

# Food packaging is becoming increasingly active and intelligent: new techniques in the war against food decay



The industry is constantly developing new packaging techniques that actively modify the ambient air of food products. As a result, packaging is becoming increasingly refined. "Smart Packaging" as it is known, has been gaining in popularity over the last few years. It slows decay substantially, improves the control of freshness, and ultimately prevents food wastage (see 'Multiple functions of packaging'). Here's a sample of some of the most recent leading innovations.



Traditional packaging is very passive when it comes to protecting food. It forms a barrier to the outside world without any further intervention and indicates only the expiry date. Since the nineties, however, more and more refined packaging techniques have been emerging. They are known as "Smart Packaging". The European Directive 1935/2004/EC differentiates between intelligent and active packaging.

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## Intelligent packaging **informs**

**Intelligent packaging aims to inform.** It goes much further than indicating the storage life. For instance, it informs if the packaging has been damaged or if the product was not cooled sufficiently at a certain stage in the logistics chain. Time-Temperature Indicators

(TTIs) are a form of intelligent packaging that focus on temperature variations. Premature decay is often due to unforeseen interruptions in the cooling chain.

## Active packaging **conditions**

**Active packaging conditions the air in the packaging to slow down the (bio)chemical degradation processes and to steer the behaviour of microorganisms.** Some examples are airtight packaging filled with a specifically composed gas mixture (Modified Atmosphere Packaging or MAP) or air permeable systems with controlled conditioned air (Equilibrium Modified

Atmosphere Packaging or EMAP). Certain types of packaging decrease the influence of harmful substances by evacuating them or by neutralizing them chemically. All of these packaging systems actively affect the product during its entire storage life to postpone decay or loss of quality as long as possible.

good to remember

The industry is developing increasingly refined packaging systems to **improve the storage life of fresh food products** and to avoid food spillage.

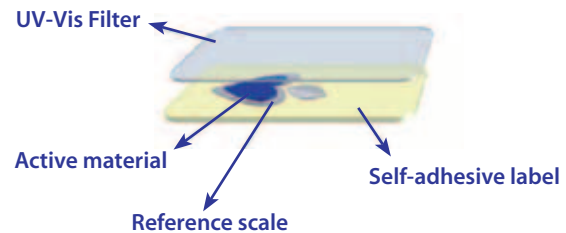
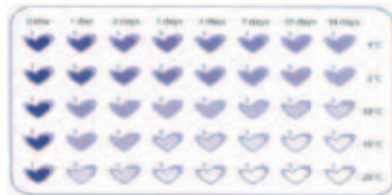
**Intelligent packaging** such as TTIs refines **storage life information** by taking into account temperature variations or other incidents.

**Active packaging** techniques such as MAP or EMAP condition the food's ambient air to **slow down the (bio)chemical degradation processes** and to steer the behaviour of microorganisms.

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The heart of the OnVu label becomes paler as the ambient temperature accumulates. This indicates gradual decay.



## Label's fading colour indicates decay

**The industry firmly believes in Time-Temperature Indicators or TTIs to detect weak links in the cooling chain. Such labels indicate visually whether a product has been subject to unforeseen temperature swings and to what extent this has damaged the product.**

German company Bizerba sells the OnVu system, a label with blue ink based on organic crystals. The label is activated by UV light during the packaging process. This colours the label dark blue. The colour gradually becomes paler under the influence of the

accumulated ambient temperature. The fading colour intensity provides a good indication of the extent of decay. However, the label of each product and each packaging requires specific conditioning. For instance, a label for fish in normal aerobic packaging requires a lower UV dose for activation than a label for the same fish in MAP packaging. The latter is better protected. It is also possible to tailor the packaging to the product by changing the composition of the ink.

## Enthusiasm versus conservatism



**The OnVu pilot project in the Mexican Superama chain was welcomed enthusiastically.** Research pointed out that the label made customers more aware of their part in the cooling chain when taking their merchandise home as well as when storing it at home.

'Some customers even asked if they could purchase the labels for their own use,' says Rob Dieu, Sales Manager Industrial Applications for Bizerba Belgium. 'It is an understandable request, but unfortuna-

tely it is not technically feasible.'

In Germany, Bizerba needed to come up with an alternative solution. Some distributors feared that customers who leave their fresh food lying around in the sun would complain afterwards that the product had not reached its expiry date. That is why, in a number of tests in Germany, a double-layered label was used. The actual OnVu label was removed at the cash register, revealing an awareness label underneath. 'It was a pity though,' admits Dieu, 'because this way the consumer loses its control tool. But, each innovation experiences a certain conservatism in the beginning.'

