European Trends in Obtaining and Maintaining Food Quality

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ABSTRACT  
Faced with significant changes and mutations at consumer level, the EU food market finds itself in a position in which it has to function by rules that could be considered “non-specific”. From a traditionally inelastic market, it has gradually become a consumer market on which the producers have to innovate constantly in order to meet the demands of consumers who are in search of new foods that would have new properties and would satisfy superior needs. Therefore, innovation in food production is a must for the producers’ survival. The main directions are research & development, preservation and packaging of food.

KEY WORDS  
Consumer, nutrition, medi-foods, light, quality

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1. Introduction

The European trends in food production take a large series of phenomena into consideration. They can be grouped into four fundamental and scientifically and economically significant directions, namely (1) developing quality implementation and monitoring mechanisms; (2) innovation in food industry; (3) developing new agricultural production systems; and (4) renewing the food offer.

The quality implementation and monitoring mechanisms (1) imply especially the implementation of the complete traceability of the agricultural and food products.

Innovation in food industry (2) is a process the most important developments of which are the involvement of research in producing foods and developing new ones, and the use of new methods for preserving, packaging and labeling food products.

The development of new systems of agricultural production (3) includes smart agriculture, bio-agriculture and the use of bio-technologies as its most significant phenomena.

Renewing the offer of food products (4) is characterized by the fact that new categories of goods appear on the market or already existing ones are developed following new demand requirements, including functional foods, dietetic products, GMO-based products, traditional products of regional origin, and last but not least the bio products.

This paper will refer mainly to the innovation trends in food industry, with a special focus on (a) research & development in industrial innovation; (b) new food preservation methods; and (c) trends in food packaging, among a whole series of other trends in these areas.
2. Research & Development in Industrial Innovation

The main trend (Monnier 2007, 51) in this area of EU food industry is the increasing role of the consumer in industrial innovation, especially in new product concept development. To reduce the subsequent risks of the consumers’ food preferences is one of the main concerns of the large food producing companies of the EU when they seek to launch new products. They use marketing for this purpose and the procedure they usually apply has several main stages, namely (Monnier 2007, 51) (1) basic concept testing; (2) prototype development; (3) preliminary testing, and (4) secondary testing.

The basic concept testing (1) is a poll that presents a targeted consumer group with the project of a new product or new product line in an attempt to establish what the consumer might expect from it in point of its objective and subjective features. Generally speaking, this test implies interrogating select groups of consumers who know nothing about the tested product about a series of features that are considered to be more relevant in the subsequent selection and acquisition processes.

Prototype development (2): the information provided by the basic concept testing can help build a prototype of the respective product. This prototype functions as a preliminary blueprint the producers can use to further develop the product.

Preliminary testing (3) is a first organoleptic assessment of the “prototype” product by experts, in laboratory. Marks are given to each main property, which allows experts to define and compare the organoleptic properties.

Secondary testing (4) is a second organoleptic assessment of the product which was modified according to the results of the previous stage. It is conducted among new relatively large select consumer groups. The tendency is to create testing conditions that are as close as possible to real consumption conditions (samples of the tested product are distributed to the consumers who test them at home. The results are gathered one week later.)

Finally, the producer is the one to have the last word by selecting the average sum of the properties of the future product, starting from the results of the last test, hence the tendency for foods to have apparently weak organoleptic features. Thus, without reducing the consumers’ contribution (the selection starts from the values of the properties they provided), the producer eliminates a major source of risk for the product to be rejected as he/she preserves only those features that are likely to accommodate the largest pool of consumers.

2.1. Considering Food Consumption Style

It is a European trend in increasing the weight of consumer influence over the food innovation process and it has not been deemed a priority until recently. (Monnier 2007, 52). Understanding the consumption style means to identify the food habits of various categories of consumers.

2.2. Faster Food Consumption

It is a third European trend and it is closely connected to the current profile of the EU consumer (Monnier 2007, 53). The producers respond to this trend by (1) extending the food validity period (the target is the consumer who purchases food at larger time intervals), (2) reducing the time necessary to prepare the food, (3) eliminating the need to use dishes (by marketing the food in disposable containers) and/or (4) selling food in smaller shares (for individual consumption, regardless of the place and time of consumption).
2.3. Consumer Health Concerns

This phenomenon emerged in the 1980s with the no-sugar and no-alcohol beverages. They were then followed by food with a specific content of minerals of vitamins. Lately, consumers propose ever more often products the ingredients of which could help to prevent diseases, and would have properties that could be used in cures, keep the body fit or even have cosmetic effects.

2.4. Increasing the Consumer’s Possibility to Directly Assess the Properties of the Food Product Based on His/Her Senses Prior to Consumption

This is a fifth important trend and although it is not directly connected to the consumer’s option, it directly influences him/her in selecting food products. This trend leads to the importance packaging has lately acquired as well as that of the correspondence between the expected properties of taste, flavor, smell, and aspect and the color the products or their packaging can have.

