

PACKAGING OF MEAT AND POULTRY PRODUCTS

The meat industry is an important sector of food industry in the world and comes in the first five ranked agricultural commodities like rice, milk, wheat etc. However, in India, this industry is not so developed due to religious taboos and economic conditions. India is the largest producer of animals in the world. Both animal husbandry and meat industry have a great socio-economic and cultural importance in the country.



Frozen Meat and Poultry Products in Flexible Pouches and Pouch In Carton

Though India possess 48% of the world's animal population comprising about 209 million cattle, 92 million buffalo, 121 million goats, 56 million sheep, 16 million pigs and 407 million poultry, it shares less than 1% of world's total meat production. Though 70% of Indian population is considered non-vegetarian, the per capita meat consumption is hardly 2.5 kg/annum due to several seasons. India produces 4.7 million tonnes of meat valued at Rs. 15,500 crores annually, which is only 2.13% of the 221.15 million tonnes of meat produced in the world.

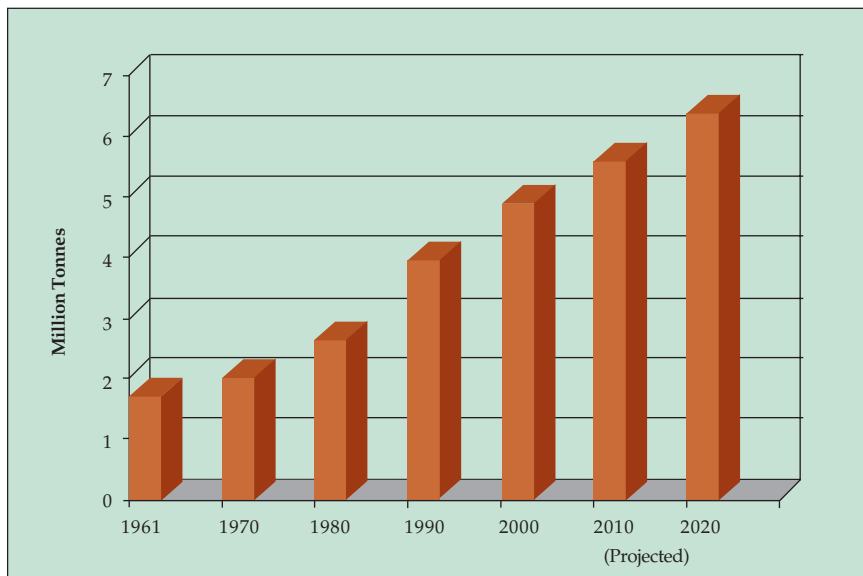
The current and projected production of meat / meat products and poultry in India is given in Table 1 and Figure 1.

TABLE 1
Production of Meat Products & Poultry in India ('000 tonnes)

	1994	1995	1996	1997	1998	1999	2000	2001
Mutton & Goat Meat	637	647	669	670	675	800	825	850
Pork Meat	366	420	420	420	420	464	480	495
Buffalo Meat	1200	1204	1204	1205	1210	1250	1270	1300
Poultry Meat	507	479	479	527	540	559	575	594
Other Cattle Meat	1290	1292	1292	1292	1295	1295	1300	1305

[Source: Ministry of Food Processing Industry – Annual Report (2001-02)]

Figure 1: Production of Meat in India



[Source: Faostat]

Meat and meat processing industry in India is growing steadily with the increasing urbanisation, quality consciousness and change in food habits and hence there is a market for scientifically produced meat products. There is also a growing demand for processed, packaged, convenience and ready-to-eat or ready-to-serve meat products that require minimal preparation.

The meat and meat products can generally be classified as fresh meat, frozen meat, cured meat, thermoprocessed meat and dehydrated meat products. The packaging requirements could vary across these product groups.

Importance of Meat Packaging

Food packaging is an integral part of food processing and a vital link between the processor and the eventual consumer for the safe delivery of the product through the various stages of processing, storage, transport, distribution and marketing. All over the world, the consumers are showing greater awareness towards food packaging as it provides awareness on the quality, quantity and the hygienic standards. A very important aspect of meat preservation is the suitable packaging of the product. The main purpose of packaging is to protect meat/meat product from microbial contamination, effect of light, oxygen or any physical damage or chemical changes. The selection of the packaging material has to be done very carefully to protect the different physico-chemical properties like nature of pigments, sensory attributes and microflora.