**An OnVu label trial revealed that customers became more aware of the part they play in the entire cooling chain.**

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MAP packaging consists of airtight trays filled with a modified mixture of  $O_2$ ,  $N_2$  and  $CO_2$ .

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MAP slows the growth of bacteria; **meat stays fresh for longer**

**Fresh food products such as fish, high-fat meat and prepared meals cannot be stored for a long time without taking special measures. In the nineties, the industry developed a technique that practically doubles storage life:** Modified Atmosphere Packaging or MAP. MAP is an attractive alternative to vacuum packaging. It consists of airtight trays filled with a modified

mixture of  $O_2$ ,  $N_2$  and  $CO_2$ . This gas mixture does not influence the quality of the food in a negative way; it simply slows down the microbial activity. At the same time, it ensures that the product stays aesthetically appealing. For instance, red meat remains juicy red in MAP packaging whereas in vacuum packaging its colours change to a darker purple.

Costs **cannot increase**

**Initially, MAP was mainly used for fish, afterwards for fresh meat products as well.** Today, MAP is used increasingly for products such as cheese and prepared meals. 'The technique can be applied in a number of ways,' says Christian Vlasselaer, Managing Director at Multivac, manufacturer of packaging machines. 'The only variable is the composition of the gas mixture.'

Nevertheless, some economical considerations influence the choice of packaging. MAP packaging is more expensive than traditional packaging with an air permeable stretch foil. It requires not only more complex and flexible machinery because, for

example, the trays must always have the same dimensions, but also larger machinery because the gas mixture requires more space. In addition, there can be no contact between the meat and the foil. 'That is why we always allow "head space",' explains Christian Vlasselaer. 'We try to limit it as much as possible to constrain transport and other costs.'



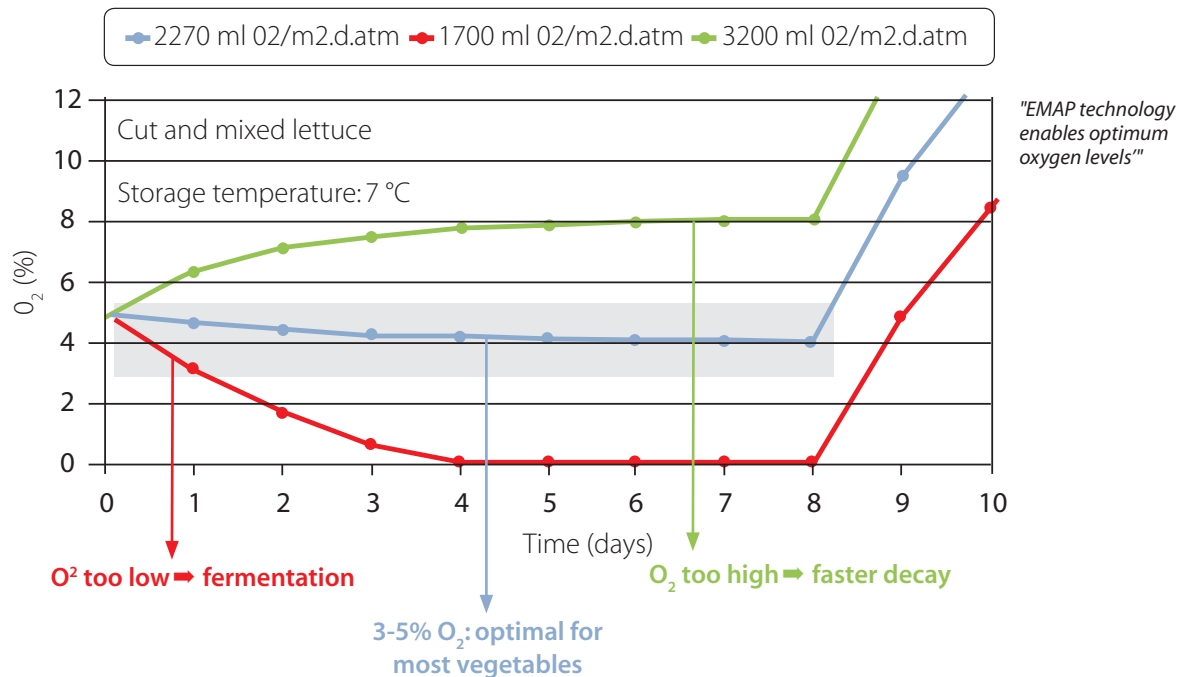
**Limiting the head space even further**

**Adjusted techniques mean the head space can be reduced further.** There are, for instance, systems that first package the meat tightly in an air permeable foil to prevent it from moving around.

