



Packaging Options for Case-ready Chilled Meats Part I - General & Vacuum Packaging

A proportion of meat is still displayed for retail without any form of packaging, particularly in butchers' shops. However, the establishment of meat retailing through supermarkets and other non-traditional meat retail outlets over recent decades has introduced a requirement for protective packaging.

Conventional retail-ready packaging

Protective packaging has been used to allow the presentation of meat to the consumer without risk of contamination as a result of consumer handling and/or inspection of the product. The predominant packaging form is an EPS foam tray over-wrapped with a stretched plastic film such as PVC.

However other options are used, including:

- semi-rigid plastic trays or tubs over-wrapped with stretched plastic film - often used for diced or minced meat;
- individual stretch wrapping of cuts - generally limited to bone-in cuts such as lamb legs and shoulders.

The plastic film used is highly permeable to oxygen (to enhance the red 'meat' colour of oxymyoglobin) whilst acting as a barrier to moisture loss. While the primary benefit from packaging has been the protection against contamination, there have been ancillary advantages from this form of packaging. These advantages are:

- *improved visual appearance.*
- *Extended visual presentation resulting from protection of the meat surface to prevent its drying out and becoming unattractively brown in colour.*
- *Display of a range of pack sizes to meet consumers' needs, allowing the retailer to present products as single-meal options and influence consumers' purchase quantities.*

The development of the concept of meat 'meals' ready for presentation in a refrigerated display case has allowed the introduction of alternative approaches to meat retailing, away from the traditional on-site carcase breaking, meat slicing and bulk-tray presentation process.

Centralised boning

Preparation of permeable film stretch-wrapped product on trays has allowed the implementation of centralised preparation of retail-ready meat packs. Vacuum-skin permeable film packaging is also available. The limited shelf life of product in these forms of packaging limits the application to retail outlets located close to the centralised packing operation. This option is particularly effective for supplying small non-traditional meat outlets - such as convenience stores, which do not have their own butchering resources - from a nearby butchering facility.

Alternatively, the development of vacuum packaging of meat allows the primal cuts to be boned, vacuum packaged, chilled and stored at a central location before being distributed to the retail outlets for final preparation in retail packaging. A number of benefits have been realised through the use of centralised boning in this way, for example:

- *Cost benefits from increased scale of centralised operations.*
- *Reduced capital expenditure at the retail outlets.* Outlets no longer need facilities for boning; only those required for slicing and packaging.
- *More consistent meat quality.* The controlled ageing of product, as in vacuum-packaged primals, allows for more consistent meat tenderness.
- *Minimisation of loss of potential yield.* This is due to storage of product in a protective package rather than as naked meat.
- *More efficient usage of meat cuts at the retail outlets.* Each retail outlet is not committed to full body lots and has the option to maximise the throughput of cuts required by its consumers.
- *Meat retailers have greater opportunity to market their product.* Less time is spent on meat preparation and away from the customer, and therefore more time with the customer.

Unfortunately, the longer meat is stored as vacuum-packaged primal cuts, the shorter the shelf life as a permeable stretch-film-wrapped, case-ready product. The limitation to this option is the retail shelf life of the product, which is generally no more than two days.

Recent advances have been made to overcome the retail shelf life limitations of traditional permeable film, retail-ready packaging and a new generation of packaging options has been successfully developed. These options have allowed the total preparation of retail consumer units of fresh meat at the centralised location. The products from these options are generically known as 'case-ready' meats – they are retail-ready meats, with extended shelf life, that can be taken out of a box and put directly on display without further work.

Case-ready options

Case-ready technologies can be divided into those that use modified-atmosphere-packaging (MAP) techniques and those that use vacuum-packaging (VP) techniques.

In deciding the technology to use it is first essential to determine:

1. *The shelf-life requirements of the product in the market.* Shelf-life criteria must be established for product between the centralised packaging operation and the retail display case, and during retail display. It must be established who will use this shelf life effectively, i.e. the processor or the retailer.
2. *Definition of the requirement for display as a bloomed or non-bloomed product.*
3. *The age of product prior to case-ready packaging.* The time between slaughter and packaging defines the effectiveness of some case-ready packaging technologies. For example, a long shelf life of > 4–6 weeks can only be achieved from product that is packaged less than two days after slaughter. Product that has been pre-aged as vacuum-packaged primals can only be used for shorter-shelf-life, case-ready packaging.

