Modern Food Packaging Technologies: Regulatory Aspects and Global Trends

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Welcome to the NPTEL online certification course on Modern Food Packaging Technologies Regulatory Aspects and Global Trends. In the last two lectures, we have seen the packaging of meat and meat products. Now in the following lecture, we will be studying the packaging of poultry products and the topics which we will be covering is packaging of poultry products, global market of poultry products, packaging of poultry meat, packaging methods and materials, packaging of egg and modern trends in meat and poultry packaging. The packaging of poultry products, the packaging of fresh foods and egg products is done to protect them against contamination by dust, microbes, toxic substances or factors which influence taste, flavor and loss of moisture. Packaging should support to prevent spoilage, weight loss and enhanced consumer acceptance of the product.

Factors which impact self life of muscle foods may include both endogenous and exogenous factors in addition to sources of secondary contamination. The factors that affect the quality of poultry products are with respect to animal is that is animal specific factors, product specific factors, process factors and environmental factors. The animal specific factors include breed, genetics, age, feeding, husbandry, animal health, stress susceptibility, pre slaughter handling. Whereas the product factor includes nutrients, pH value, water activity value, marbling, salt content, texture, moisture, electrical conductivity and acidity.

These factors either singly in combination that affects the meat quality and microbial growth and the self life of the product. Whereas the process factor includes the hygiene, initial bacterial count, cross contamination, process technology, cooling technology, ripening, irradiation, heating technology and that environmental factors include the temperature, time, moisture, pressure, packaging, gas atmosphere, storage technology, logistic factors and light. The process factors that may influence the environmental factors and again these two factors either individually or in combination again controls the meat quality and microbial growth and in turn the self life of the product. The endogenous factors are pH, acidity, water activity or moisture content. Whereas the major exogenous factors are presence of atmospheric oxygen, microorganisms, storage temperature, exposure to sunlight and evaporation or desiccation.

The secondary contamination of muscle foods during slaughtering, carcass dressing, cutting and processing is unavoidable. Bacterial growth during storage cannot be altogether prevented by only use of packaging. However secondary contamination of these foods from sources such as contact with dust, dirt and unclean hands and equipment can be surely avoided to minimize or delay product deterioration. Now, the packaging of poultry products in that let us take the egg. The nature has given the egg a natural package that is the shell.

Despite its relative strength it is an extremely fragile product and even with the best handling methods serious losses can result from the shell damage. The complete structure of the individual shell has been given in the in this picture. The shell is covered with an external cuticle a membrane called cuticle followed by a hard white shell. And after the hard white shell there is outer shell membrane and again there is inner shell membrane all these four layers they protect it from various spoilage agents. Thus it requires that eggs be protected by the adoption of specialized packaging and handling procedures.

Eggs also need to breathe hence packaging material used must be permeable to oxygen. The material used must be clean and odorless to prevent portable contamination and tinting. Egg packaging materials can be reused, but care must be taken to possible damage odors and cleanliness. The packaging must withstand handling storage and transport methods of the most diverse kind and protect the eggs against temperature that cause deterioration and humidity. Consumers like to see what they are buying especially if it is a fresh produce.

An egg package should be designed so that the customers not only know the product as such, but can also see the eggs they are buying. The global rendered poultry products market and it is expected the growth rate of 3.2 percent through 2027 and the expected market size of 7.63 billion US dollars. The rise in meat production is the main driver of the market.

In this the North America is the largest region in the market. The global organic poultry market, nowadays people are more concerned about the organic poultry or any product which is produced organically and it is expected to grow at the rate of 5.2 percent during or up to the 2027 with an expected market size of 12.65 billion US dollars by 2027. The consumer awareness about the health benefits of organic food including organic poultry is the main driver of the market and the Asia Pacific is the largest region in the market.

If we concerned about the India, the India produces about 65,000 million eggs per year and 3.8 million tons of broiler chicken per year costing about 90000 crores of rupees

estimated for the poultry market. Out of total non vegetarian food consumed in India 80 percent contribution is of chicken, 80 percent of the chicken consumption by the urban area. Poultry industries is consumption per year is 12 billion tons maize and 4 million tons of soybean meal they consume for the poultry feeding. Over wraps packaging of poultry meat, a packaging method and materials, the over wraps packaging of whole dress 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. The bag is then heat sealed or twist tied or clipped shut.

Tray with over wraps, a small whole dress 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 degree Celsius temperature in refrigerator. The 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 percent nitrogen and 40 percent carbon dioxide or 50-50 ratio of nitrogen and carbon dioxide is ideal for modified atmosphere packaging of chicken meats.

Shrink film over wrap, many thermoplastic films such as polyethylene, polypropylene, polyvinylidene can be biaxially oriented to stay stretched at ambient temperature. The dressed chicken is over wrapped with such films and pass through hot air tunnel or dipped in water tub maintained at 90 degree Celsius temperature for a few second to effect shrinkage of the film. Vacuum packaging, the ideal materials for vacuum packaging of poultry are laminates of polyester, polyethylene, polyamide, polyethylene, PVDC copolymer films, nylon and EVA. Many factors must be taken into consideration during packaging of eggs. The packaging of eggs, many factors must be taken into consideration during packaging of eggs.