Another technique uses a foil consisting of two air permeable layers and an airtight top layer. The layer in the middle always contains oxygen.

**MAP technology helps reduce the amount of preservatives in food.**

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### EMAP conditions the air underneath permeable foil

**Because fruit and vegetables remain physiologically active after harvesting, they cannot be packaged in airtight MAP.**

In order to offer these products a longer storage life, the industry has developed the Equilibrium Modified Atmosphere Packaging (EMAP). In most cases, these are small trays with a limited but easy-to-control permeability.

Harvested fruit and vegetables need to be able to respire (take up oxygen) and transpire (releasing vapour and warmth). If not, they would quickly die. On the other hand, respiration stimulates the metabolic activity that leads to decay. That is why the product cannot come into

contact with too much or too little oxygen and the surroundings cannot be too humid or too dry. Likewise, the CO<sub>2</sub> concentration needs to be kept within certain boundaries to avoid the product turning brown, which is a frequent problem with cut vegetables.

Designing EMAP packaging to prolong storage life as much as possible is a balancing act. Modified foil or small cavities ensure controlled air permeability. Often, the air inside the packaging is conditioned with a mixture of O<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub> that has been tailored to the product's specific needs. Well-designed EMAP packaging is able to prolong storage life by 25% and even up to 300%.

### Taking into account practical limitations

**Smart Packaging has its limits. Lots of new techniques require more complex packaging machines and more expensive materials.** This risks increasing the cost of packaging. The industry

needs to limit the total amount of packaging materials it uses and avoid compromising recyclability, without incurring substantial mark-up costs compared to traditional packaging.

### For additional information:

- On innovative packaging: [www.pack4food.be](http://www.pack4food.be)
- On the OnVu system: [www.bizerba.com](http://www.bizerba.com)
- On MAP applications: [www.multivac.com](http://www.multivac.com)
- On packaging recyclability: [www.pack4recycling.be](http://www.pack4recycling.be)

# A Bag-in-Box for milk: handy, economical and environmentally friendly



Wine producers discovered long ago the advantages of Bag-in-Box (BIB) packaging with a tap. The Belgian dairy group Inex uses specific BIB packaging for fruit juices and milk for commercial as well as home consumers. Such packaging simplifies the dosage and keeps the liquid fresh for a longer period after opening.

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## Aseptic packaging sealed with a tap

**The first Bag-in-Box (BIB) packaging for milk was developed for industrial kitchens and the catering industry. For years now, Inex has been supplying those customers with milk in BIB packaging of 5, 10, 20, or even 1.000 litres.** Inex packages the milk aseptically in a plastic bag, which is sealed with a tap. This tap is handy because it enables perfect dosage and prevents the penetration of air. This keeps the milk fresh for a longer period after opening.

In 2005, Inex launched its Milktap. This BIB packaging comes in 3 or 5 litres, ideal for the smaller business consumer. But it's also advantageous for the home consumer. Werner Pycke, Purchasing Director at Inex explains: 'UHT milk in traditional packaging remains good for 3 to 4 days after opening. In our Milktap, the milk remains good for at least three weeks after opening because the product does not come into contact with oxygen. What's more, it's very appealing. Kids love it, principally because the box is printed to look like you are milking a cow.'

## A positive environmental balance

**The Milktap is also good for the environment.** A longer storage life once the packaging is open reduces the chance of the milk spoiling. The rectangular shape makes it possible to efficiently stack the boxes on pallets. All of this limits the

cost as well as the environmental impact of transportation. Moreover, the production of BIB packaging results in low CO<sub>2</sub> emissions. Recycled and recyclable cardboard makes up 80% of the packaging.

good to remember

The specific design of the tap enables products such as UHT milk to be packaged aseptically in a Bag-in-Box.

Milk in a Bag-in-Box remains fresh for at least three weeks after opening because oxygen cannot contaminate the product.

80% of the packaging consists of recycled and recyclable cardboard.

# A Bag-in-Box for milk: handy, economical and environmentally friendly

How does the Milktap **succeed in keeping the milk fresh for longer?**



### Step 1: a plastic bag that protects the milk

The milk is packaged in a LDPE bag (Low Density Polyethylene) of 3 or 5 litres with an oxygen barrier made of EVOH (Ethylene Vinyl Alcohol) that can be used for packaging UHT milk aseptically. That is why the milk can be stored at room temperature unopened.



### Step 2: a tap that seals hermetically

Thanks to the well thought out design of the tap, the Bag-in-Box can be filled aseptically on an adjusted packaging line. Once opened, the membrane prevents air from penetrating the tap.