The purpose is to retard or prevent the main deteriorative changes and make the products available to the consumers in the most attractive form. However, initial quality of the meat has to be very good because packaging can only maintain the existing quality of meat or delay the onset of spoilage by controlling the factors that contribute to it. The product, therefore, is

only protected for a limited period determined by the system that is used. Thus, meat and meat products need a specialised package profile depending upon the type of processing, condition of storage and distribution.

With respect to each product group classified above, the packaging requirement and types are discussed separately.

Packaging of Fresh Meat

Packaging Requirements

Fresh meat is highly perishable and a biologically active item. The quality of fresh meat is affected by the growth of micro-organisms, enzyme activity and by oxidation. The microbiological activity continues even after refrigeration and packaging, though at a reduced rate.

The factors that make fresh meat unsaleable are changes in colour, odour, taste and texture. The pigments present in fresh meat are proteins like hemoglobin and myoglobin. Hemoglobin does the function of transfer of oxygen from the blood and myoglobin acts as a storage mechanism of oxygen in cells. Myoglobin has a purple red colour, which is the characteristic colour of fresh meat when it is first cut. In presence of oxygen, there is formation of oxymyoglobin, which imparts a bright red colour to the meat. In the absence of oxygen, oxymyoglobin gets reconverted to myoglobin.

An undesirable brown colour is formed due to metamyoglobin when meat gets exposed to air for a few days. Yet another form of discolouration on the surface of the meat, which is dark reddish-brown colour is due to loss of moisture. Dehydration of meat on the surface results in concentration of the pigments. Further concentration of pigments occurs, when the interior moisture containing dissolved pigments migrates to the surface and evaporates.

Another factor, which accelerates desiccation and oxidation of meat, is ultraviolet light. Undesirable flavours, odours and textures can occur due to the action of enzymes, molds, bacteria and oxygen if they are not properly controlled. During the storage of fresh meat, the flavour / odour may get affected due to the pick-up of foreign odours or as a result of oxidative rancidity. Hence, the principal role of fresh meat package is:

- To prevent moisture loss
- To offer the product to the consumers in most desirable colour-red bloom
- To prevent further bacterial contamination of meat
- To arrest pick up of foreign flavour and odour by meat
- To control oxygen transfer

To prevent dehydration, a relative humidity of 85% to 95% is required during storage. This can be achieved by use of a packaging material, which has a good water vapour barrier. The material should also prevent absorption of odours and flavors from external sources. The control of oxygen permeation requires a compromise between development of ideal colour and prevention of oxidative rancidity of fats. Therefore, it is recommended to use a plastic film with moderate oxygen barrier properties.

In order to retain the desired red colour of the meat, a packaging material with good oxygen permeability of 5000ml O₂/m²/24 hrs/10 atmosphere at 24°C with 100% RH inside the pack and 52% RH outside the pack is required.

Temperature has a very strong influence on the spoilage of meat due to bacteria or molds. Proper storage conditions and selection of good packaging film can help accomplish these objectives. Fresh meat should be stored at 0°C and 85 to 90% RH.

Packaging Materials and Techniques

- **Tray with Over-wrap:** Retail cuts of fresh meat are generally placed in rigid trays of expanded polystyrene or clear plastic trays, over-wrapped with transparent plastic films. The advantages of using these trays are that they are non-absorbent and aesthetically appealing. Usually blotters are kept at the base of the tray to absorb meat juice. The over wrapping film should have excellent optical properties. Cellophane coated with nitrocellulose on one side has been in use for wrapping fresh meat for a long time. The un-coated side is kept in contact with the meat. Moisture saturation on the inner side of the film increases its oxygen permeability, while nitrocellulose coating on the outer side prevents excessive moisture loss to the atmosphere. Another grade of cellophane with polyethylene coating on one side is used to pack irregular shaped meat cuts.



Plastic Trays with Peelable Lids for Ready-to-Cook Poultry Products

LDPE may also be used for fresh meat packaging. At gauges lower than 0.001 in, it is sufficiently permeable to oxygen and provides a suitable moisture vapour barrier. One problem, however, has been the condensation of moisture on the inner surface of the polyethylene.

