

# MEAT RESEARCH NEWS LETTER

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## THE USE OF PACKAGING FILMS FOR CHILLED FRESH MEATS

Increased sales of packaged meats, together with the popularity of aged beef and the possibility of exporting chilled packaged meat, demand more of packaging as an aid to handling and distribution. The technical advantages of packaged meats are the preservation of appearance, flavour, moisture and, in some cases, an increase in shelf life.

### PACKAGING MATERIALS

A large variety of packaging films is available and new types are constantly being developed. Selection of a particular type is based on the following main considerations bearing in mind the cost, the required storage life and the temperature of storage:-

#### GAS PERMEABILITY

Film materials differ widely in their gas permeability properties. A rough classification of some films of comparable thicknesses can be made according to their oxygen permeabilities at high relative humidity levels.

##### High Permeability

- \* Polyethylene
- Polyvinyl chloride
- Polystyrene
- Regenerated cellulose (plain or coated with nitro cellulose)
- Polypropylene
- \*\* Rubber hydrochloride

##### Low Permeability

- Polyamide (nylon)
- \*\*\*\* Polyester
- \*\*\* Vinylidene chloride-vinyl chloride copolymers
- Regenerated cellulose (coated with above copolymer)
- Aluminium foil laminates

Where two or more films are combined by coating or laminating, the permeability of the combination is similar to that of the least permeable member.

The storage life of a package is related directly to the bacterial load at the time of packaging and the temperature conditions under which the product is held. The problems in packaging fresh meats are that of colour stability and bacterial spoilage and the requirements for the control of each are sometimes mutually incompatible:-

(i) PERMEABLE FILMS

Films with high permeability to oxygen are commonly used for short term storage where the most important consideration is appearance of the product.

Satisfactory development of the bright red colour (oxymyoglobin - refer News Letter 69/4) occurs at oxygen percentages comparable to that in air. This means that the higher the permeability of the films to oxygen, the better will be the colour of the meat.

Storage temperatures as close as possible to 29.5°F (but not below) are desirable to give maximum shelf life and optimum colour. Temperature should always be maintained below 45°F to prevent the growth of food poisoning organisms, such as Salmonella.

The shrink and stretch type films further improve package appearance by clinging closely to the products.

Films permit some loss of moisture by permeation but should be well sealed to guard against excessive moisture loss. Because of the reduction in surface moisture evaporation, bacteriological spoilage of these wrapped meats in air is likely to occur sooner than with unwrapped meats, where more weight loss is incurred. "Weep" will occur in any film and absorbent trays are commonly used to prevent free fluids from detracting from the appearance of packages.

\* Such as the product sold under the name of "Polythene" and "Zendel" film.

\*\* Such as the product sold under the name of "Pliofilm".

\*\*\* Such as "Cryovac S", a product of W.R. Grace and Co., "Glowrap Shrinkbags", supplied by Globus Casing Co. Pty. Ltd., and "Saran", a product of Dow Chemicals (Aust.) Ltd.

\*\*\*\* Such as "Mylar", a product of Dupont, and "Melinex", a product of I.C.I.A.N.Z. Ltd.

Extended storage life comparable to that of vacuum packed meats in impermeable bags can be achieved by controlled atmosphere storage in gas tight chillers using atmospheres of 25% carbon dioxide. In this atmosphere the red meat colour is fairly well maintained because the oxygen level is still relatively high. Above 5% oxygen no more surface browning occurs than that experienced in air.

(ii) IMPERMEABLE FILMS

Meat packaged in films of low oxygen and carbon dioxide permeability has extended storage life and the development of rancidity is inhibited.

The composition of the gaseous atmosphere inside an impermeable package determines, to a great extent, the storage life of the meat and reflects both the efficiency of the packaging process and the performance of the wrapping films. Perfect seals are essential and the lower the permeability of the film to gases, and the lower the oxygen concentration and higher the carbon dioxide concentration in the pack, the longer will be the storage life.

For maximum storage life, temperatures should be as close to 29.5°F as possible, and definitely not above 36°F.

