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Role for Novel Processing

The NovelQ Project is formulating strategic solutions for technical and basic research hurdles in order to develop and successfully demonstrate novel processing schemes.

by Dr. Huug de Vries

Food that fits into a healthy lifestyle and is manufactured in a bio-based society, constitutes one of the most important social issues. Within this context the need for novel eco-friendly processing schemes to deliver high-quality, healthy and safe foods is being researched in the European project called NovelQ.

Striving for healthy food in a bio-based society is based on the following consumer trends:

- The growth in healthcare costs related to the quality of life: a new balance between curative and preventative health care;
- A rapid growth in obesity;
- Ageing society and related chronic diseases;
- Lifestyle changes towards 'on-the-go';

- Further individualisation and development of products that are geared towards the needs of individuals;

These trends – in combination with the considerations that the potential of using renewable resources is limited, severe changes in climate are foreseen and the economic development in China, India and other emerging countries is fast – require reconsiderations of our food production and consumption patterns. A new balance needs to be reached among the use of renewable resources for food, energy and bio-based products at a global level.

In particular, if one takes into account the market trends, such as:

- Growth in fresh and fresh-like products at the expense of dried products;

- Highest growth in the field of convenience food;
- Increasing diversification of purchase channels;
- Food developments with health-related claims;
- Increase in organic and 'pure & fair' products.

New Demands

New and sustainable food chain schemes, including more environmentally friendly processing, are required.

The following examples can be given: low-energy production chains, extended-Life-Cycle-Assessment schemes for fresh food chains with limited 'footprint', valorisation of residue flows, new packaging concepts, vegetable-based high-protein food products, mild physical instead of chemical preservation, etc.

Ground breaking innovations are also imperative to reach the recommendations of the Health Councils, e.g. in increased consumption of vegetables, high-fibrous foods,

low salt foods, etc.; naturally, without compromising the desired taste, convenience, safety, diversity and a fair price/quality relationship.

Food security in regions with temporary or structurally insufficient amounts of food will also become a priority on the Food Agenda.

Practical, small-scale, flexible and robust production systems need to be developed for these purposes ('fairtrade' and 'pure and fair trend'); even mobile processing systems should be considered.

These trends show that a multi-disciplinary approach is necessary in the food domain. Innovations are expected at the crossroads of product and process development, nutrition, consumer behaviour and the impact of situational factors on the (subconscious) choice, and the eating and drinking behaviour.

This will have a positive impact on the R&D intensity in the food sector, being the lowest one in 15 calculated industrial sectors in Europe (IPTS 2005).

The NovelQ Approach

Since March 1, 2006, thirty six project partners have joined the EU-funded project NovelQ.

The overall objective of this trans-national, inter-sectorial Integrated Project 'novel processing methods for the



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production and distribution of high-quality and safe foods' is to formulate strategic solutions for technical and basic research hurdles in order to develop and successfully demonstrate novel processing schemes.

The exploitation of potentially unique novel processing characteristics will improve quality, facilitate (incremental) innovation and further increase the added value of the EU food sector through:

- Substantially extending shelf-life [without compromising safety] of, especially, fresh-like convenience foods of plant origin.

This is quite often the limiting factor in maintaining the shelf-life of prepared whole meals. Solving this problem will help to maintain the value (quality and export) of regional recipes;

- Responding to the demands of consumers for food with fresh characteristics similar to those of the raw material (taste, aroma, texture, healthy ingredients);

- Responding to the demands of consumers for foods that contribute to individual health and well-being. Such foods will help to lower the levels of diet-related diseases and reduce associated health and social costs across the European Union;

- Enhancing eco-friendly innovative processing, as a direct consequence of reducing:

- Current wastage of fresh produce via extended shelf-life,

- Energy inputs, via low-temperature and low-energy processing,

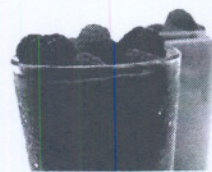
- Usage of water and chemicals, via applications of new hygiene approaches, and

- Migration problems and packaging materials; via e.g. in-pack processing (thereby avoiding need for repackaging).

Novel Achievements

In order to reach these goals, the following novel – often non-thermal – technologies are researched for plant-based products, both solid and liquids, including carrot, tomato, strawberry, apple and broccoli. These commodities have been selected because they integrate food structure issues, colour and flavour-related aspects, health-related components, including allergens and food safety issues. However, the anticipated results will have broad applicability to other type of products, to the level of whole meals – including regional recipes that are typical of the rich and diverse European cuisine.

“High pressure processing research has been starting from a rather mature level with regards to both food science and equipment geared towards mild pasteurisation processes at pressures between 400-600 MPa”.



High Pressure: In this project, high pressure processing (HPP) research has been starting from a rather mature level with regards to both food science and equipment developments geared towards mild pasteurisation processes at pressures between 400-600 MPa. Several pasteurised products are already on the market, such as convenience meals, juices and smoothies, tapas, ham, etc. These are produced by food manufacturers and equipment suppliers who are members of the NovelQ Industry Advisory Platform.

The scientists within NovelQ have extended the current state-of-the-art towards an integrated modelling approach including safety, quality, shelf-life, high pressure vessel and packaging

aspects to provide a sound science base for the applicators. In parallel, sterilisation processes are researched to produce shelf-stable foods with fresh-like characteristics, co-ordinated by KU Leuven. Here, the challenges are much higher because of combined homogeneously pre-heating and pressurisation in large scale vessels at minute time scales. Moreover, novel packaging materials had to be developed that would withstand fast build-up of pressures up to 600 MPa and, concomitantly, temperatures above 100°C.