In order to avoid this, LDPE film with minute holes is used. By modifying LDPE with Vinyl acetate a good clear film can be made, which has suitable oxygen permeability. Polyvinyl chloride is also used for fresh meat packaging. It accounts for an estimated 95% of all applications. The film is highly plasticised in order to provide oxygen permeation and contour wrapping. Biaxially oriented polystyrene film is also used to pack some fresh meat packages. Its clarity and permeability provides an aesthetically pleasing and functional package, but it is not durable and has sealing problems.

Meat thus wrapped, can be kept for approximately 10 days at a temperature of 0°C before it becomes microbiologically unacceptable. However, it would be un-saleable in less than half this time because although still edible, it changes colour from red to an unattractive brown. If during storage, there are fluctuations in temperature up to 5°C (which is quite likely commercially) the actual shelf-life would be only 2 days. The storage life of meat is dependent on the initial level of bacterial contamination and the temperature during storage. Generally, therefore pre-packed fresh meat are refrigerated

as near as possible to -1°C , which is the lowest temperature at which meat can be stored without freezing it.

- **Shrink Packaging:** Plastic Shrink films are used for wrapping large and uneven cuts of fresh meat. It is a technique in which heat shrinkable polymer film is shrunk around the meat product by application of heat to achieve a skin-tight and compact pack. The packaging film should have structural strength. It should be a good water vapour barrier and be capable of withstanding storage temperature of about -45°C .

The advantages of plastic shrink film include neat appearance, ease in handling and a contour fit. Hot tunnels are used to effect a tight wrap. Heat shrinkable polyvinyl chloride, polypropylene, irradiated polyethylene PVDC and rubber hydrochloride are used to shrink wrap fresh meat.

- **Vacuum Packaging:** This technique is used for packaging of primal and sub-primal cuts of buffalo meat. In vacuum packaging, the product is filled in a bag/pouch, air is withdrawn either by nozzle vacuuming or by chamber vacuuming and the bag/pouch is heat sealed thus storing the product in an air free environment. The plastic film used for vacuum packaging must have a high resistance to gases and water vapour with perfect seals and good mechanical strength. Since vacuum packaging provides a barrier to the product from oxygen and moisture, it is suitable for a period of 3 weeks. The most commonly used film for fresh meat vacuum packaging is PVDC (poly vinylidene chloride). It offers low oxygen permeability and shrink characteristics so that large cuts can be kept for up to 21 days with minimum loss of moisture. Typical packaging materials used are:



Plastic Pouches for Vacuum Packed Poultry Products

- Polyethylene / co-polymer coated cellulose film laminates
- Polyester / polyethylene film laminates
- Polyamide / polyethylene laminates

These are usually used as sachets with PE inside to promote efficient heat seals

- Laminates of plastic film with aluminium foil
- PVDC co-polymer films
- EVA / Saran / EVA laminates
- Nylon / EVA / laminates
- PVDC / Polyester / PVDC / PE laminates
- LDPE / BA / nylon / BA / LDPE

Vacuum packaging is more a means of keeping meat at better level of quality than the means of increasing shelf-life, because it is virtually impossible to remove all the oxygen (small

quantities remain trapped within the product). Also, some anaerobic organisms, which are not affected by oxygen are not reduced.

A shelf-life of up to three weeks for fresh meat is achieved by vacuum packaging, but it is not popular at retail level because of purple red colour of meat. During the period of three weeks, the enzymes in the meat continue the process of tenderising. At the end of the storage period the meat blooms. Vacuum packaging ensures a life of 8-10 weeks at 0°C for buffalo meat. Lamb and pork have a short life as compared to beef. Lamb has higher pH while pork has higher initial load of bacteria. However, vacuum packaged boneless joints are reported to have a shelf-life of 2 weeks at 1°C.

Vacuum packaging in cryovac barrier bags is also used for storage and transport of fresh meat products.

