High Pressure Processing

NovelQ is an EU-funded Integrated Project stimulating innovation in novel food processing and packaging (FOOD-CT-2005-015710). Since 2006, 36 research organisations and universities have joined forces to explore novel food processing techniques and understanding more about the public perception new technologies in food manufacturing. Efforts have focussed on high pressure processing (HPP) for sterilisation (e.g. apple juice), the effects of pulsed electrical fields (PEF) on food pathogens, cold plasma as a surface disinfectant and new packaging. Fruits and vegetables (e.g. carrots, tomatoes, strawberries, apples and broccoli) have been used as test foods because they present particular problems with respect to texture, colour and flavour, food safety and potential health benefits. The results, however, are applicable to many food products including whole meals.

Background

Consumer preferences have shifted towards fresh, healthy, tasty foods, which are readily accessible, easily stored and quickly prepared. Providing such foods in a form suitable for mass production and distribution, which will store as readily at home as in the supermarket, without affecting flavour, texture and colour, is technically difficult and expensive. The majority of European food manufacturers are small companies with few resources and limited expertise to develop and implement new technologies. The advantages and disadvantages as well as the technical problems and potential risks associated with new technologies are often more complicated than first imagines. This business case, describing high pressure processing (HPP), considers some important issues and serves as a basis for discussion.

What is high pressure processing?

HPP allows food processing at room temperature or higher, and enables pressure to be transmitted instantly throughout the system, irrespective of size and shape. It kills bacteria and almost eliminates heat damage and the use of chemical preservatives/ additives, improving the overall quality of products. Application of HPP can create ingredients with novel functional properties and allow the use of ingredients that would be destroyed by conventional heat transfer methods (i.e. oven and hob).

What are the problems?

HPP sterilisation and pasteurisation are relatively expensive compared with traditional heat transfer method, and to achieve the pressures necessary, processing must be done in a sealed, pressured vessel. Semi-continuous processing can only be achieved with several vessels in the production line. The use of novel processing technologies in food production is closely monitored and further research, on the effects of HPP and consumer perception, is necessary for proper control (legislation) with respect to food safety (microorganisms), food composition and its interaction with packaging. The quality and supply of raw materials may also require different approaches or suppliers to existing heat transfer methods.

What are the advantages?

HPP at 500-700 MPa allows product modification such as starch gelatinisation, gel formation including jams, and tenderisation of meat and fish. However, the precise uses of HPP depend on the pressures and temperature selected.

HP pasteurisation at room temperature and 200-600 MPa, reduces the number of (vegetative) micro-organisms and prevents product spoilage. Treatment times can vary from 1-10 minutes and throughput is 1-2 tonnes per hour. Products can last up to one month in the refrigerator, but additional preservation is necessary for storage at room temperature. HP pasteurised products are available such as guacamole, vegetable-paste meals, fruit salads, juices, salsa, oysters, filets of salmon and tuna, chicken breasts, ham, tapas, rice, sandwich fillings and smoothies.

For HP sterilisation, products are heated to 70-90°C at 800 MPa, and adiabatic heating – without heat transfer – means temperatures rise to 120 °C. Treatment times are generally less than three minutes and shelf-life is extended to months at room temperature. However, only large pilot-scale systems are currently available, and more research is needed to understand the effects of HP sterilisation on food spoilage enzymes and microorganisms including spores.

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