

InsideFood: Integrated sensing and imaging devices for designing, monitoring and controlling microstructure of foods.



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Aims. The new EU FP7 project (2009-2013), with the acronym *InsideFood* ('Integrated sensing and imaging devices for designing, monitoring and controlling microstructure of foods') aims at developing novel instruments and software for inspecting food microstructure. Applying them will improve our understanding of process-structure-property relationships through advanced mathematical models, even allowing us to predict physical properties of foods from microstructure and –composition. Food microstructure-related features of interest include: susceptibility of apple fruit for senescent breakdown, bitter pit, core browning and watercore; wax development and skin quality of apple; evolution of microstructure and texture and functional quality during processing of osmo-air-dried foods and vegetables; the effect of formulation and processing on microstructure and texture quality of crispy bread and breakfast cereals. Finally the innovative sensor technologies will be implemented for optimization and control of food processing, on-line non-destructive quality assessment and development of novel food products.

Method. In the framework of *InsideFood*, we will focus on both food model systems (multiphase gels, foams) as well as actual foods (cereal products, fresh and dried fruit) being exposed to several processing and storage treatments. Further, we will use the following non-invasive sensors for characterising food microstructure:

- *Tomography*: magnetic resonance (micro)imaging (MRI), X-ray nano and micro computed tomography (μ CT), and high-resolution optical coherence tomography (OCT)
- *Spectroscopy*: time and space resolved NIR spectroscopy, NMR spectroscopy and multidimensional relaxation and diffusion methods

Since we are dealing with products of important EU-dimension, and to cover the range of expertise to achieve integration of knowledge and methodologies, an EU-scale approach is necessary. The project will be carried out by an international consortium including 6 research institutes, 4 small or mediumsized enterprises and 2 large companies. The partners of InsideFood are: Katholieke Universiteit Leuven (K.U.Leuven), Belgium; Institute of Food Research (IFR), United Kingdom; Research Center for Non Destructive Testing GmbH (RECENDT), Austria; Politecnico di Milano (PoliMi), Italy; SkyScan NV (SkyScan), Belgium; NESTEC SA (Nestlé), Switzerland

Mercury Computer Systems SAS (MCS), France; Szkoła Główna Gospodarstwa Wiejskiego (SGGW), Poland; Flanders Centre of Postharvest Technology vzw (VCBT), Belgium; Bruker BioSpin GmbH (Bruker), Germany; Chaber S.A. (Chaber), Poland; Universidad Politécnica de Madrid (UPM), Spain.

Expected results. Technology development will be executed in 4 main work packages, each contributing to the understanding of different aspects of food microstructure. The

research lines are 3-D micro and nano-imaging, measurement of water and solute status on the microscale, microstructural texture properties and finally optical properties. Imaging techniques using X-ray technology at and below a resolution of 1 micrometer of the 1-D, 2-D and 3-D microstructure will play a prominent role in this project.

Microstructure will be related to food quality attributes (texture as measured by compression, penetrometry and acoustic emission, water status, absence of internal defects) and safety aspects (absence of foreign materials) of the selected foods and food model systems. Multivariate data analysis and modelling will lead to the identification of key microstructure features that can be used as quality indicators in the development of online sensors. Moreover, these microstructure sensors will be used to improve nutritional aspects of food through the optimisation of sugar- and gluten-free cereal products.

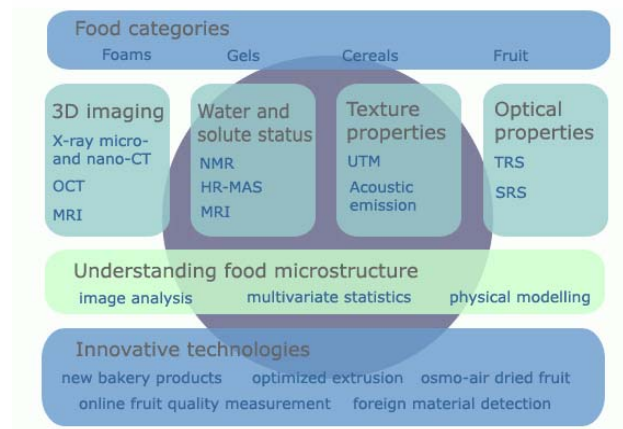


Figure 1: Research and development actions of the *InsideFood* project

Benefits of InsideFood. InsideFood explicitly aims at measuring *food microstructure*, the *spatial distribution of food components within foods*, with state of the art tomographic, spectroscopic and texture measurement techniques including X-ray micro- and nano CT, MRI, OCT, NMR, TRS and SRS, and acoustic emission. *Nutritional quality* (sugar- and gluten-free cereal products), *sensory quality* (texture of all foods) and *safety* (foreign material detection in cereal products) are considered. *Online and inline techniques* including NMR, MRI, TRS, SRS and X-ray imaging to *visualise and monitor structure* will be developed. Measurement at the speed of the food process is targeted thereby being able to use the tools for *dynamic process control*. To this end prototypes are evaluated on process lines and process control is studied at Chaber, Nestlé, VCBT and PoliMi. *Prototypes* will be constructed by K.U.Leuven, IFR, PoliMi, RECENDT and UPM. The consortium includes *food technologists* (K.U.Leuven, IFR, Nestlé, VCBT, Chaber, UPM), *sensor specialists* (K.U.Leuven, IFR, UAR, PoliMi, SkyScan, SGGW, Bruker, UPM), and *IT specialists* (K.U.Leuven, PoliMi, MCS); a *sensor SME* (Skyscan) and a large sensor company (Bruker) are involved. The results are directly to the *benefit of end-users*, including 2 SMEs (VCBT, Chaber) and a large food company (Nestlé).

The results will be distributed by means of newsletters, symposia, a technology trade fair and a stakeholders group. All information can be found on www.insidefood.eu.