- **Skin Packaging:** Another development that offers advantages for presentation as well as packaging design variety is skin packaging. The process allows the packaging film to conform exactly to the profile of the product. This gives rise to many opportunities for enhanced product presentation as well as further improving the integrity of the pack itself. In a skin pack, the product becomes the die for the thermoform packaging operation. The semi-rigid bottom web may or may not be thermoformed. The top web is heated in an evacuating chamber until it is near its melting point, at which it drapes over the product and forms a skin around all the contours. Upon sealing and cooking, it retains its new shape, ensuring intimate contact with the product, irrespective of surface irregularities. Skin packs are prepared with an oxygen barrier plastic film.
- **Modified Atmosphere Packaging:** The use of MAP technology in meat industry has shown increasing trend during the past decade. MAP extends the shelf-life of meat and meat products under refrigerated storage and maintains, colour, texture and flavour of the product for a considerably longer time in flexible plastic films. Application of MAP improves shelf-life of raw chilled meat with reference to colour, delaying bacterial spoilage and minimising exudate loss.

Meat requires different conditions for packaging, beef needs high oxygen content to maintain a bright brick-red colour. Chicken needs little oxygen and reduced amount of carbon dioxide. Pork with its high fat content needs less oxygen and some nitrogen for glow.

MAP involves placing fresh meat in an environment in which the oxygen availability is altered from that in the air. This is commonly done either through the removal of air/oxygen by vacuum and then back flushing with carbon dioxide, nitrogen or a combination of the two. Carbon dioxide inhibits the growth of typical aerobic meat spoilage micro-organisms. Carbon dioxide also inhibits mold growth, but the same is true for complete nitrogen flush and vacuum packaging in which the oxygen is almost totally removed. In all three processes, low oxygen availability atmosphere are created, inhibiting aerobic meat spoilage organisms. It has been reported that, in general, the use of 20% carbon dioxide and 80% oxygen is a good proportion with respect to balancing the attractive meat colour and retarding the bacterial growth thus extending the shelf-life. A mixture of 70% oxygen,

20% carbon dioxide and 10% nitrogen at 0°C slows bacterial growth so significantly that microbially caused discolouration, sliminess and aroma changes are eliminated. A mixture of 80% carbon dioxide and 20% nitrogen is better bacteriostatically, although some colour loss occurs. Fresh pork in 10% carbon dioxide can be stored for a period of 40 days at 4°C.

Similarly, the blends of gases containing 90% carbon dioxide and 10% nitrogen; 85% carbon dioxide and 15% nitrogen are equally effective in providing packages with good colour retention, good bacterial check and good product and package appearance. The typical gas mixtures used for some of the meat products are given in Table 2.

TABLE 2
Typical Gas Mixtures used for some of the Meat Products

Product	Temperature in °C	O ₂ %	CO ₂ %	N ₂ %
Fresh Meat	0 – 2	70	20	10
Cured Meat	1 – 2	0	30	70
Pork	0 – 2	80	20	0
Poultry	0 – 2	0	20 - 40	80 - 60

Changes in meat, fish and poultry as brought about by modified atmosphere are given in Table 3.

TABLE 3
Changes in Meat, Fish and Poultry as brought about by Modified Atmosphere

Changes	Results
Enzymatic ageing process	unaffected
Microbial spoilage	increased CO ₂ reduces growth of aerobic spoilage organisms by penetrating membranes and lowering intracellular pH
Fat oxidation	reduced O ₂ reduces oxidation of fats, although oxidation can still occur at low O ₂ tensions
Oxidation of myoglobin	increased CO ₂ promotes metamyoglobin formation and colour darkening.

For these types of packages, the packaging film should have good gas barrier and sealability properties and have optimum clarity and antifogging properties so that packs maintain their clear appeal in or out of the chill display. For most MAP applications, conventional multi-layer, high barrier films are used. The various types of packaging films used for MAP of different meat products are given in Table 4.

