Different packaging concepts and methods for preserving meat quality

There are different packaging concepts depending on the particular product and the processing stage within the added value chain. This means that different technology and packaging materials are required, when transport or maturation packs for example are being produced, from those required for retail packs for the end consumer. In addition to the high demands placed on hygiene and functionality, one of the most important objectives of a pack is to provide extended shelf life for the product.

Meat is a valuable food product. It is therefore essential, that all those involved in the process chain exercise the greatest care in handling the product. One important aspect of this is the product processing, which should be as sparing on resources as possible. But there is also special importance attached to the packaging, since this contributes to preserving quality and extending the shelf life of the product, thereby also contributing to reducing food waste. Essentially it depends on the product to determine, which is the most suitable packaging concept, method, or technology.

TRANSPORT PACKAGING

Transport or maturation packs are generally used for larger pieces of meat in the B2B sector. These industrial packs protect the wholesale meat primals from external influences, while also minimising the effects of the meat drying out. The packs are used for transporting the product from the supplier or abattoir to the meat processor, sausage producer, wholesaler, local butcher or caterer, and they are also used for transporting product within individual processing companies. One other benefit: the meat can mature in the pack and therefore improve still further in quality. This is used primarily for beef. A good example of this is roast beef, which is transported from South America to Europe, where it is further processed.

An ideal type of packaging for these large meat cuts are vacuum packs or shrink packs, which are produced on chamber machines or chamber belt machines of different output categories. Selection of the appropriate machine depends on the products to be packed, their size, and weight and also the required output or level of efficiency. If the products to be packed are evenly sized, alternative packaging concepts to packing in film pouches may be used, and these enable a higher degree of automation to be achieved. One example of this is thermoforming packaging technology.

RETAIL PACKS

In the case of retail packs, the marketing aspect is an additional objective. The pack must be presented attractively at the point of sale and encourage the consumer to purchase the product. Product differentiation features include the visual appearance and sensory feel, the visibility of the product in the pack and its printing or labelling, as well as other functions such as opening aids, reclosure features, or ease of stacking on the supermarket shelf.

In parallel with this, there has been a trend in recent months towards greater sustainability in packaging and a higher level of environmental awareness, which have been influenced by the discussions about the use of plastic packs, the EU Packaging Strategy, and current packaging legislation. This trend has a direct effect on the design and production of packs, as well as the packaging materials used. This means when packing food products, only as much packaging material should be used as is absolutely necessary to protect the content of the pack. In addition to this, alternative packaging solutions, particularly paper fibre-based materials, are also gaining in importance for the meat industry, as well. This is because they contribute significantly to increased pack recyclability.

Depending on the product and the expectations of both the retail trade and consumers, there is a wide spectrum of retail packs available, ranging from rigid thermoformed packs and pre-made trays to flexible packs in a wide variety of designs. Examples of these are vacuum packs, vacuum skin packs, and shrink packs. In addition to the chamber and chamber belt machines already mentioned, there is a whole range of suitable thermoforming packaging machines and traysealers, which can be selected for the different requirements.

METHODS FOR PRESERVING MEAT QUALITY

Vacuum packs or MAP packs are generally the preferred type of packaging for preserving the quality of the meat product and extending its shelf life. The differences in the various products do however require the packaging concept to be designed in individual ways. In principle both methods are comparable in the contribution they make to the microbial effect on shelf life.

VACUUM PACKING

In the case of vacuum packs, the extended shelf life is achieved by removing the oxygen (O_2). Otherwise the oxygen would quickly cause spoilage of the food through chemical or biological processes. The vacuum prevents the growth of aerobic microorganisms, such as pseudomonads. Despite this however, the metabolic processes of anaerobic lactic acid bacteria continue in the vacuum pack, and these also of course grow on the meat. Due to their metabolism, these lactic acid bacteria produce carbon dioxide (CO_2), which dissolves gradually in the meat and reduces the pH value of the product. This process stems the growth of other bacteria.

Oxygen or the removal of oxygen also has an effect on the colour of the meat. The meat's colour essentially depends on its myoglobin content and state. The myoglobin is responsible for the intramuscular transport of oxygen, and it is present in different quantities in the various products. Lean meat, for example, contains only 2 grams per kilogram of meat, while beef on the other hand can contain up to 20 grams per kilogram. Since there is predominantly deoxymyoglobin in freshly cut meat, it has a purple colour, which appears paler or stronger depending on the type of meat.

