiplied light emission (sulphur emission wavelength: 393 nm).

Samples of different cheese varieties produced in Switzerland were analysed by GC-MSD/PFPD, and VSC profiles were found to be very different. Extraction of VSCs was done by headspace solid-phase microextraction where volatile compounds from the gaseous space above the sample in a closed vial are ab- and/or adsorbed on a polymer matrix and thermally desorbed into the GC.

GC-MSD/PFPD allows the efficient and reliable analysis of volatile sulphur compounds which are often present in very low concentrations and nevertheless influence cheese flavour due to their low sensory thresholds.

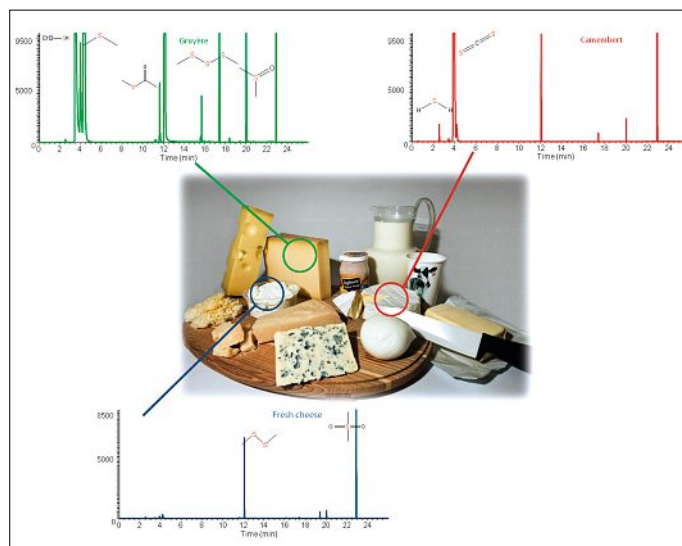
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Reference

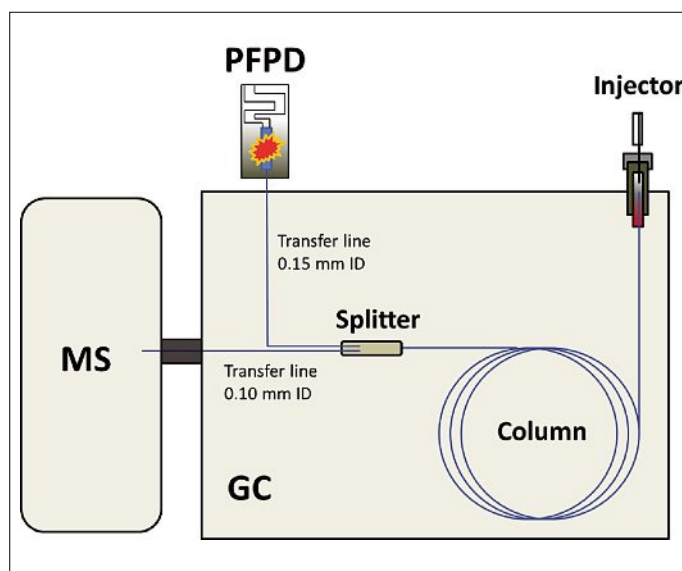
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Pulsed-flame photometric detector sulphur-specific trace comparison between three different cheeses produced in Switzerland: Gruyère, Camembert, and fresh cheese.



The GC-MS/PFPD experimental setup used at Agroscope's flavour analytical laboratory in Bern: A GC (Thermo Finnigan Trace GC) is equipped with a mass spectrometer (Thermo Scientific DSQ II Single Quadrupole) and a PFPD (O.I. Analytical, detector model 5380) to simultaneously measure the MS trace and the sulphur-specific response chromatogram.