TABLE 4
Plastic Packaging Films used for MA Packed Meat Products

Types of Film/Packaging Structure	Product
Curlon 863 (Nylon/Curpolymer-surlyn)	beef rib eye rolls of 1" thick
Nylon – Polyester Vacuum bags B 540, Cryovac, W.R. Grace	ground beef
Saran coated PVC bags	beef strip loins
PA80/PE 100-PE 100/PA80/PE 100	smoked pork loin
Mylothene 12/80/5	sausages
PETP/X/PE/X, 12/5/70/5 laminated plastic bags	fresh pork chops
Thermoformed plastic pouches (lower part PVC/PE, 250/70 and cover PETP/X/PE, 12/5/70)	processed ham
Cryovac barrier bags	ground beef patties
Foil laminate pouches	boneless pork loin

To attain shelf-life extension in packaging and distribution of fresh meat in MAP, it is very important that temperature be maintained as near to 0°C as possible. As compared to vacuum packs, gas packed products have a better appearance but have a comparatively shorter life. These packages also require more space during storage and use more packaging material. In vacuum packs, since the drip loss is negligible, higher shelf-life can be attained. The disadvantages of vacuum packs are the unattractive purple colour of the meat and the problems of packaging meat cuts with bones, which can pierce through the film.

Packaging of Frozen Meat

Major portion of exports of meat from India is in frozen form. Preservation of meat by freezing, offers the greatest advantages of increase in shelf-life, inhibition of bacterial growth and preservation of fresh texture and flavour. If frozen meat is not properly packed there is continuous dehydration from the surface resulting in freezer burn. This condition affects the surface texture and colour. Meat fat is also prone to the development of oxidative rancidity if a good oxygen barrier is not used. Hence, frozen meat needs protection against:

- Dehydration and loss of surface texture
- Moisture loss
- Temperature fluctuations
- Rancidification
- Pick up of odours / flavours
- Expansion and contractions which occur during freezing and thawing

Packaging Requirements

A suitable packaging material must, therefore, have a very low moisture vapour and oxygen transmission rate. The material should also be durable at freezer temperature, have very high wet strength and be impermeable to odour and flavours.

Packaging Materials

Plastics are amongst the most commonly used materials for packaging of frozen meat. Generally, low density polyethylene (150 - 200 gauge) is used for this purpose as it provides adequate clarity and is stable at low temperatures and is available at low cost. Polyester or Nylon / PE laminates and heat shrinkable low density polyethylene and PVC / PVDC co-polymer films also provide functional properties, besides giving neat appearance to the frozen meat cuts. Shrink packaging also allows convenient handling of the product.

Frozen meat may be in the form of chunks, minced or various cuts. The unit packs consist of 1,2,4 or 8 lbs in LDPE bags of 250 - 350 gauge. After placing the meat in the bags, the bags is folded and then the packed product is blast frozen at -40°C for a period of 4 to 12 hrs depending upon the size and shape of the package. After freezing, unit packages are packed and stored in corrugated boxes made of either paper or plastic, which are either waxed internally, or on both the surfaces. These boxes are stored at -20°C and the expected shelf-life for the product is around one year.

Packaging of Cured Meat

Cured meat like ham, bacon, luncheon meat and frankfurters have a shelf-life of 12-15 days at 4°C depending upon the degree of curing. The attractive pink colour present in cured meat is due to a pigment called nitrosomyoglobin. Although this enzyme is more stable than oxy-myoglobin, it is readily oxidised to metamyoglobin. The colour of the meat can fade due to the action of light.

Packaging Requirements

The role of package for cured meat is to minimise light fading by preventing the entry of oxygen and loss of moisture. The spoilage due to growth of bacteria and yeast is expected to be reduced by freezing or refrigeration. The package must be able to withstand low storage temperatures and also present an attractive appearance. The packaging material should be a good oxygen and water vapour barrier. It should be flexible enough to make a close surface contact with meat. The packaging film should be capable of lamination or co-extrusion and hermetical sealing.



Meat and Poultry Products Packed in Laminated Plastic Pouches

Packaging Materials

- **Over wrapping:** Short-term storage of cured meats can be done by over wrapping the product with polyethylene. Some other films like Poly Vinyl Chloride (PVC)

Polyvinylidene Chloride (PVDC) provide tight fitting over-wraps. Aluminium foil/paper laminate can protect the cured meats against light. Another type of package called the chub pack is used for some ground products. Chub packs are tubes stuffed with soft products which is twist tied or clipped at each end. The packaging film used for chub packs is generally polyethylene.

