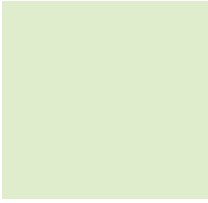
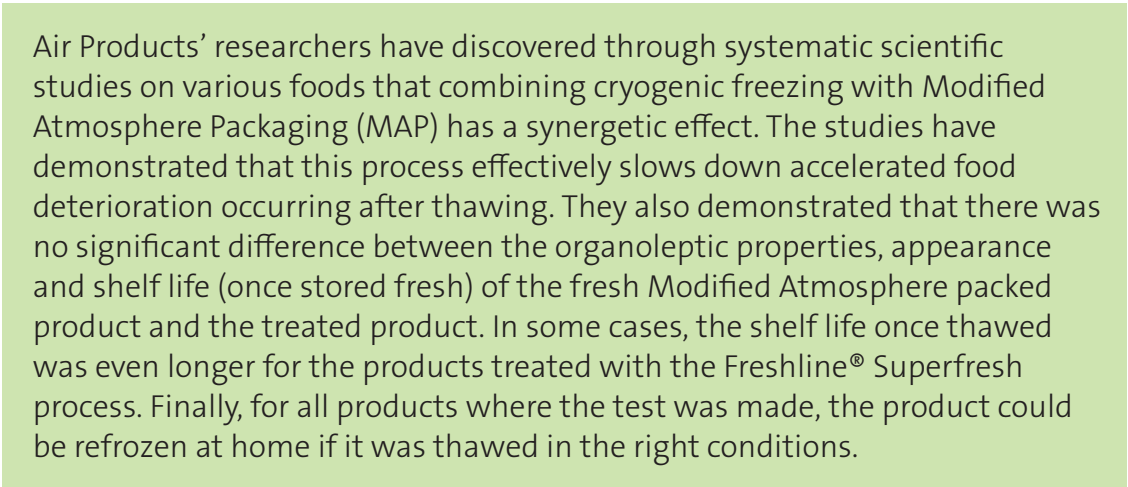


Freshline® Superfresh solutions, freshness on demand

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In today's world, food processors have their fair share of challenges to remain competitive. Globalisation, cost cutting, quality, safety, traceability, sustainability including waste reduction, customer expectations and several other realities are constantly on their minds.

Numerous discussions with Air Products' customers about their challenges and priorities led to a new R&D project. How could one keep chilled food products fresh for longer than standard existing techniques while still offering a quality product? The R&D team developed the Freshline® Superfresh solutions.

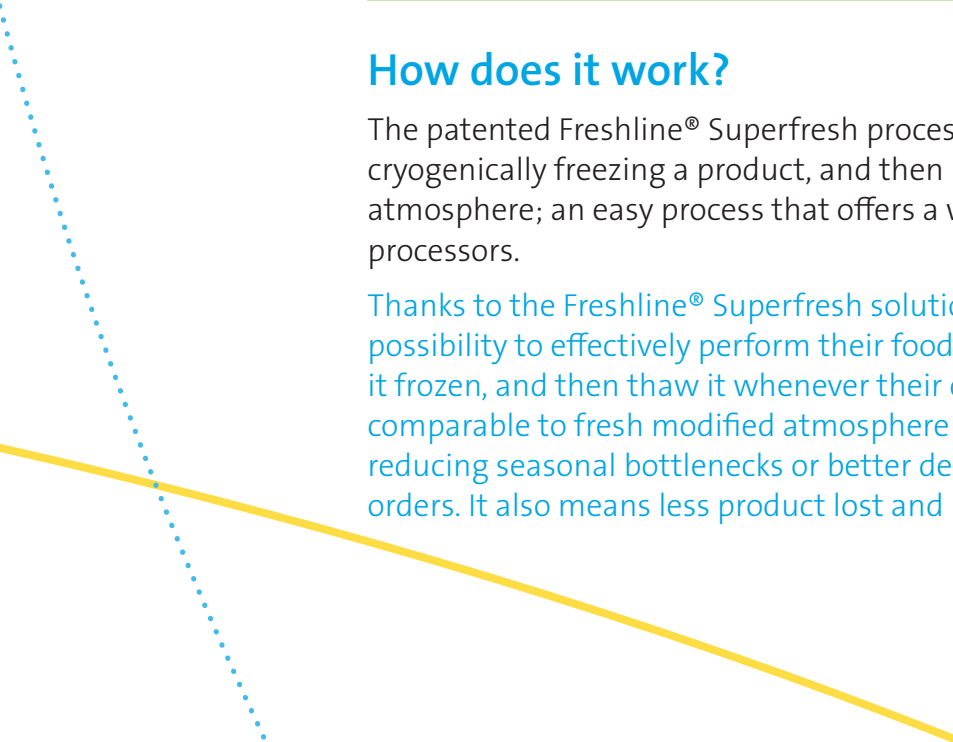
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Air Products' researchers have discovered through systematic scientific studies on various foods that combining cryogenic freezing with Modified Atmosphere Packaging (MAP) has a synergetic effect. The studies have demonstrated that this process effectively slows down accelerated food deterioration occurring after thawing. They also demonstrated that there was no significant difference between the organoleptic properties, appearance and shelf life (once stored fresh) of the fresh Modified Atmosphere packed product and the treated product. In some cases, the shelf life once thawed was even longer for the products treated with the Freshline® Superfresh process. Finally, for all products where the test was made, the product could be refrozen at home if it was thawed in the right conditions.

