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. Dear friends, in the last lecture we have seen the packaging of yogurt, curd and butter. And now in this lecture we will be covering the packaging of cheese, ice cream and milk powder. Cheese is the generic name for a group of fermented milk based foods produced in at least 500 varieties around the world. Although some soft cheese varieties are consumed fresh without a ripening period.

The production of a vast majority of cheese varieties can be subdivided into well defined phases like manufacture and ripening. The despite differences in detail in the manufacturing processes used for individual varieties the conversion of milk into cheese generally comprise four stages. And that is the coagulation, the physicochemical changes in the casein micelles due to the action of proteolytic enzymes and or lactic acid lead to the formation of a protein network called coagulum or gel. Followed by drainage the separation of whey after mechanical rupture of coagulum by molding and in certain cases by pressure to obtain a curd.

Then salting incorporation of salt by deposition on the surface or within the body of the cheese or by immersion in brine. Followed by ripening the biochemical changes in constituents of the curd brought about by the action of enzymes mostly of microbial nature. The adjacent figure that has given the flow chart of manufacturing cheese the raw milk whether it is pasteurized or unpasteurized both can be used it can be acidified with the starter culture followed by addition of whey, the rennet and the coagulation is formed followed by filtration by which separates the whey then salting and shaping and then aging that is the ripening of the cheese. The packaging of cheese is mainly done to protect the cheese at the time of storage and transportation. Traditionally cloth was used with wood to give support and protection, but the invention of polymers or plastics has revolutionized cheese packaging.

Cheese manufacturing is nowadays highly mechanized and at the same time many developments are taking place in the area of cheese packaging also. Cheese is packaged mainly in two forms packaging cheese for storage and ripening that is bulk packaging and packaging for consumers that is retail packaging. For bulk packaging of cheese it is

either paraffined or vacuum packed in flexible film. For waxing the cheese can be lifted by means of suction and half immersed in wax and then other half can be immersed. For vacuum packaging there are now available vacuum packaging machines, gas flushing machines, over wrapping machines and vacuum skin packaging machines.

Paraffining is now completely replaced by film packaging at as it causes considerable loss of cheese while removing paraffin. Many cheap and easy to supply films are now available. Film packaging of cheese this has become synonymous with rindless cheese. In the latter green cheeses of uniform size and shape are ripened in bags made of plastic films. The wrapped cheese may be placed in a wooden box or jig to preserve its shape.

If the cheese is made and ripened in the conventional way it may be cut into retail portion and wrapped by such method as cryo-wag. Desirable properties of films for packaging of cheese. The film must be strong so that it does not tear or change its property when rubbed against a sharp point. It should be easily applied and sealed. It must be impervious to water vapour and oxygen.

When the film is in contact with cheese it should not change its inherent properties. The material must be chemically inert and non-toxic for the human beings. Plastic film packaging of cheese is applicable to varieties except such extreme types as cottage which has very high moisture content and as a formation which is very low moisture content. There are many advantages and few disadvantages of film packaging which are summarized as follows. The merits it affords a considerable saving in labour.

It protects the cheese from attack of mould, insect, rodents and fault inducing microorganisms. It is easily applied and method can be readily mechanized. There is practically no loss of moisture and of weight in the cured cheese. In traditional ripening the loss may be 3 to 7 percent which can go even up to 12 percent. The method permits and is suitable for packaging small quantities which make handling and retail trade easier.

The method is most easily used for rectangular blocks. It is cheap and convenient. Humidity control is unnecessary during ripening and storage. More cheese can be stored in given volume. Turning is unnecessary during ripening.

It permits rindless curing so that whole of the cheese can be eaten when rind is formed as in traditional method the loss can be as high as 10 percent. At the same time there are certain demerits that is not at all technical problem in film packaging have been solved. For example, failure to obtain a perfect seal and to remove all air may result in mould growth. The moisture content of the cheese at packaging must be less than for traditional

packaging and must be carefully standardized. Failure to do so may lead to the growth of 10 producing microorganisms.

The ripening process in some cheeses such as Camembert may be affected. The film does not always give the same mechanical protection to cheese as traditional methods. The most careful attention to detail is necessary in film packaging. The retail packaging of cheese. Retail packaging is an important aspect which affects not only the shelf life of the cheese, but also its marketability.

Cheese is available in the form of slices, cubes, tubs, paper board cartons with foil overlaps etcetera. These are available in different retail sizes like 100 gram, 200 gram etc. With the developments taking place packaging technology cheese packaging is also revolutionized. Active packaging and modified atmosphere packaging is being used for retail cheese packaging. Now the packaging materials which are used for the cheese packaging.

Different systems have been employed for the packaging of cheddar cheese and other British varieties. These may include the following. Pukka film, this type of packaging material consists of a wax cellulose laminate. The first the cheese block is wrapped with the laminate followed by it is over wrapped with the wax cellulose and finally, the cheese is placed in a chamber for sealing by the application of heat and pressure. Uniblocc system, the press cheese is wrapped with a plastic film for example, certain and over wrapped with a layer of paper prior to packing within 6 wooden slats.

