Detection and Identification of Flavour Compounds from Amino Acid-Carbonyl Compound Interactions in Model and Real Food Systems

Vaida Kitrytė
Kaunas University of Technology
Lithuania

Amino acid-carbonyl compound interactions in foods

- Parallel fundamental 'three-step' reaction mechanisms
- Common low molecular weight volatile, semi-volatile and non-volatile intermediates
- Parallel polymerization mechanisms
- Highly coloured melanoidin-like polycondensation reaction products

Scheme 1. Current view of the nonenzymatic browning in foods

Volatile compounds from amino acid-carbonyl compound interactions

- Aldehydes
- Ketones
- Carboxylic acids
- Esters

Scheme 2. Analysis of the various model reaction products from amino acid-carbonyl compound interactions
Volatile compounds from amino acid-carbonyl compound interactions

Volatile nitrogen-containing heterocyclic compounds

- Pyridines
- Pyrazines
- Pyrroles
- Quinolines

Volatile compounds from amino acid-carbonyl compound interactions

Volatile oxygen-containing heterocyclic compounds

- Furans
- Pyrans

Volatile profile of thermally-processed food products, e.g. coffee, barley, potatoes, some sorts of cheeses, and meats

- Pleasant aromas, e.g. sweet, roasted nutty, cracker, bread, caramel-type, cracker-type, etc.
- Less desirable flavours, e.g. green, bitter, astringent, burnt, vegetable pungent, phenolic, fatty, tailowy, waxy, oily, roasted, rancid, etc.
- Low to very low odour thresholds, e.g. α-acetyl-N-heterocycles (2-acetyl-1H-pyrrole, >2000 ng/L air; roasty cracker-like aroma)
- Colour formation in heated foods
- Extraordinary polycondensation activity

SPME-GC-MS analysis

- Sensitive (detection limits – up to ppt levels for a certain compounds)
- Reproducible
- Solvent-free
- Cost-efficient
- Extraction, concentration, and sample introduction in a single step
**SPME-GC-MS analysis**

- The polarity and thickness of the coating on the fiber
- Sampling time and temperature
- Time between extraction and analysis
- Sample and headspace volume
- Sample agitation
- Sample matrix effects
- Analyte loss
- Geometry and condition of injector
- Temperature at the injection port
- Parameters and condition of column
- Carrier gas
- Oven temperature
- Stability of the detector response, etc.

**Analysis and interpretation of data obtained**

- The complexity of the mass spectra
- ‘Shape’ and resolution of spectral peaks
- Detection of minor compounds

---

**Figure 1.** Mass spectra, obtained after thermal degradation and SPME-GC-MS analysis of water-soluble and non-soluble reaction products from glycine/hexanal/D(+)-glucose model system (125°C, 120 min).

Thank you for the attention!