How does it work?

The patented Freshline® Superfresh process is quite simple. It consists of cryogenically freezing a product, and then packaging it under a modified atmosphere; an easy process that offers a wealth of possibilities to food processors.

Thanks to the Freshline® Superfresh solutions, food processors have the possibility to effectively perform their food preparation when it suits them, store it frozen, and then thaw it whenever their customer needs it, with a quality comparable to fresh modified atmosphere packaged (MAP) products. This means reducing seasonal bottlenecks or better dealing with last minute changes in orders. It also means less product lost and more associated cost savings.

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The scientific proof

When validating the concept of the patented Freshline® Superfresh process, different treatments were analyzed and compared for different food products. All of the food products were stored at 4°C over a predetermined number of days and tested on a regular basis. Below is a list of different treatments that were tested:

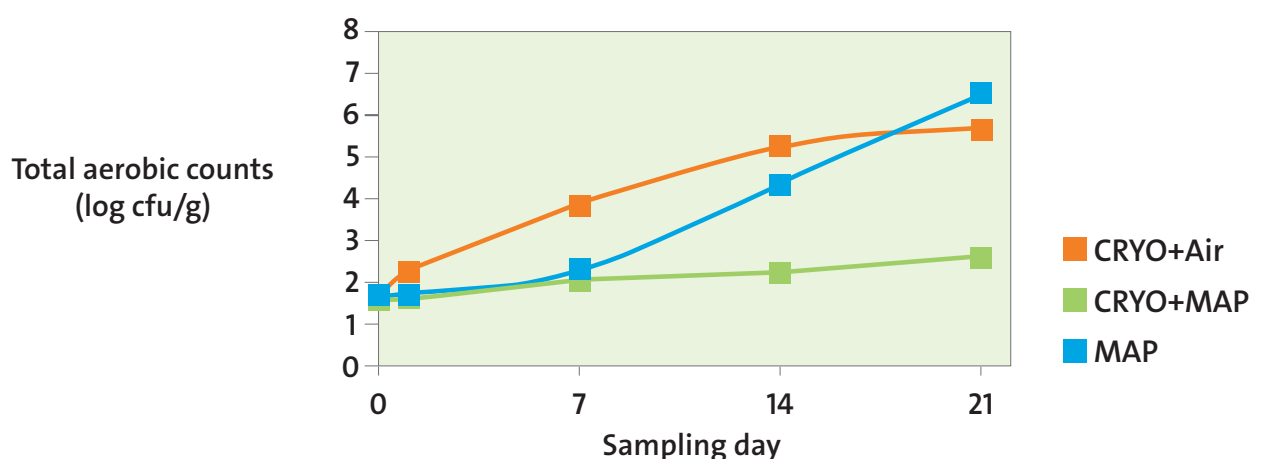
- Cryogenic freezing followed by air packaging, storage at -18°C for varying periods (to see if the storage time had an impact), thawing, then storage at 4°C
- Cryogenic freezing followed by MAP packaging, storage at -18°C for varying periods (to see if the storage time had an impact), thawing, then storage at 4°C
- Standard MAP packaging (without any freezing upfront) stored at 4°C

Different MAP mixtures were used, depending on the kind of food product to be packaged, and, in some cases, the possibility of re-freezing the product was also analyzed.

The products tested to date include breaded chicken, chicken drumsticks, lasagna Bolognese, cod steaks, grilled vegetables, prepared foods, ready meals, and bakery products.

In Figure 1, you can see the synergetic effect of the Freshline® Superfresh process on the aerobic counts (log cfu/g) of breaded chicken. Some samples were kept fresh and simply packaged under MAP, other samples were cryogenically (CRYO) frozen and packaged under air or MAP, then after 1 month, thawed and stored at 4°C for 21 days.