Vacuum Packaging

Under the conditions of low oxygen percentage, the myoglobin in meat is in the reduced purple form and this colour at present has undesirable sales appeal. Although the bright red colour will return if the vacuum packaged cuts are opened, once opened the meat will only have a very limited storage life as the oxygen/carbon dioxide levels inhibitory to bacterial spoilage are lost.

Two types of vacuum packaging are used:

(a) Evacuation and Sealing without a Chamber.

Evacuation is performed via a tube. The vacuum produced is not as good as that achieved by the chamber system, the amount of oxygen usually falling to about 1 - 2% of the final gas composition.

However, the vacuum employed reduces the air content in the bag to a level such that the carbon dioxide subsequently released from the meat builds up to around 20% of the gas composition. It is this carbon dioxide build up in the bag which is important in retarding the growth of bacteria. Vacuum packaging should therefore be done within ½ hour of boning or cutting so that carbon dioxide is not lost to the air.

Due to the reduction in head space, and consequent higher carbon dioxide concentration, heat shrunk bags give a slightly longer storage life than non-shrink bags. At 30.5°F, meat in sealed bags will have a safe shelf life up to about 7 weeks. At 35°F, the meat would keep for about 5 weeks.

(b) Vacuum Sealed in a Chamber.

The package to be sealed is completely enclosed in a chamber, which is then evacuated and the package sealed prior to its release from the chamber. In this process, bacteria are retarded by the same action as above.

Reduction of oxygen concentration does not affect the normal spoilage organisms until its level falls below 0.8%. If a vacuum is such that the resulting oxygen level is less than 0.8%, this low oxygen content ensures better retardation of bacterial growth than evacuation without a chamber, where only the carbon dioxide has an inhibitory effect. At this oxygen level there will be less browning than produced in method (a), but to prevent any browning, oxygen levels of less than 0.2% are needed.

### Gas Packaging

Either pre-made pouches or roll stock films are used. The package containing the meat is flushed with an inert gas to displace the air, and then sealed. A step involving evacuation may be used in conjunction with this gas flushing step. It is important that the operation takes place as quickly as possible after boning or cutting.

Two gases, or a mixture, are commonly used:

(a) High purity grade Nitrogen.

Flush with oxygen-free nitrogen to aim for a residual oxygen level in the pack of 0.2% or less. This will give storage life equivalent to about 25% carbon dioxide (i.e. up to about 6 weeks at 35°F). In this atmosphere there will be minimum browning and the meat is purple in colour but on exposure to air will return to its original red colour.

(b) Carbon dioxide.

Flush with 20% carbon dioxide in air to give about 20% carbon dioxide in the pack at the time of sealing. Within a short period this level can build up to 25 - 30%. Concentrations of carbon dioxide over 30% can cause a greyish discolouration of the meat and should be avoided.

(c) Combination of Nitrogen and Carbon Dioxide.

A suitable mixture is 20% carbon dioxide with 80% nitrogen. The flushing should aim to reduce the final oxygen level in the pack to 0.2% or less. Colour will be similar to (a) above, using Nitrogen.

With a residual oxygen level of 0.2%, this method will give longer storage life than the two previous methods because of the dual action of high carbon dioxide with low oxygen concentrations.

MOISTURE PERMEABILITY

Most films minimise evaporative weight loss. However, even in properly sealed bags some weight loss will occur, but this is less than 0.2% in 2 weeks and is not detectable on the common meatworks scales.

It is usual to select a film which is sufficiently permeable to moisture vapour to prevent unsightly condensation within the package, but not so permeable as to lead to excessive weight loss. Shrink and stretch films which cling tightly to the meat largely eliminate the condensation problem.

GENERAL

Packaging, properly used, opens up new sales outlets. However, the advantages of packaging will be lost if the product is not produced, transported and sold under proper conditions of sanitation and refrigeration. Enquiries on any aspect of this subject are welcome.

NEXT ISSUE will be:

"The Use of Films for Packaging Cured and Processed Meats".