But this colour is not stable. Depending on the particular type of meat and its processing, the deoxymyoglobin oxygenates into oxymyoglobin at a higher concentration of oxygen. The original purple colour of the meat then changes to a brick-red colour. If the oxygen content is reduced to a low value, or the meat is stored for a long time, the unattractive brown-coloured metmyoglobin is automatically produced. The meat may actually still be faultless from the microbial point of view, but it is often no longer accepted by the consumer due to its visual appearance.

If the oxygen is largely removed, as in the case of vacuum packaging, this also creates more stable preservation of the meat colour - and therefore a higher level of consumer acceptance. If the oxygen is removed completely from the pack, the colour of the meat tends towards purple again thanks to deoxymyoglobin. But the quality of the meat also plays an important role here. If the reduction capacity is not sufficient to metabolise the residual oxygen, which is present in the pack and dissolved in the meat after the packaging procedure, the meat appears brown despite the absence of oxygen in the pack. However, this tends to be accepted by the consumer in the case of beef in vacuum packs, for example more than with any other.

Another aspect which should be taken into consideration: with vacuum packs, the escaping meat juice is not caught by an absorbent pad, as is the case when packing under modified atmosphere, but rather the juice collects in the cavities around the meat. These cavities can be reduced by shrink or skin packaging, whereby the film is pulled skin-tight around the meat by means of a special process, and this reduces the escape of juice significantly.

The different vacuum packs can be produced on thermoforming packaging machines, as well as traysealers and chamber machines. Two attractive versions of the vacuum pack, which have become established in the market, are vacuum skin packs and shrink packs.

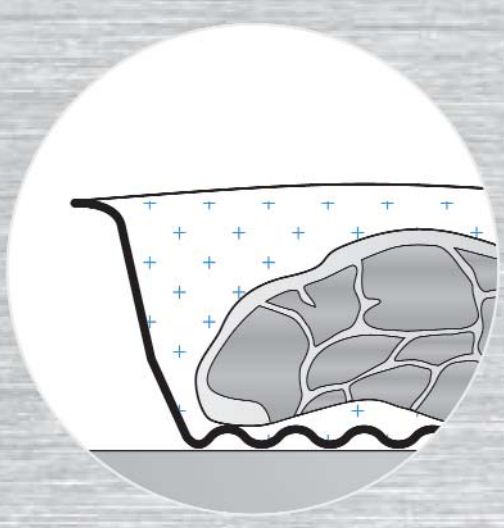
DIVERSITY OF VACUUM PACKS - VACUUM SKIN PACKAGING

Thanks to their high level of product protection and their attractive appearance, vacuum skin packs are on an upward trend in the self-service retail sector. This type of pack involves the upper web being tightly draped around the product without tension like a second skin, before being sealed to the entire surface of the lower web or pre-made tray. The product is not distorted and keeps its natural appearance. The food

product is also fixed firmly to the base of the pack or tray, so that it can not slide around, and it can therefore be presented at the point of sale as either a stand-up pack, a hanging pack or a conventional horizontal pack. The vacuum in the pack contributes to an extended shelf life for the product. In addition to soft meat like fillet pieces, other products with sharp or hard features, such as bones for example, can also be packed securely in this type of pack. If vacuum skin packs are stored in the freezer, they also provide reliable protection against freezer burn.

It is however essential to select suitable film material. The mechanical properties of the upper web must be designed for the shape and height of the particular product, so that even those products with high protrusion or sharp features can be packaged attractively and securely. Suitably dimensioned standard trays must be used for producing vacuum skin packs on traysealers. With thermoforming packaging on the other hand, reelfed upper and lower webs are used to produce the packs. In addition to logistical and financial benefits, the advantages of reel-fed materials lie in the fact that universally used films can be utilised and there is a higher degree of flexibility, since packs can be produced to individual designs, for example with specially formed contours or other features.

Research institutes, universities, leading machine and film manufacturers, as well as recycling companies are all systematically working on suitable packaging technology to extend shelf life and preserve product quality. One current example is the QualiMeat project, which is being sponsored by the Interreg Europe program and runs until December 2019. The six partners involved - the University of Kempten, Innsbruck University, Innsbruck Management Center, MULTIVAC, the Kempten Center for Food and Packaging Industry, and NATURA-BIOMAT GmbH - are researching the interaction of various packaging systems and materials on fresh meat. The aim is to optimise packaging materials and processes for improving the preservation of fresh meat quality.