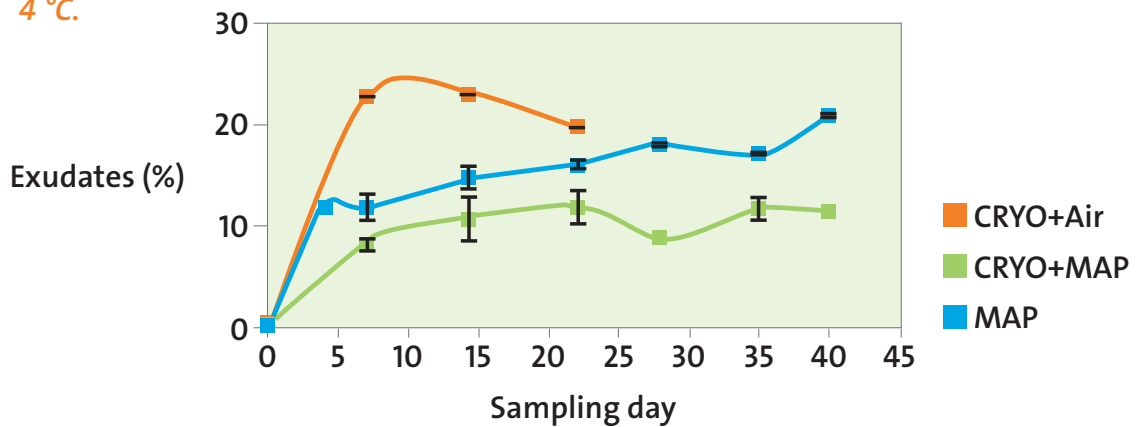
Fig 1: Evolution of total aerobic counts (log cfu/g) in breaded chicken breasts packaged under different conditions (CRYO+Air, Cryo+MAP, MAP) and evaluated during 21 days at 4°C. The values represented are the average of three samples ± standard error.



The studies also evaluated whether the duration of the frozen storage period had an impact on these results. The samples that were treated with the Freshline® Superfresh process remained stable, indicating the stability of the product even when it was frozen for long period of time.

Different elements were looked at depending on the nature of the product tested, such as organoleptic properties or visual features. For example, in the case of cod the drip loss was measured (figure 2), which indicates better results for the products treated with the Freshline® Superfresh process (CRYO+MAP).

Fig 2: Evolution of exudates generated (%) in desalted cod steaks packaged under different conditions (CRYO+Air, CRYO+MAP, MAP) and evaluated during 40 days at 4 °C.



For products such as lasagna Bolognese where the color is important, the tests demonstrated that the Freshline® Superfresh process could provide stable and satisfactory results after the thawing process (figure 3 and 4). These results could be attributed to a lower lipid oxidation in the Cryo+MAP treatment.

Fig 3: Evolution of the a* parameter (redness/greenness) in lasagna Bolognese cryogenically frozen and packaged with air (CRYO+Air) and with MAP using the mixture CO₂/N₂: 50/50 (CRYO+MAP), kept frozen (-18 °C) during 1 month, thawed and kept at 4 °C during 21 days.