- **Shrink Packaging:** Ham and other large irregular cuts of meats are packed in shrinkable PVDC/PVC co-polymer films where the air is evacuated and the contour is over wrapped either by immersing in hot water (90 - 95°C) or passing through hot air tunnel to effect the shrink.
- **Vacuum Packaging:** For long term storage of bacon blocks, luncheon meat etc. vacuum packaging is the right choice. This technique assures a shelf-life of 5 months at 4°C and 6 - 8 months at -18°C. The following laminates are used for vacuum packaging:
 - Cellophane / PVDC / LDPE
 - Polyester / PVDC / LDPE
 - Polyamide / PVDC / LDPE
 - Metallised Polyamide / Ethyl vinyl acetate (EVA)
 - EVA / PVDC / EVA
 - Polyamide / LDPE / ionomer
 - PVC / PVDC / LDPE is used for packing sliced luncheon meat.

In all the above cases, plastics provide a wide range of packaging solutions.

Packaging of Thermo-processed / Cooked Meat

Most cooked meat are canned and have a long shelf-life of over two years. Thermal processing is usually done above 100°C by applying pressure. Generally, hermetically sealed rectangular tinfoil containers with easy open devices are used.

Meat products like patties, sausages, nuggets and meat balls are packaged in pouches made of polyethylene, polypropylene, PVDC, rubber hydrochloride etc. for short term storage testing for 10-12 days at 4°C.

Products like corned beef, corned pork, meat gravies, meat soups, liver sausages, chicken curry, boneless chicken etc. are hermetically sealed and cooked to make commercially sterile for long term storage at room temperature. Metal containers are used for this purpose. Canned meat products are shelf-stable for a number of years at room temperatures. Tinfoil is mostly used to pack these products. They are coated on the inner side with sulphur - resistant lacquer. Shallow drawn aluminium cans with internal lacquer are also used to pack some products.

Packaging of Dehydrated Meat

Dehydration is a successful means of preserving many meat products with proper packaging because they are highly susceptible to oxidation resulting in rancid odour. The

packaging materials used are tinfoil cans. Metal foil / plastic film laminates are used to pack compressed bars of dehydrated minced meat with inner cellophane and outer paper / aluminum foil / PE laminate. This pack is said to be shelf-stable for one year. Flexible pouches suitable for vacuum and modified atmosphere packages made from polyester / PE / Aluminium foil / PE or cellophane / PE / Aluminium foil / PE laminates are also used.

Packaging of Meat Products



Pouch-in-Carton for Ready-to-Cook Poultry Products

Various meat products like sausages, frankfurters, luncheon meat, corned beef, cooked ham, bacon, meat pies etc., are made from comminuted and seasoned meat blended with various cereals, binders, spices and preservatives. Their packaging requirements are similar to fresh meat such as trays and films, shrink film bags, envelopes and pouches.

Packaging Materials

Some varieties of smoked products such as sausages, salami, frankfurters are vacuum packed in pouches with or without trays or card board inserts. Sliced meat products like ham, bacon are loosely packed in a pouch or they are singled or stacked and vacuum packed. Some products like chicken leg masala, chicken-in-curry, meat-in-brine etc are packed in metal cans. The laminates used for vacuum packaging are combinations of cellophane / PVDC / polyethylene or polyester / PVDC / polyethylene. Some plastic films can be drawn into cavities, which make neat package for slices. These packages are made from combinations of polyethylene / PVDC / polyamide or polyester.

Packaging of Poultry

Poultry meat is high in protein, low in calories and easy to chew and digest, but poultry fat is unsaturated and is very prone to the development of oxidative rancidity. Shelf-life of poultry varies according to type of processing, nature of processing environment, initial flora and post-slaughter treatment.



Chilled and Frozen Poultry Products in Flexible Plastic Pouches and Thermoformed Plastic Tray

Packaging of poultry meat is undertaken immediately after the dressing operations are over. Unpacked refrigerated storage may result in surface dehydration, freezer burn, characterised by surface dis-colouration, tough texture and diminished juiciness as well as flavour loss. Poultry is usually packed as whole dressed poultry, cut up poultry and poultry organs. Dressed poultry have a shelf-life of 5-7 days at refrigerated storage conditions of 0-5°C.