The defining of these criteria will determine the most appropriate packaging technology. It is likely that no single technology will be ideal for all products for retail display, and a centralised packing operation will use more than one packaging technology.

This brochure focuses on VP-based technologies. Additional information on MAP-based technologies can be obtained from the brochure entitled "Packaging Options for Case-ready Chilled Meats - Part 11 Modified-atmosphere Packaging".

Vacuum-based technology in case-ready packaging

A range of options is available in the area of case-ready packaging using vacuum-based technology, including:

- oxygen barrier bags;
- permeable bags or trays within a barrier master pack;

- thermoformed barrier packs;
- vacuum-skin barrier packs;
- Peelable-skin packs to change barrier film to permeable.

However, as case-ready packaging technology is further developed and implemented, it is likely that further options will be included and others superseded.

Oxygen-barrier bags

Case-ready packs can be prepared in conventional oxygen-barrier bags as used for vacuum packaging of primal cuts. However, as the meat pigment, myoglobin, is retained in the non-oxygenated form (reduced myoglobin) and has a distinctive purplish colour, these are not suitable for the packaging of meat if the normal bright red colour of fresh meat is expected by the consumer. Value-added cuts including marinated meats, cooked meats, pickled and cured meats, and seared meats retain a more natural colour according to their processing procedure and are less affected by the low-oxygen environment. Therefore these products have a colour more acceptable to the consumer and are suitable for this packaging option.

Equipment for this style of pack is relatively inexpensive, suitable for low throughput, and its use is already widespread within the meat industry. Snorkel, swing-lid and thermo form vacuum packaging machines can be used. Care should be taken when choosing equipment, however, as some food additives are corrosive and can damage equipment.

For further information on vacuum packaging using impermeable bags, refer to the brochure entitled "Vacuum Packaging Primal Cuts".

Seared fresh meats have an expected shelf life in the intact bag of about 20 days, while meats containing additives can have a shelf life of up to 12 weeks, dependent on the pre-packaging, value-adding process and the quality and cleanliness of the ingredients.

Permeable bags or trays within a barrier master pack

The poor consumer acceptance of the purplish colour of meat, with the myoglobin pigment in the reduced myoglobin form, can be overcome by allowing the meat to be exposed to oxygen prior to retail display. This results in the reduced myoglobin converting to the bright red oxy-myoglobin. Individual retail cuts can be vacuum packaged in a bag made of film with a high-oxygen permeability. These cuts are then vacuum packaged in a master bag made of a barrier film. As many individual cuts as required can be included in the master pack with the choice of number being dependent on their size and retail display requirements.

The barrier master bag excludes oxygen, resulting in an extended storage life. Prior to retail display, the master bag is carefully opened and the cuts removed. Oxygen permeates through the permeable film and, within about 20 minutes, the meat surface blooms to the bright red colour that is expected by consumers. Product is protected from contamination within the permeable packaging and is ready for display.

This option is suitable for fresh roasts or other larger cuts. Normally 4-6 cuts are held in each master pack and the fresh meat has about 3 weeks storage in the master pack, with 3-5 days retail display once bloomed. Inexpensive, low throughput, vacuum packaging chamber equipment, currently prevalent in the meat industry, can be used to prepare these packs, which can be 'bag in bag' or 'bag on permeable tray in bag'.

Thermoformed barrier packs

For large numbers of small items, automatic or semi-automatic packaging in thermoformed packs is economically viable. Heated moulds are used to form individual flexible or semi-rigid trays from roll-stock film. The product units are then manually or mechanically placed in the trays. The loaded trays move into a chamber where a separate film is placed over the top of the product and sealed to the edge of the trays while under vacuum. The individual units are then separated, leaving packs that are of regular shape and sealed around the outer edge. Films can be pre-printed to provide display information such as product description, ingredient listing, pack weights or promotional information.

