# BOOK OF ABSTRACTS

## 11th International Symposium on
# RECENT ADVANCES IN FOOD ANALYSIS

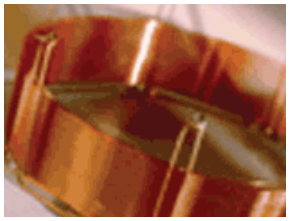
**November 5–8, 2024**

**Prague, Czech Republic**

Jana Pulkrabová, Monika Tomaniová, Stefan van Leeuwen, Michele Suman, Michel Nielen and Jana Hajšlová

Editors



UNIVERSITY OF CHEMISTRY AND TECHNOLOGY PRAGUE

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## R6
# COMPUTER VISION HIGHLIGHTS QUALITY TRAITS IN ARTISANAL CHEESE: INVESTIGATING VALCASOTTO CHEESE BY COMPREHENSIVE TWO-DIMENSIONAL GAS CHROMATOGRAPHY AND QUANTITATIVE VOLATILOMICS

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Today, assessing the quality of food products is vital for consumer satisfaction and safety. Food quality is a multifaceted concept, influenced by numerous factors, which makes its evaluation complex. Conventional analytical methods often lack the ability to fully provide a comprehensive and objective understanding of the molecular and biochemical complexities underlying food quality, especially in complex matrices like cheese. This study employs advanced analytical techniques combined to Artificial Intelligence tools (i.e., Computer Vision - CV) to highlight molecular interactions along with artisanal cheese ripening in cellars. The research emphasizes the benefits of using comprehensive two-dimensional gas chromatography coupled with parallel detection by mass spectrometry and flame ionization detector (GC×GC-MS/FID) over conventional one-dimensional GC. The superior chromatographic resolution and sensitivity enables accurate quantification of a large set of analytes by exploiting the FID predicted relative response factor concept. Moreover, by image patter recognition algorithms that track and align features over many patterns, CV could be featured providing a prompt evidence of compositional differences among samples classes. Valcasotto cheese was taken as a reference for artisanal production within the concept of Prodotto Agroalimentare Tradizionale - Traditional Food Product. The sampling, covering the entire production chain, included milk from two farms and harvest seasons (early spring and summer), and corresponding curds further ripened in two different locations (*i.e.*, controlled ambient at 4°C and Valcasotto caves) for 30, 90 and 120 days. By multiple headspace solid phase microextraction (MHS-SPME), we optimized the capture of a broad range of volatiles and semi-volatiles developed along the cheese making process. Moreover, by quantitative volatilomics marker volatiles and impactful odorants – including key-aroma compounds, were precisely tracked across samples facilitating the identification of markers qualifying the unique yet distinctive traits of the artisanal production of Valcasotto. Of the most informative analytes, highlighted by CV on image classes (milk *vs.* curd *vs.* T30 *vs.* T60 *vs.* T120 days ripened cheese), acetoin, phenylethylalcohol, 1,8-cineole; limonene, γ-terpinene, and terpineol characterize curd volatilome and concur in the aroma traits of this semi-finished product. 1-Octanol, 1-octen-3-ol, δ-decalacton, ethyl-3-methyl butanoate, and ethyl hexanoate had meaningful variations at early ripening stages in traditional caves *vs.* controls. At the latest stage, when Valcasotto cheese is ready for marketing, sulfur derivatives (dimethyl sulfone, dimethyl sulfide, dimethyl sulfoxide), short chain fatty acids (butanoic acid, 2-methyl butanoic, and propionic acid) and methyl ketones formed by β-oxidases (2-nonanone, and 2-heptanone) dominate likely imparting characteristic aroma traits of musty, cabbage, and rancid notes.

**Keywords:** cheese, computer vision, food analysis, comprehensive two-dimensional gas chromatography, mass spectrometry