Packaging Materials

- **Over-wraps:** Packaging of whole dressed chicken halves or cut-up parts are done in plastic films like polyethylene, polypropylene, PVDC, rubber hydrochloride or nylon-6. These are films of 150 to 200 gauge in thickness. Polyethylene is the most widely used packaging material in our country because of low cost and easy availability. These thermoplastic film sheets can be fabricated into bags. Each dressed eviscerated bird is inserted into a bag. Gilblet of individual bird is wrapped in waxed paper or parchment paper and placed into the body cavity before bagging. The problem of body fluid accumulation is avoided by putting an absorbent pad or blotter on the pack of each bird to soak up the liquid. The bag is then heat sealed or twist-tied or clipped shut.
- **Tray With Over-wraps:** Small whole dressed chicken, broilers, roasting chickens are placed in a polystyrene foam tray and over-wrapped with transparent plastic film. A blotter underneath absorbs the excessive meat juice accumulated. Chicken thus wrapped has a shelf-life of 7 days at 4°C in refrigerator.
- **Shrink Film Over-wraps:** Many thermoplastic films such as polyethylene, polypropylene, poly vinylidene can be biaxially oriented to stay stretched at ambient temperature. Dressed chicken is over-wrapped with such films and passed through hot air tunnel or dipped in water tub maintained at 90°C for a few seconds to effect shrinkage of the film.
- **Vacuum Packaging:** The ideal materials for vacuum packaging of poultry are laminates of polyester / polyethylene (PE), polyamide / polyethylene, PVDC co-polymer film, nylon/ EVA.
- **Modified Atmosphere Packaging:** In this technique, the atmosphere surrounding the product in the pack is modified by flushing carbon dioxide, nitrogen and oxygen alone or in combination. Mixture of 60% nitrogen and 40% carbon dioxide or 50% nitrogen and 50% carbon dioxide is ideal for modified atmosphere packaging of chicken meat.



Dressed Chicken Packed in Plastic Pouches

Modern Trends in Meat and Poultry Packaging

With the development of new meat products entering the market, high quality alternative packaging materials are also emerging. The consumer is becoming more discerning in his or her choice of food products and there is a trend, which shows a shift from traditional food items and eating habits. Some of the recent trends in the meat packaging industry are covered here.

Retortable Flexible Pouch

A retort pouch can be defined as a flexible package into which a food product is placed, sealed and then sterilized at temperatures between 110°C to 140°C. The finished product is commercially sterile, shelf-stable and does not require refrigeration. A retortable pouch

is made of a laminate of three layers held together by adhesive. The outer layer made of polyester, polyamide or oriented polypropylene provides support and physical strength to the composite.

The middle layer of aluminium foil acts as a barrier against water vapour, gases and light. The inner layer of polyethylene, polypropylene or PVC provides heat sealability and food contact. The different laminates used for a retort pouch are polyester / aluminium foil / modified high-density polyethylene or polyester / aluminium foil / polypropylene-ethylene co-polymer. A retortable pouch like the metal can, can be sterilised by heat and it has the advantage of lower cooking time as it has a thinner profile than metal cans. They are not required to be stored at refrigerator temperatures and are shelf-stable, as canned food. Also, these types of packages require less storage space and are lighter in weight as well.

Roast-in-bags

It is an oven stable vacuum skin package that can be used to cook meat at a temperature up to 204°C. It is fabricated from polyethylene terephthalate (PET) film due to its unusual properties such as it does not become brittle with age, has long shelf-life, has resistance to most chemicals and moisture and is dimensionally stable.

Microwave Packages

Convenience food fall into two categories, frozen and retortable. The current trend in frozen food is dual oven-ability i.e. products that can be heated in a microwave oven and conventional oven. Shelf-stable retortable food are better suited to microwave heating. Owing to the growing importance of microwave ovens, other materials are overtaking the conventional aluminium trays.

While selecting thermoplastics for dual ovenable packages, the critical properties to be considered are dimensional stability up to 200°C to 250°C, good impact strength at freezer temperatures and microwavability. Heat resistant plastic trays made from materials like polyester, polypropylene, nylon and polycarbonate can be used in combination or as monolayers. These trays are closed with heat-sealable lidding materials or over-wrapped or shrink wrapped or sealed inside a microwave bag. Thus, due to their flexibility of forming different shapes and sizes on in-line formation, rigid plastic trays dominate the microwavable packaging.