The cheese is compressed within the slats by a specially designed machine and the pressure is maintained by placing 4 metal straps around cheese. In some instances the wrapped cheese is placed within a thin cardboard box before final packaging. This box serves as a dispatch unit when the cheese leaves the factory and the wooden slats are retained on the premises. Store pack, the package cheese for example, in a vacuum pouch or heat shrink bag is wrapped in a thin cardboard box and is placed in a wooden box with a loose cover. The later piece is held on to the box using a plastic band for strapping.

On dispatch the strap is removed from these boxes which are retained in the factory. Vacuum pouch, different types of plastic film laminates can be used to package cheddar cheese and such pouches should provide a barrier against oxygen ingress and moisture loss. One such example is the diolon pouch which consists of 20 micrometer nylon and 60 micrometer polyethylene. Heat shrink bags, an example of such a bag is the cryo bag BB4L bag which consists of three main layers. Polyolefin, a PVDC barrier layer against oxygen and moisture and a cross linked polyolefin.

Gas production in cheddar cheese during the maturation period is considered a serious problem and a quick remedy is to package the cheese in carbon dioxide permeable material for example, cryo vac BKIL bag. Now, the packaging of ice cream as per Food Safety and Standards Regulations 2011, ice cream, kulfi, chocolate ice cream or softy ice cream means the frozen milk product confirming to the composition specified obtained by freezing a pasteurized mix prepared from milk or other products derived from milk or both with or without addition of nutritive sweeteners and other permitted non dairy ingredients. The said product may contain incorporated air and shall be frozen hard except in case of softy ice cream where it can be frozen to a soft consistency. Why do we package ice cream? To prevent freezing burn, ice cream packaging acts as a barrier against freezer burn which occurs when air comes into contact with the ice cream. Freezer burn can negatively impact the taste and appearance of the product, the brand visibility and promotion.

Well designed packaging serves as a promotional and e-commerce marketing tool showcasing the brand logo, design and other branding elements. One can attract customers with an eye catching ice cream packaging. Extending self life, proper packaging can extend the self life of the ice cream by providing a protective barrier against external factors that could cause spoilage or degradation. The factors to be considered in selection of ice cream container. The first is the cost protection against moisture loss, temperature loss and contamination.

It should also provide the ease of handling and disposal that is case of opening and recloser if required. Effect upon the quality of ice cream, neatness of appearance, advertising that package may carry, storage problems, point of consumption in relation to the location of the factory and size of unit desired. Now the packaging materials used for the ice cream packaging. The bulk container, the three types of packaging materials used for bulk containers for ice cream include fiber board containers, metal containers, plastic that is the polyethylene containers. Now the LDPE, low density polyethylene is heat sealable, inert, odor free, shrink and when heated.

It acts as a barrier to moisture and has high gas permeability. It is less expensive therefore, widely used. Has ability of fusion welded to itself to give good tough liquid tight seals. The HDPE, the high density polyethylene container has been also used for packaging of ice cream. The benefits of HDPE include weather resistance, malleability, light weight, cost effective, hygienic, recyclable and FDA approved.

Cone sleeves, cone sleeves are aluminum covered paper and printed for brand promotion. May accommodate the waffle cone as per design and capacity. Glass bottles

and jars used for 100 ml to 500 ml provide excellent protection to the product. Not in much use because of their facility and high weight. Higher cost is one of the drawbacks.

The corrugated paper box, mostly used for ice cream brick packaging under refrigerated conditions. It can be recycled, economical, easy to print, may take any shape and light weighted. Wrapper are typically made of multiple materials like mixture of plastic, aluminum and paper and polypropylene film and cellophane. The advantages are they are economical, easy to print, may take any shape and light weight. The steel and tin cans, these are used for bulk package of 500 ml to 1000 ml can.

Properly lacquered tin cans are most must be used, must be sealed properly to prevent oxidation in the product. Higher cost is one of the drawbacks. Now, the packaging of milk powder. The rising demand of milk powder has offered the cascade of packaging demand in the production chain of manufacturing sector. Milk powder packaging is a type of packaging solution which is carried out to pack powdered milk into suitable bags, pouches, cans, bottles etc.
Milk powder packaging a constant need if one really wants to consume adequate nutritional content. Milk powder packaging is suitable way to store milk powder for a longer period. It offers better storage and cascade of benefits to value end user by extended shelf life without requiring refrigeration. The basic purpose of milk powder packaging is to prevent the entrance of moisture, light, humidity and other environmental factors that can finish the purity of a milk powder.

Moreover, it ensures the end user that product is safe from triggering factors to maintain potency and efficacy especially microbial contamination. Factors affecting the goodness of milk powder. The first is the moisture content. In order to effectively preserve the qualities and characteristics of milk powder from domination of moisture and the formation of cake or lumps packaging is taken into account. Oxidation of milk powder is linked to the presence of unsaturated fats which turns the milk flavor rancid.

