THE SCIENCE WORLD
A Monthly e Magazine
ISSN:2583-2212
April, 2025 Vol.5(4), 6709-6713

Monograph

Packaging of meat and meat products

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Doi:10.5281/ScienceWorld.15186529

Abstract

Packaging plays a crucial role in connecting processors with consumers, ensuring the safe delivery of products—from fresh and cured meats to pork and poultry—throughout the various stages of processing, storage, transportation, distribution, and marketing. Plastics are predominantly utilized in various packaging forms, including trays, overwraps, shrink films, vacuum packaging, modified atmosphere packaging, and retort packaging. Recent advancements such as smart packaging, eco-friendly packaging, nano-composite material packaging, and biodegradable bio-based packaging are increasingly recognized for their commercial potential. The focus of new packaging solutions is primarily on enhancing food safety (by controlling microbial growth, delaying oxidation, and improving tamper visibility), maintaining product quality (by managing volatile Flavors and aromas), and promoting convenience and sustainability to align with global trends and consumer preferences.

Introduction

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. 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.

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Published 04/04/2025

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. 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.

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 unsaleble 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. 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

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Published 04/04/2025

- 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 flavours from external sources. The control of oxygen permeation requires a compromise between development of ideal colour and prevention of oxidative rancidity of fats. 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. 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. Biaxially oriented polystyrene film is also used to pack some fresh meat packages. Meat thus wrapped, can be kept for approximately 10 days at a temperature of 0°C before it becomes microbiologically unacceptable.

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.

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.

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Published 04/04/2025

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.

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 continous 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.

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 oxymyoglobin, it is readily oxidised to metamyglobin. The colour of the meat can fade due to the action of light.

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 tinplate 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.

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. 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.

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Published 04/04/2025

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.

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Published 04/04/2025