Polyester coated paperboard cartons are also used as microwave packages. These containers can be formed on a conventional tray making, carton forming and folding carton making machine. Crystallized polyester containers are also very popular for microwave packaging as well as for conventional oven cooking. These trays are very stiff and can be sealed in a high-speed tray sealing machine with transparent or non transparent lidding material. They are easy to handle, sturdy, attractive, cost competent and can be compartmentalised for multi-component food items. They are self-serving and reusable.

Cryovac Packages

Pre-cooked meat packages with shrink film are an innovation with equipment made and supplied by Cryovac. In this system, there is a double chamber machine. In the longer chamber the meat is placed in the film bag and the mouth of the bag is drawn into the smaller chamber.

In the longer chamber a low level of vacuum is just drawn to balloon the bag in order to eliminate formation of air pockets.

A high level of vacuum is then drawn into the smaller chamber where the mouth of the bag is placed. When both the chambers are at maximum vacuum, an automatic clipper closes the bag. The packaged meat is then sent to the shrink tunnel. Cryovac package forms a skin tight package. This together with the use of a film with low oxygen permeability stabilises the product and increases the shelf-life.

Studies Conducted at IIP

Shelf-life studies of some meat and poultry products were carried out at the Institute, using modified atmosphere packaging technology. The products considered for the study were:

- Chilled minced meat
- Salami
- Sausages
- Ready-to-cook chicken products (chicken drumsticks)

The shelf-life studies were carried out at refrigerated storage conditions of 0°C to 5°C. The products were packed by three different packaging systems viz.:

- Ordinarily packed
- Vacuum packed
- Gas flushed

The packaging materials used were:

- 1) 10 μ PET / 45 μ HDPE – LDPE – Co-extended
- 2) LDPE – BA – Nylon – BA – LLDPE
- 3) HDPE – LDPE – HDPE
- 4) HDPE – LLDPE
- 5) HDPE + LDPE (Blended)

100% Carbon dioxide was used for making gas flushed pouches.

Chilled meat and ready to cook chicken drumsticks were packed in material 1 and 2 by ordinary and vacuum packaging method. Salami and sausages were packed in materials 1 and 2 by all the three methods viz. Ordinary, Vacuum and Gas flushing. Materials 3,4 and 5 were used to pack chilled minced meat, salami & sausages by ordinary method only.

The shelf-life of the meat and poultry products in different packaging materials is given in Table 5. The results of the study indicate that vacuum packaging gives a better shelf-life for processed meat products as compared to ordinary/gas packaging.

TABLE 5
Shelf- life of the Meat and Meat Products in Different Types of Packs

Material	Chilled Minced Meat		Salami			Sausages			R.T.C. Chicken Drumsticks	
	Ordinary Pack	Vacu-um Pack	Ordinary Pack	Vacu-um Pack	Gas	Ordinary Pack	Vacu-um Pack	Gas	Ordinary Pack	Vacu-um Pack
10 μ PET 45 μ HD - LD Co - ext	3 days	4 days	16 days	28 days	28 days	18 days	63 days	24 days	12 days	28 weeks
LDPE - BA - Nylon - BA - LLDPE	4 days	7 days	20 days	35 days	35 days	19 days	63 days	24 days	14 days	31 weeks
HDPE - LD - HDPE	2 days	–	15 days	–	–	18 days	–	–	–	–
HDPE / LLDPE	2 days	–	15 days	–	–	18 days	–	–	–	–
HDPE + LLDPE	2 days	–	15 days	–	–	18 days	–	–	–	–

Conclusion

With continually growing demand for processed, packed, convenient ready-to-eat and ready-to-serve meat products, a variety of specialised package profiles are available depending on the type of processing techniques and storage conditions. From fresh meat to cured meat, from pork to poultry, the purpose of packaging is mainly to make the products available to the customers in the most attractive form along with maintaining the quality of the contents. Plastics are used in every form of packaging like trays, overwraps, shrink films, MAP and retort packaging. Plastics in the form of laminates, plain films, overwraps or retorts play a major role in imparting barrier properties and aesthetics to the packaging media. All in all, the use of plastics in meat and poultry packaging acts as one of the most important factors in the growth of food processing industry today.

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