2.5. Other Trends

Beside these five trends, we can also add the role of advertising in the communication between producers and consumers. In order to reduce risks, the producers do not directly and clearly advertise the new properties a food product can have lest they create a feeling of rejection. Even in the case of new foods, they still refer to properties and comparisons to properties the consumers know (they even refer to tradition, regional and national particularities, natural aspect etc.) to make the people buy the respective product.

3. New Food Preservation Methods

Fresh food is generally threatened by two main categories of altering factors: microorganisms that degrade the product and the enzymes which accelerate the chemical degradation reactions. The best methods to slow down the action of the latter are refrigeration and rapid freezing (under -18° C), while pasteurization is mainly used to eliminate micro-organisms. As it implies heating the products, its side effect is the modification of taste as the aromatic molecules are sensitive to temperature. In order to solve this shortcoming, producers today use rapid pasteurization to 95–98° C (instead of 80–95° C) in just 10 seconds, followed by an instantaneous cooling of the product. Yet, this method too has a weak point as it cannot be used to disinfect low or no-acid products such as milk and certain vegetables (beans, potatoes etc.) which also contain spores. In their case, the only effective method used to date is sterilization, which has negative effects as a result of high temperature.

In order to remove the faults of the two high temperature-based methods, producers are currently developing and using new methods such as (Constans, Pasteur a trouve ses maitres 2007, 94) high pressure food preservation and pulsed electric field processing.

3.1. High Pressure Food Preservation

It is a method that allows the preservation of fruit and vegetable fresh juices, as well as deli meats, fish and seafood. According to this method, the product to be preserved is first packed in vacuum and then placed into a water-filled container; a pump is used to create a pressure of 2,000 to 6,000 bars, i.e. the same pressure felt at a depth of 20 to 60 km in the ocean. Because pressure
affects the entire product instantaneously, its only modification is a slight change in volume (approximately 15% at 6,000 bars), but it does not lose its shape. Bacteria are completely disabled as the method is based on abiosis.

The foods that cannot be subjected to this method are those that contain air such as bread or the high-acidic ones that cannot be correctly stored in vacuum such as salad or vegetable and fruit mix.

The most important advantages of this method are (1) the complete destruction of micro-organisms by destroying their cell membrane following the crystallization of lipids at room temperature; (2) the preservation of the food’s taste as the fresh ones cannot be told apart from foods thus processed; (3) the preservation of strong chemical bonds as vitamins and aromatic substances are not affected; and (4) the disablement of enzymes in certain situations as some proteins are altered.

As for the minuses, they include first of all the need to fine tune the intensity at which the method is applied as molds are usually easier to remove and most bacteria are killed at pressures exceeding 4,000 bars. On the other hand, micro-organisms such as Listeria (deli meats, cheeses etc.) or sporulating bacteria need a pressure of 6,000 bars. Secondly, the method can cause protein denaturation leading to strange results (hard eggs without boiling) or economically non-beneficial (the meat turns brown thus losing its commercial aspect although the taste is preserved).

Although its principle is not new (it emerged as early as the 19th century), high pressure processing was practically developed in the 1990s once scientists developed containers strong enough to withstand the necessary pressure.

3.2. Pulsed Electric Field Processing

It is a preservation method more recent (Constans, Pasteur a trouve ses maitres 2007, 95) than high pressure processing and relies on the principle that bacteria can be removed by using a high enough voltage. The foods that are to be preserved are processed using an electric field with a voltage of 18,000 to 40,000 volts per centimeter. The exposure to electricity lasts from $1/10^6$ to $1/10^9$ of a second (a longer time risks heating the product). For the time being, the only foods that can be thus processed are homogenous liquids that have no gas bubbles or large particles.

The most important pluses of this method are the complete elimination of micro-organisms as their cell membrane is destroyed (its molecules are tore apart and disorganized in the process), the preservation of taste, the preservation of strong and weak chemical bonds, i.e. a very low protein denaturation.

As for the minuses of the method, it is worth mentioning the need to adjust the pulsed electric field by changing the voltage or the frequency of electric shocks because of the various endurance levels of different micro-organisms, as well as a slight reduction of the vitamin C content.

3.3. Outlook on Use

For all the advantages they have relative to pasteurization, the two methods will not yet replace it in the near future but rather supplement it. As a matter of fact, they can be very well used in combination with it in order to eliminate the micro-organisms and spores that cannot be removed by short-time heating. For instance, pasteurization at 65 – 70°C combined with pulsed
electric field processing for less than a second allows producers to reduce E. coli as 5-minute 75°C pasteurization would do while having much lower effects on taste.