It is important to obtain information regarding the necessary requirements for a particular market such as quality maintenance, storage facility, type of transport, distance to be travelled, climatic conditions, time involved and costs. There are many different types of egg packages which are vary both in design and packaging material use. Packaging eggs with clean and odorless rice husks, wheat chops or chopped straw in a firm walled basket or crate decreases the risk of shell damage. It is also possible to pack eggs in a simple basket without cushioning material such as straw. Thus damage to the

eggs may occur more easily this kind of packaging may be fit for short distance transportation.

A very common form of packaging is the filler tray. The fillers are placed in boxes or cases after filling. Filler trays are made up of wood pulp molded to pack the eggs. They are formed so that they can be stacked one on top of the other and can be placed in boxes for transport. Filler trays also offer a convenient method of counting the eggs in each box without having to count every single eggs.

Usually a standard egg tray carries 30 eggs therefore, if a box holds 5 trays for example, the box has a total of 150 eggs. The cases may be made of swan wood, but they are more commonly made up of cardboard. A special care must be taken in stacking while using cardboard cases so that excessive weight is not placed on a case at the bottom of the stack. Fillers can also be made of plastics. The advantage of using plastic fillers is that they are reusable and washable.

The fillers can be covered with plastic films and be used as packages for final sale to the buyer. More importantly plastic transparent fillers facilitate the inspection of eggs without handling or touching the eggs. Eggs can also be packed in packages that are specific for retail sale. Each packages can hold 2 or 12 eggs. These cases can be made of paper board or molded wood pulp or plastic.

It is possible to pack eggs in a small paper board cases and cover them with plastic film. The advantage of using polystyrene egg cases are superior cushioning and protection against odors and moisture resistant to mold growth. Some cases are good for retailers and consumers. They are easy to handle by the retailers and customers can inspect the eggs. retortable flexible packaging, modern trends in meat and poultry packaging.

The retortable flexible pouch, this we have discussed in a last lecture about the construction of these retortable flexible pouch. A retortable pouch can be defined as a flexible package into which food is food product is placed sealed and sterilized at temperature between 110 to 140 degree Celsius. The finished product is commercially sterile, shelf stable and does not require refrigeration. A retortable pouch is made up of a laminate of 3 layers held together by adhesive. In the adjacent picture, it is given that it is made up of 3 or 4 layers which can go up to 7 layers of the different packaging materials and here a notch is there which allows us for the easy opening and the round bottom is made for the easily stand up the product.

The outer layer made up of polyester, polyamide or oriented polypropylene that provides supports and physical strength to the composite. The middle layer of aluminum

foil acts as a barrier against water vapor, gases and light. The inner layer of polyethylene, polypropylene or PVDC provides heat sealability and food contact. The different laminates used for retort pouch are polyester, aluminum foil and modified high density polyethylene or polyester, aluminum foil, polypropylene and ethylene copolymer. A retordable pouch like the metal can be sterilized by heat and it has the advantage of lower cooking time as it has a thinner profile than the metal cans.

They are not required to be stored at refrigerated temperature and are self stable at as canned foods. 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 sink skin package that can be used to cook meat at a temperature up to 204 degree Celsius. It is fabricated from polyethylene terephthalate film due to its unusual properties such as it does not become brittle with age, has long shelf life, has resistant to most chemicals and moisture and is dimensionally stable or microwave packages. Convenience food fall into two categories frozen or retardable.

The current trend in frozen food is dual oven ability that is products that can be heated in a microwave oven and conventional oven. Self stable retardable food are better suited to microwave heating. Owing to the growing importance of microwave ovens other materials are overtaking the conventional aluminum trays. While selecting thermoplastics for dual ovenable packages the critical properties to be considered are dimensional stability up to 200 to 250 degree Celsius.

Good impact strength at freezer temperatures and microwave ability. Heat resistant plastic trays made from materials like polyester, polypropylene, nylon and polycarbonate can be used in combination or as mono layers. These trays are closed with heat sealable leading materials or over wrapped or shrink wrapped or sealed inside a microwave bags. Thus due to their flexibility of forming different shapes and sizes on inline formation, rigid plastic trays dominate the microwaveable packaging. Laser coated paper board curtains are also used as microwave packages.

These containers can be formed on a conventional tray making, curtains forming and folding curtain making machines. The crystallized poly polyester 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 head high speed tray sealing machine with transparent or non transparent leading material. They are easy to handle, sturdy, attractive, cost competent and can be compartmentalized for multi component food items. They are self serving and usable, reusable.

Cryovac packages, pre cooked meat packages with shrink film are in 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 a smaller chamber. In the longer chamber a low level of vacuum is just drawn to ballooning 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 packages forms a skin tight package. This together with the use of a film with low oxygen permeability stabilizes the product and increases the self life. Thank you very much.