Also affecting the nutritional status and altering the taste at the same time light. Milk based products are usually sensitive to light due to the presence of riboflavin which is a strong photosensitive vitamin that turns light particle into singlet oxygen again contributing to oxidative degradation. Milk powder packaging. Usually a milk powders packaging style is carried out in either of the two ways that is bagging or canning. Both of the types have their individual benefits and some setbacks as well.

The type which is going to be chosen for packaging of a brand milk powder depends on budget, customer preference and what quality of preservative shelf life of the product is sought. The bulk bin. The fundamental concept of bulk bin is entirely new offering a

great value to repack and reprocess the whole material. This is considerable interesting mode of packaging as it limits excessive expenditure during handling and transportation.

The following types of bulk bins are tote bin. They are used to store milk powder of 800 to 1000 kg of mass. This packaging is ideal for transportation of bulk, internal transfer to central station or shipment. Moreover, it helps in reducing cost by about one half than the stainless steel. Air tight stacks bins are emptied directly into hopper via elevating.

Big bag or big bag in box. This concept of packaging has somewhat surpassed tote bin as a large size multilayer bag of polyethylene with milk powder is protected by woven plastic or triple laminated corrugated board. They are considerably low cost filling and packaging method. Can packaging. Using metal cans in milk powder packaging is a common sight in stores across the globe. There are reasons for using cans in packaging milk powder.

Metal can provide good air tight preservation and durability in shelf life for the milk powder. Usually, milk powder can be stored for 2 to 3 years approximately in a metal can packaging. This way they are also able to ensure nutritional protection by safeguarding the milk powder from moisture or any other factor. The coating is necessary since steel is prone to corrosion which will contaminate the milk powder.

Jar packaging. Nowadays plastic jar is more common for packaging milk powder as it presents sustainable packaging strategy. High quality plastic jar can present durability and strength in terms of being unbreakable. They preserve the rich nutrients found in milk powder because of being air tight and also protect the product from environmental degradation. It is lighter in weight and thus easier to be transported.

Flexible packaging. Pouch packaging permits customization in shape and size allowing companies to be creative when packaging milk powder. Some types of flexible pouches are stand up pouches, three side sealed pouches, spouted pouches, gusseted bags and zipper pouches. Stand up pouches are the prominent ones. Pouches have several advantages like transportation is easy, requires less raw materials, is not easily broken and can use them more than once.

The carton packaging. There is no doubt that carton packaging is way more friendly than other form of packaging. Many international brands prefer cartons for powder milk packaging as it is simple and cost effective. Nevertheless the moisture resistance property is somehow very less. Also during transportation and storage procedures it is prone to crush injury and protection of the essential nutrients is also very less and that is

why it is not used frequently in many regions. The advantages of milk powder packaging that greater shelf life.

Milk powder packaging provides longer shelf life to milk powder and maintains its freshness that means, it can be stored for longer periods without any material spoilage. Milk powder packaging makes is in practical consumption for households requirements and can be used under any circumstances. The customization milk powder packages are designed in a way that the standards given by world organization are matched. The milk powder packaging is also controlled by customizing its portion, branding, marketing, inclusion of measuring scoops and inclusion of measuring spouts. Convenient the convenience level of milk powder packaging is that the packaging material does not get damaged even it travelled to any port of the world.

Large quantity of milk powder can be transported in a highly efficient manner. Milk powder utilization any type of milk powder can be adjusted in any type of the packaging material. The only difference lies between the environmental conditions. Convenient packaging of milk powder helps the customer to use it in a precise manner. The eco friendly most of the milk powder packaging are biodegradable and can easily be recycled without providing any type of harm to the environment.

The impact of milk powder packaging either plastic or paper is minimized to around 0. Why is nitrogen gas used in milk powder packaging? The nitrogen is often used in the packaging of milk powder because it helps to preserve the quality of the product. This gas keeps the internal content to settle in the limited space and ensures that no bacteria can leave the system. Some of the basic requirements and advantages while using nitrogen gas are oxygen protection. Nitrogen is an inert gas that does not support combustion or oxidation.

When nitrogen is flushed into the package it replaces the oxygen and creates an oxygen free environment. This helps to prevent the growth of bacteria, fungi and other microorganisms that can spoil milk products. Moisture protection nitrogen also helps to prevent moisture from entering the package and affecting the quality of the milk powder. Moisture can cause clumping, caking and the growth of bacteria leading to the spoilage of the product. Aroma preservation milk powder has a characteristics aroma that is important to its quality and appeal.

Oxygen and moisture can cause the aroma to deteriorate over time. By using nitrogen in the packaging the aroma of the milk powder is protected ensuring that it retains its freshness and flavor. Extending shelf life by preventing oxygen and moisture from affecting the quality of the milk powder nitrogen also helps to extend shelf life of the

product. This is important for both manufacturers and consumers as it ensures that the milk powder will remain fresh and of high quality for longer periods of time. Thank you very much.