Moreover, these methods remain at the stage of trend due to other – mores significant – obstacles (Constans, Pasteur a trouve ses maitres 2007, 96). First of all, high costs: as they imply the use of new technologies, the implementation and installation costs can sometimes be very high, especially for small and medium sized enterprises (up to € 500,000 per industrial container). Secondly, the crises in the agricultural and food sector have caused producers and sometimes consumers to be reluctant when it comes to new technologies. Last but not least, the EU legislation, through the 1997 “Novel Food” regulation of the European Parliament and European Council, makes it mandatory for producers to apply for and obtain a pre-market authorization if they want to market products that were processed by using whatever new technology. If they use a new procedure, the resulting product must be safe and similar to the one it replaces meaning that its normal consumption does not cause any nutritional inconvenience. These requirements need micro-biological analyses and specific tests especially considering that in the case of high pressure, for instance, although the possibility for this to happen is almost zero, some material may transfer from the packaging structure to that of the product. However, even despite these constraints, the two methods start being used in the European food processing; the number of high pressure installations has risen from 9 in 1996 to 20 today.

We can also mention the increasing development and use of other non-invasive methods that have no side effects on nutritional properties relative to pasteurization and sterilization, such as micro-filtration and irradiation. The latter has similar effects to sterilization and does not damage the nutritional qualities of the products. Nevertheless, it is not yet widely accepted because we are not yet aware of its possible side effects, especially for consumer health.

4. Trends in Food Packaging

One of the main European trends is the active adaptation of packaging to the properties of the food it should protect. It refers especially to fresh product such as fresh fruits and vegetables. The use of traditional air-tight packaging can cause them to alter as the oxygen becomes rarefied; the resulting effect is the same as when fruits or vegetables are not protected and they breathe too rapidly. In order to avoid such effects, a series of adapted packaging methods have already been put in place (Constans, Des produits sous protection rapprochée 2007, 99) such as (1) using CO2-permeable packaging; (2) including oxygen-absorbing substances into the packaging material; (3) using desiccants; and (4) using protection substance-emitting packaging.

Using CO2-permeable packaging (1) is a method that is already used in the fruit and vegetable industrial processing. Breath is slowed down with not physiological damage to the products; research has developed biodegradable packaging made of paper and gluten.

Including oxygen-absorbing substances into the packaging material (2) allows longer shelf life for pastry or some type of deli meats.

Using desiccants (3) stops the growth of micro-organisms or the effects of ethylene – the main factor in the alteration of bananas.

Using ethanol-emitting sachets (4) can help protect rye bread against molds, or packaging containing allyl isothiocyanate (AITC) – a pungent substance found in mustard, it causes the growth of bacteria to stop; or using sulfites that are effective in protecting grapes against molds.
4.1. Going “Smart” in Packaging

It is another trend in packaging (Constans, Des produits sous protection rapprochée 2007, 99). Smart packaging can provide information about the state of the food inside it and can be fitted with freshness indicators—a chemical reaction inside them takes place in the same time with the alteration of the products—or micro-organism development indicators—that contain harmless micro-organisms the development of which provides indications about the development of those that do affect the quality of the food inside the packaging.

These systems, which are but simulators, are completed by very recent ones that test the real freshness indicators such as measuring the quantity and intensity of flavor in fruits, detecting gases produced by the biological process of harmful micro-organisms or detecting bacteria with the help of antibodies placed in the barcode that becomes unreadable if bacteria are present.

4.2. In Search of Biodegradable Materials

A typical problem of food packaging today is the waste they generate. For this reason, finding solutions to this problem has been one of the European food industry’s main concerns in recent years. This search is also encouraged by the consumers’ increasing concern about the growing use of plastic materials in packaging and the environmental challenges posed by food consumption. The cheapest and easiest to use among biodegradable materials are paper and cellophane, both based on cellulose. Polyethylene can be replaced by biodegradable plastic materials that contain polylactic acid (PLA) and are made of fermented glucoses (Grumberg 2004, 125). This type of material, just like others that are derived from vegetables such as flax, hemp or coconut, can also replace plastic sheets used in agriculture.

The tendency to move to biodegradable plastic materials is slowed down by their high costs—thrice as much as conventional plastic materials. Nevertheless, the development of industrial procedures is bringing these costs down quite rapidly. Thirteen years ago, they were ten times as high as today and forecasts say that in the following years they will become similar to those necessary for conventional materials (Grumberg 2004, 125).

5. Conclusions

Therefore, the trends in food production innovation follow three major paths. First of all, the producers seek to provide the best suitable answer to the consumers’ requirements by finding solutions to communicate with them and to improve the consumption conditions considering the requirements about the way the products are consumed in relation to the consumers’ view of the product and their relationship with it.

Secondly, the producers are in search of new technical solutions to preserve foods that would accommodate both the need to retain as much of the product properties as possible and the need to continue reducing the production and processing costs. Furthermore, finding new preservation methods also meets the consumers’ concern about the way the shelf life of the products is extended.

Finally, the producers are in search of new solutions for preserving product quality in the retail distribution circuit by finding new food packaging solutions and combining them with a better answer to the consumers’ requirements about the need to be better advised about the properties of the foods they buy.
As a whole, the three directions of development indicate a tendency of the producers to adapt via innovation to a constantly changing food market amid a growing satisfaction of consumer needs coupled with external factors such as the current economic crisis which has a direct impact on the consumers’ capacity to give an economic answer to the food producers of the EU food industry.

References