Pulsed Electric Field: Pulsed electric field (PEF) research has been starting from a semi-ma-

ture level both in food science as well as equipment developments. There has been a clear need for further understanding of safety and quality related aspects for food matrices as well as food-electrode reactions. Also, several applications for PEF are currently addressed including stress induced production and controlled release of phenolic compounds in juice (TU Berlin).

The research is further directed towards new treatment chamber designs, cost-effectiveness and environmental impact.

The latter is substantially less than traditional processing due to the relatively low treatment temperature and ultra short treatment time [private communications with Ir. H. Lelieveld, former president of

the European Federation of Food Science and Technology (EFFoST)].

Cold Plasma: Cold plasma treatment has been starting from an immature food science basis, with many unknowns in terms of effects on safety and quality aspects.

Examination of cold plasma as a means for decontamination of (packaging and food) surfaces has been started with the development of small-scale equipment to be used in the basic research part of NovelQ to evaluate the effects on material properties. A plasma demonstrator has been developed for lab-scale experiments showing no negative effects on packaging materials, while first indications for microbial inactivation could be observed.

Advanced Heating Technologies: Ohmic heating, microwave and radio frequency technologies have been researched and demonstrated since the scientific base is sound. Their potential application is mainly due to the option of volumetrically heating products; the treatment time is substantially reduced in comparison with traditional surface heating (e.g. boiling processes).

Full-scale integration in processing lines is actually focused on; this includes research on hygienic design, eco-friendliness and process efficiency. First results are obtained for ready-to-eat meals based on new numerical modelling tools for microwave tempering, defrosting, and heating. A computerised demonstration tool is available for the food industry, helping to design food recipes especially prepared for microwave or ohmic heating (SIK-Gothenburg, Sweden and CTCPA-Avignon, France).

Packaging: Within NovelQ, basic and applied issues in the area of material science have been integrated with concepts of bioactive, smart, biodegradable and eco-friendly packaging, as well as coatings, in order to fully understand and predict interactions between materials, products and processes.

Here, migration and scalping phenomena have been a key target for applying novel processes, taking into consideration the requirements as stated by the European Food Safety Authority (work carried out by the University of Montpellier II).

Based on these results, the Italian packaging company Icimendue is researching options for novel, biodegradable, packaging materials in one of the demonstration activities in NovelQ.

Consumer Perception

A major success factor or bottleneck is the perception of consumers towards novel technologies and the food

produced by using these technologies.

The following positive attributes have been mentioned: environmental friendly, no preservatives, natural, improved taste and health and innovation.

The negative aspects are: higher price, longer shelf-life, lack of information and general scepticism towards new technologies and food producers.

More information on HPP & PEF can be found in the scientific journal *Appetite*, Feb. 2009 ('*Consumer perception of the use of high-pressure processing and pulsed electric field technologies in food production*').

Supporting Exploitation

The Industry Advisory Platform (IAP) has been established to ensure the most effective transfer of demonstrated novel processing technologies to potential users and to ensure that NovelQ will focus on topics relevant for the stakeholders.

The IAP exploits and promotes results and identifies bottlenecks to be examined in the project and its spin-off projects.

Based on the input of the IAP members, three new demonstration projects have been initiated in the area of high pressure pasteurisation for fruit-vegetable products, development of novel packaging materials for high pressure sterilisation and cold plasma disinfection of surfaces of plant-based materials.

Within NovelQ, over ten new short-term demonstration activities are scheduled for the second half of 2009 and 2010 with more than 10 companies (all IAP members) involved. Best practices are continuously disseminated via established networks such as the European Federation for Food Science and Technology, Industry and non-profit organisations.

At the moment, the Industry Advisory Platform has more than 70 members. The members are from SME, multinationals, industrial network organisations and other international organisations that interested in novel processing.

The companies in the cross-sector-platform are either active as food manufacturers, food machinery equipment suppliers or packaging firms. The Platform is continuously open to new interested parties, willing to actively participate in the IAP of NovelQ.

Other European Projects

In 6th and 7th Framework Programmes from Directorate General Research of the European Commission, several other public-private research oriented projects are carried out:

- HighQ Ready-to-eat meals (e.g. high pressure homogenization): www.highqrte.eu
- Double Fresh meals: high

pressure and packaging: www.doublefresh.eu

- Healthy Structuring of raw materials with NP: www.sik.se/hstructuring
- Bake-off Bread: new heating profiles: eu-freshbake.eu
- Rescape: on plasma disinfection: www.rescape-project.eu

In the past years, the Heatox project on acrylamide and processing and the Safe-ICE (high pressure processing + low temperature) are worth mentioning.

Finally, the newly subsidised concerted support action 'Agrifoodresults' provides an excellent overview of 19 EU projects, including several in the novel processing domain (www.agrifoodresults.eu).

In Conclusion

Within NovelQ, research and development takes place in a number of areas such as consumer sciences, nutritional sciences, food technology, food sciences and underlying natural sciences (chemistry, physics, biology, mathematics).

The joint involvement of senior scientists in basic science, applied research and implementation of research results is imperative to reach the ambitious goal of producing healthy foods in a bio-based society.

Even more, the training of young scientists – being involved in the Training and Career Development (TCD) Network of NovelQ – is crucial to reach breakthrough novel processing innovations in the future as well.

At the pre-EFFoST-conference day in Budapest on November 10, the TCD members will present their latest NovelQ findings. ♦

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Dutch PEF pilot plant at the Spanish juice processing company Indulleida.