ON-LINE ANALYSIS – MONITORING DYNAMIC FLAVOR RELEASE PROCESSES

The flavor of a food reflects the constituent aroma compounds that are released during food preparation and consumption. Because these processes occur on relatively short time-scales, studies on flavor development and release – and to a certain extent on food quality – can greatly benefit from real-time monitoring of these volatile compounds. Proton-transfer-reaction mass spectrometry (PTR-MS) is a cutting-edge technique that allows aromas to be detected with a high temporal resolution and down to exceedingly low concentrations. PTR-MS technology has been successfully implemented for diverse applications in food development, packaging and food quality for almost two decades. With this tool, emerging questions in food and flavor science, food quality and packaging can be addressed by innovative research design.

Expertise

The Department of Sensory Analytics has extensive experience in the area of on-line monitoring of volatile compounds using PTR-MS technology. The PTR-MS instrument enables the instantaneous detection and quantitation of multiple volatiles in air. The rapid response time of within a fraction of a second and a detection limit down to part-per-trillion levels (ppt, equivalent to µg m⁻³) make it the ideal tool for following rapid changes in gas samples without the need for sample pre-concentration or separation.
In vivo studies

Flavor compounds are released from food during mastication and enter the nasal cavity via the retronasal pathway. Depending on their chemical properties and interaction processes along this route, compounds reach the olfactory receptors at varying times and intensities. Due to interactions between sensory modalities such as taste, odor and texture, the abundances of aroma molecules in the nose do not necessarily reflect perceived intensities. Thus, direct measurements are necessary to produce an accurate picture of aroma compound release during mastication. PTR-MS is the ideal technique for monitoring in vivo release of food aroma compounds during mastication in a non-invasive fashion, e.g. via nose-space (exhaled nasal breath) analysis.

In vitro analysis

The PTR-MS technique is readily implementable to in vitro analyses of dynamic processes such as food aroma release and characterization of migration of volatiles through packaging materials. These applications represent a quick assessment method for food aroma stability or detection of food spoilage that might occur during production, packaging, or storage. Food quality can be thus assessed based on the presence or absence of desired/undesired volatile constituents.

The benefits to you

- We have extensive PTR-MS experience and in-depth knowledge on achieving optimum detection for trace compounds
- Our laboratory is equipped with state-of-the-art PTR-MS instrumentation
- You have access to a team with expertise in developing novel methods and specialized testing procedures
- We are proficient at implementing PTR-MS for in vivo as well as in vitro studies
- Our team works inter-departmentally within Fraunhofer IVV as well as with different institutes throughout the extensive Fraunhofer network, offering an excellent source of inter-disciplinary expertise. This is reinforced by our close ties with universities and companies

What we offer

We have broad knowledge of PTR-MS technology and have the expertise to develop customized assessment methods specifically suited to your needs, for instance:

- **Optimization of a product** by adding or replacing specific aroma ingredients
- **Characterizing** the different release patterns of encapsulated flavors in contrast to non-encapsulated aroma addition
- **Detection of volatile compound migration** through layers of packaging materials
- **Monitoring the temporal release** of flavor compounds from virtually any food matrix
- **Control of ripening processes** or detection of the formation of oxidation products in real time during food processing
- We are continually updating and refining our expertise and constantly aligning ourselves to the latest technological developments such as the deployment of PTR-Time of Flight-MS (PTR-TOF), high temperature PTR-MS, and liquid and gas calibration units

**Dynamic in vivo flavor release from an aromatized protein foam**

1. In vivo release profiles of sweets using PTR-MS.
2. Discussing the comprehensive PTR-TOF-MS mass spectrum.