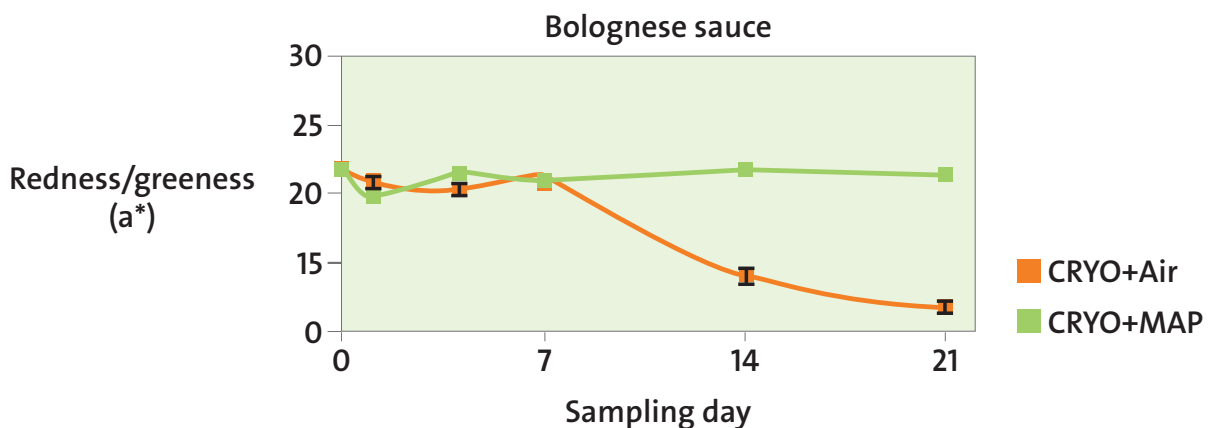
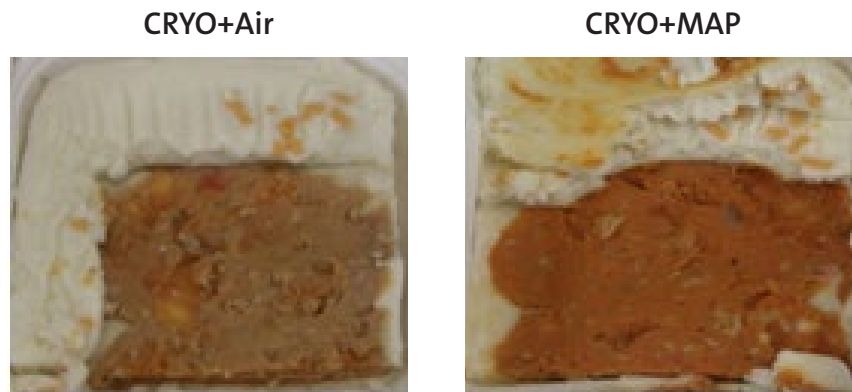
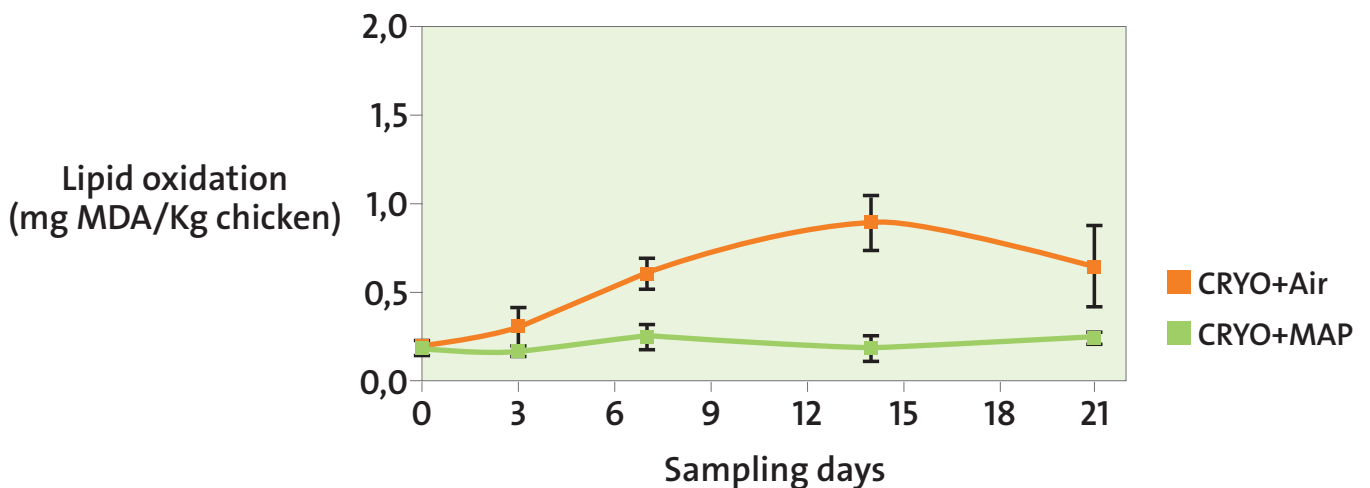


Figure 4: Color appearance of bolognese sauce samples (CRYO+Air and CRYO+MAP) after 14th day at 4 °C.



For higher fat content products such as chicken contained in paella, lipid oxidation was also analyzed (figure 5). Here again, the results showed the Cryogenic freezing + MAP (Freshline® Superfresh) treatment was satisfactory.

Figure 5: Evolution of lipid oxidation in chicken samples in a paella product packaged with air (Air+CRYO) and with MAP using the mixture CO₂/N₂: 30/70 (MAP+CRYO), then cryogenically frozen and stored during 2,5 months at -18 °C, then thawed and kept at 4 °C during 21 days. The values represented are the average of three samples ± standard error.



All of these test results and many more show the efficiency of the Freshline® Superfresh process. It adds extra flexibility to food production while keeping a quality comparable to fresh modified atmosphere packaged (MAP) products. In an era where it is crucial that we all contribute to food waste reduction efforts while preserving food products in a natural way, this process offers many possibilities while allowing food processors to reduce costs and deal with supply chain constraints.

Feel free to contact Air Products if you have any question or if you wish to see the full set of results for a specific product tested.

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