### Step 3: a practical and fun cover made of light cardboard

The bag is packaged in a compact and easy to stack cover made of light cardboard. A fun print in the shape of a cow makes the Milktap commercially attractive.

### Your company can also benefit from more efficient packaging

Efficient packaging saves costs for the manufacturer, is beneficial to the consumer, and is good for the environment. Your company can benefit from it as well.

#### Tips from Inex

- Check if existing packaging methods for a certain customer segment can also be used for other segments.
- Evaluate a packaging's ease of use from a consumer as well as from a production and distribution point of view.

### Inex and the environment

Inex dairy group is located in Bavegem. It produces approximately 300 million litres of milk per year. Inex combines constant product optimization and quality control with sustainable development.

#### Achievements:

- Inex joined the Flemish Government's **Benchmarking Covenant** in 2004. By doing so, the group committed itself to radically optimizing its energy use. In 2008, Inex presented an **ambitious Energy Plan**, which was approved by the Benchmarking Verification Agency.
  - Over the past few years, Inex has invested substantially in optimizing its water management, mainly **to reduce its overall water consumption.**
  - Inex is currently investing in a press installation for **plastic foils**. This means the supplier's packaging material no longer ends up as waste but **can be processed by recycling companies.**

# Smart Packaging: the answer to an evolving market

Department store group Delhaize has been using state-of-the-art Modified Atmosphere Packaging (MAP) for some of its fresh food products since the nineties. At first, it used MAP for fish and sandwich filling, afterwards, for fresh meat as well. The system is particularly useful in stores without their own butcher counters.

These stores are growing in numbers as they reflect the trend towards smaller neighbourhood shops.

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## Self-service stores benefit from Smart Packaging

MAP consists of airtight trays filled with a mixture of O<sub>2</sub>, CO<sub>2</sub> and N<sub>2</sub> to keep the food fresh for longer. 'They are especially useful in our self-service stores where MAP makes it easier for us to offer fresh meat,' says Jan Claessens, Purchaser for Delhaize's Butcher Department.

Self-service is gaining in popularity in Delhaize stores. The difficulty they face in finding trained personnel to process and sale fish means they have been using the self-service sales method for

fresh fish since the nineties. Since 2000, the same goes for fresh meat, not only in the smaller AD Delhaize stores but also in the larger supermarkets.

Small local stores are seeing something of a renaissance. That's why Delhaize has divided its store offering into the City, Proxy and Shop & Go concepts. Most of these neighbourhood stores are franchises run by self-employed people who often do not have the personnel or infrastructure to run their own butcher counters.

## No expensive equipment, less waste

MAP enables the Delhaize self-service stores to organize the selling of fresh meat more efficiently. They outsource all preparation and packaging to suppliers that use MAP. This means they do not have to acquire their own specialized equipment or qualified personnel. The prolonged storage life offered by MAP reduces

product waste. This results in a broader array of fish and fresh meat for the customer to choose from, just as in the larger stores. What's more, a MAP tray presents the product in an attractive way. 'Belgians like to see what they are buying,' says Jan Claessens. The sole disadvantage is that stores cannot meet demand so flexibly.

Do you also have an interesting prevention project?

Has your company realized a successful packaging prevention project?

Let us know via [prevention@fostplus.be](mailto:prevention@fostplus.be).

good to remember

MAP packaging ensures an aesthetically appealing product with long storage life. This leads to less product waste.

At Delhaize, the storage life of food products in MAP packaging is **always checked** under realistic conditions, including transportation at 20°C.

The introduction of MAP packaging makes it easier for Delhaize stores without a butcher's counter to sell fresh meat.

# Smart Packaging: the answer to an evolving market

How does **Delhaize limit its waste** in the MAP chain?



### Step 1: quality control with suppliers

'Our MAP is extremely reliable,' states Jan Claessens. Delhaize imposes strict quality standards for its suppliers. For instance, the meat needs to be cooled after each processing step and prepared packages are checked for leaks at least two to three times a day.



### Step 2: realistic storage tests

The longer the storage life, the higher the chance that the product is sold in time. This avoids waste. At Delhaize, the storage life of food wrapped in MAP is always checked under realistic conditions, including transportation at 20°C.



### Step 3: packaging innovations

Delhaize is constantly looking for techniques to make MAP even smaller and more efficient. Currently, it is investigating a packaging technique with a semi-permeable top foil that ensures contact between the gas mixture and the meat at all times. Delhaize is also investigating the application of MAP trays made out of renewable materials.

Jan Claessens, Head of Purchasing for the Butcher Department at Delhaize

"MAP enables us to offer fresh meat using self-service and at the same time minimize non-sales. This eventually leads also to less packaging wastes."