As the films used provide an oxygen barrier, the product is displayed in the purple, reduced myoglobin form. Consequently, this option is generally not used for fresh meats. Thermoformed vacuum packaging is in widespread use for processed cooked or semi-cooked meats such as sliced ham or bacon. The shelf life obtained is dependent on the product packaged but is generally up to 3 weeks for sliced fresh meat in the unopened pack and up to 4-6 weeks for sliced cooked meats. Specialist high-speed equipment is required, so this option is appropriate only for processes with high throughputs.

Vacuum-skin barrier packs

Vacuum-skin packaging provides an almost invisible protective skin over the product, resulting in excellent presentation. Product is placed on a backing tray or board and a barrier film is sealed over the product and onto the backing material. By sealing the package under vacuum and heat, the film over the product moulds to exactly fit the contours of the product, forming a 'skin'.

Creating a vacuum-skin on a flat backing board or shallow backing tray provides opportunities for printing a range of marketing information onto the package. Packaging films have high oxygen barrier properties and therefore produce a case-ready product that is not bloomed and retains the purplish colour of reduced myoglobin. Consequently this option is generally not used for fresh meats but is used for processed or value-added products such as seared steaks, which do not rely on the colour of oxymyoglobin for presentation acceptance.

Vacuum skin-packaging equipment can be highly specialised, requiring high utilisation to be economically viable. However it provides strong opportunities for automation of packaging and labelling. Smaller machines, sealing 6-8 units per cycle, are available for the smaller processor.

Shelf life of sliced fresh meat is up to 3 weeks in the intact pack under ideal storage temperatures.

Peelable skin packs to change barrier film to permeable

Advancement on the vacuum-skin pack is the use of a 'peelable' film. Peelable films are multi-layer, laminated films in which an oxygen-barrier layer can be separated from a permeable layer. The bond between the barrier and permeable multi-layer section of the film is a controlled bond that is significantly weaker than bonds between the other individual multi-layers and sealing layer.

The vacuum skin package is prepared with the barrier film on the outside of the package. During heat sealing, both multi-layers are bonded to the backing tray or plate and form an integral part of the package. During the vacuum skin packaging process, a small tag of the upper multi-layer is formed to act as a grip or handle to facilitate peeling.

After storage as a vacuum package, the product is prepared for retail display by tearing away (peeling) the upper barrier film using the preformed tag. This is carried out manually at the retail display point, leaving a permeable vacuum skin packaged product. Within 20 minutes, oxygen permeates through the film, converting the meat pigment to the bright red oxymyoglobin form. Three to four weeks storage at 0°C as an impermeable vacuum package, followed by three days storage as a 'bloomed' display pack are achievable.

Other packaging options

A further range of case-ready packaging options is available by replacing the low oxygen environment of vacuum packaging with a variety of conditions tailored to suit product, packaging and shelf life needs by controlling the gas environment within the package.

For further information on these options see the brochure entitled "Packaging Options for Case-ready Chilled Meats, Part 11 – Modified-atmosphere Packaging".

Process control

The packaging technology chosen is only as effective as the control applied to the overall packaging process. An effective quality assurance program is essential to ensure that the following issues are addressed and controlled:

- Product hygiene prior to, and during, packaging
- Temperature control from slaughter to consumer
- Handling procedures
- Stock control, both in the processing and retailers cold rooms.

It cannot be stressed strongly enough that the success of case-ready packaging of meat and meat products is critically dependent on the control of product hygiene and temperature throughout the life of the product from carcase to consumption. A HACCP-based quality assurance program should be implemented.

To ensure effective management from slaughter to the consumer it is essential that the following points should be involved before committing to any case-ready packaging technology option:

- Product and production capabilities
- Market intelligence
- Experienced suppliers of both packaging equipment and materials
- Reliability of processors supplying carcase or vacuum-packaged meat to the retail packaging process
- Capability of cold chain operators to maintain recommended temperatures for meat chilling and transportation.
- The retailer's ability to display the product effectively

Case-ready packaging technology can only be successfully implemented if the points outlined in this brochure are addressed.

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