MODIFIED ATMOSPHERE (MAP)

In the case of packs with modified atmosphere, the atmosphere in the pack is replaced with a gas mixture, which is matched to the product. This usually consists of carbon dioxide, nitrogen, or oxygen.

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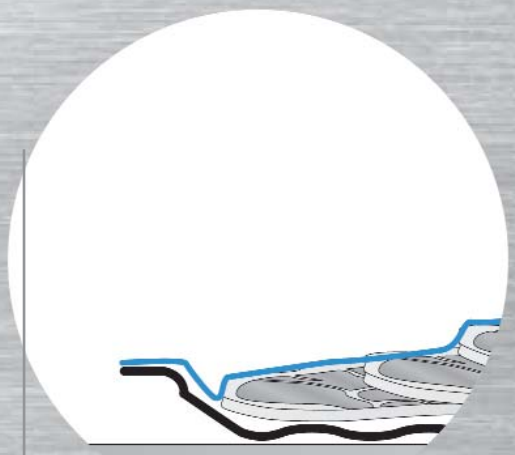

VACUUM

Packaging under vacuum extends the shelf life of products since the biochemical degradation of the product is slowed down by the removal of the atmosphere. As the products may be compressed in the process, vacuum packs are only suitable for food which is not sensitive to pressure.

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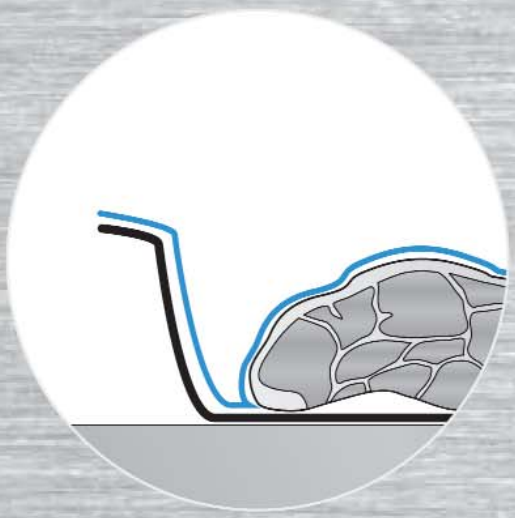
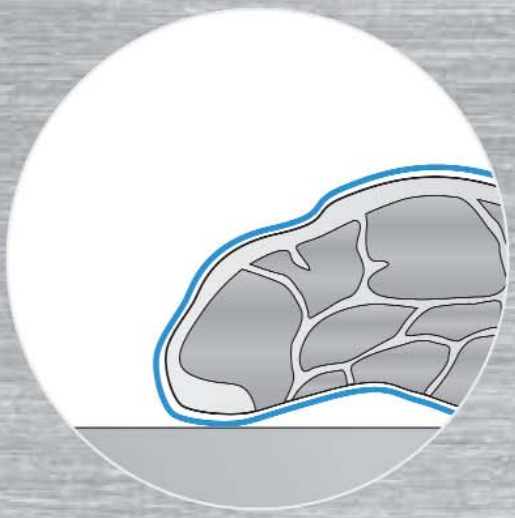
MultiFresh™ from MULTIVAC is a special process for producing vacuum skin packs which can be made on both thermoforming packaging machines and traysealers. The comprehensive machine range meets all the requirements of pack size, output, and level of automation. The special MultiFresh™ films combine functional benefits with outstanding visual properties. MultiFresh™ packs are characterised in particular by their high level of transparency and brilliant gloss – and they also offer optimum product protection, while at the same time ensuring an extended shelf life is achieved for the product.



MULTIFRESH™

MultiFresh™ vacuum skin packaging uses a special skin film, which encloses the product without tension like a second skin and seals to the entire surface of the lower web. The upper web passes through a heating station to activate the film properties, and it is then pre-stretched in the sealing die.



FORMSHRINK

The FormShrink process uses special, extremely shrinkable thermoforming films. The finished packs pass through a shrink unit. The shrink properties of the film are activated by the heat effect of the hot water, and the film then lies tightly around the product..