### You can improve the packaging of your products as well

Carefully selected packaging can improve the quality as well as the cost of the product you offer.

### Tips from Delhaize

- Tailor the packaging to the organization of your logistics and sales.
- Ensure good quality control throughout the entire logistics chain.
- Take into account the availability and motivation of your personnel.

### Delhaize and the environment

Delhaize is constantly on the lookout for environmentally friendly alternatives to all of its activities.

#### A look at some of their achievements:

- In 1994, Delhaize was the first in Belgium to use **reusable bags**. They encourage customers to use them by giving them additional bonus points if they opt for environmentally friendly initiatives.
- The electricity at Delhaize is 100% **AlpEnergy**. This electricity is produced in hydropower plants in the French Alps, without the emission of greenhouse gases or harmful substances.
- Delhaize has been selling a new range of **environmentally friendly products** since 2008. Most of them carry the European Eco-label.
  - Delhaize is investing in a programme to reduce **the energy consumption** of its stores by 35% by 2020. It is also building a new environmentally friendly storage location with 8.000 m<sup>2</sup> of solar panels on the roof.
- The truck drivers at Delhaize have followed an **eco-proactive driving** course to limit the environmental impact.



## Wasting less food

### Packaging that makes it easier to store food

**Packaging keeps food fresh and so avoids spillage. Losses are very small at the source and during distribution, but Belgian households throw away about 10% of all the food they purchase. To reduce that percentage, new types of packaging are being made to actively and intelligently protect the food. They not only prolong storage life, but also inform on the product's true freshness. They also make it possible to consume the product in several phases.**

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#### More efficient refrigerator management

**Food wastage between the stages of production and distribution is minimal because packaging protects adequately against decay.** However, further down the value chain, every Belgian household throws away on average 10% of all purchased food. In most cases, it's leftovers, but it's also products that have

perished in the fridge. To assist consumers in better managing the cold storage of food, new types of packaging are underway. Less wastage is good for the environment. Believe it or not, discarded food often has more impact on the environment than the packaging itself.

#### Prolonging the storage life of food products

**Today, there are various technologies that help prolong the storage life of food.** Active packaging (see also Feature) checks and controls the humidity and the concentrations of oxygen (O<sub>2</sub>), carbon dioxide (CO<sub>2</sub>) and nitrogen (N<sub>2</sub>). This means the food stays fresh for longer.

Intelligent packaging indicates the true freshness of food at any given moment in the logistics chain. This is extremely useful. Packaging can get damaged or become exposed to higher temperatures, during a temporary breakdown of the cooling chain for instance. In such cases, the quality of the food deteriorates faster than expected. Intelligent labels can help ensure the products can still be consumed in time.

#### How does food decay?

There are different mechanisms leading to food decay:

- Microbial decay, often in combination with germ growth
- Chemical and enzymatic activity that lead to vitamin loss and changes in the colour, flavour, odour and texture
- Oxidation and acidification
- Migration of gases and humidity, altering the texture and flavour

**Good packaging protects food against all of these mechanisms.**

good to remember

Packaging **limits food waste** because they prolong the product's life expectancy

Clear information on the packaging helps consumers **better manage their food**

Active packaging **makes preservatives less necessary** and are **beneficial** to food safety

# Wasting less food



**Active packaging prolongs storage life without adding preservatives. It also simplifies the distribution of fresh products.**

### Information on true freshness

**To avoid waste, it is extremely important that packaging states the ideal storage temperature. However, intelligent labels take things a step further.** They take into account each unforeseen event such as incidents during transportation and distribution or any "casual" handling at home. Therefore, storage

life information is always up-to-date. Consumers are sensitized and stimulated to always store food in a cold environment and to consume it in a timely fashion. More and more packaging can be closed or sealed after opening to better protect the product.

### Healthy for people and the environment

**Active packaging not only limits waste, it is also good for our general health.** The packaged product remains fresh for a longer period, so packaging is an excellent alternative to preservatives that can be present in the food. Food's prolonged life expectancy has other benefits as well:

- Treatments such as sterilization and cooling are becoming less imperative
- Air shipments can be replaced by slower, more environmentally friendly transportation methods

### Multiple packaging and portioning

**Ever more packaging can be closed and sealed again after opening to protect the product better.** Moreover, in Europe

there is a trend to propose different volumes so that each household can adjust its groceries and consumption to its own needs.

**Intelligent labels stimulate consumers to manage the content of their refrigerator optimally.**

### For additional information :

- On innovative packaging: [www.pack4food.be](http://www.pack4food.be)
- On food and waste: [www.wrap.org.uk](http://www.wrap.org.uk)