

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 requirement for the fluid milk and cream. In the present lecture we will be covering the packaging of yogurt curd and butter. Let us take the first that is packaging of yogurt. Yogurt the most important of the fermented milk products is a coagulated milk product obtained by lactic acid fermentation through the action of typically *Lactobacillus bulgaricus* and *Streptococcus thermophilus*.

Yogurt and yogurt drinks are delicious and nutritious and they are increasingly becoming a necessity in people's life. The yogurt packaging design not only provides people with a good visual enjoyment, but the material of its packaging is also very important for the preservation of yogurt. This is the incremental growth rate which is increasing from the 5 percent and it is estimated of 26.08 billion US dollar in 2018 and it rose to the 2023.

The year over year growth rate from 2019 is estimated at 4.55 percent. The market is moderately fragmented with few players occupying the market share. Once one of the key drivers for this market will be the increasing accessibility and availability through organized retailing. The yogurt drink market actually if we see by the product wise then vegan and conventional and packaging type wise the bottles, tetra packs, other packaging of types and distribution channel wise the hyper markets and supermarkets, convenience stores, e-commerce, portals and others and they are increasing with a cumulative annual growth rate of 6.

4 percent from 2022 to 2030. And these are the key companies which are dealing with the different milk products and the market size value in 2021 was around 49.33 billion US dollars which is expected to rise in 2030 by 85.28 billion US dollars. Packaging materials, the glass ceramic packaging, glass bottles and ceramic jars have good gas barrier properties which can effectively prevent the yogurt from being oxidized and deteriorated. At the same time it can prevent the volatile substances in the yogurt from volatilizing into the atmosphere.

They are the more commonly used packaging for yogurt which has the characteristics of

reusable and low cost. However, due to high weight of glass bottles and ceramic bottles they are fragile, difficult to clean and inconvenient to recycle. Therefore, these two types of yogurt packaging are suitable for short term packaging. The plastic packaging, there are three main types of plastic packaging for yogurt, HDPE bottles polystyrene and PET packaging. The smooth body of the HDPE bottle can be labeled with paper.

It is usually used to package sterilized fermented yogurt. The shelf life of this bottle yogurt is generally about 20 days and needs to be refrigerated. The polystyrene bottles has a good surface finish and is resistant to low temperatures. It can tolerate a low temperature of minus 30 degree Celsius. The shelf life of yogurt packaged in this material is generally about 21 days.

The light transmittance of PET bottles is very low. The low light transmittance very well extends the yogurt shelf life. In addition the PET bottle is an excellent oxygen barrier which is very suitable for packaging, pasteurized milk, UHT milk and flavored milk beverages. Composite material packaging, the yogurt packaging machine, the yogurt packaging machine manufacturer reminds us that the composite packaging material composes of two or more materials with different characteristics. The comprehensive performance of the composite material packaging can meet the needs that a single material cannot meet.

The composite yogurt packaging has good overall performance, heat sealing effect and printing effect. Moreover the yogurt packaged with composite material cannot only improve the yogurt quality, but also extends its shelf life. Ecolean packaging, Ecolean material is an environmentally friendly packaging material with good barrier properties and the material can be gradually degraded in nature. The Ecolean part packaging has a good standing property which reduces the space occupied. And when one can finish drinking and when one cannot finish drinking at one time the tear of the package can be automatically sealed keeping the yogurt fresh.

The metal packaging, metal packaging has good light barrier properties and oxygen barrier properties. And the use of metal packaging ensures aseptic packaging and greatly extends the yogurt shelf life. However, the cost of metal packaging is higher due to the higher acidity of yogurt. They requires metals to have higher acid resistance. In order to protect the filled yogurt, yogurt packaging machine manufacturers recommend using tin plate 3 piece cans or aluminium 2 piece cans to improve the corrosion resistance of the metal pipes.

This is the summary of protective effect of different packaging materials for yogurt. The transparent brown glass ranked first and it has got good light barrier properties and

the it perfect in the protecting the oxygen. Whereas, the paper board and PS that has got second place and it has excellent light barrier properties, but the very poor oxygen barrier property. Whereas, the transparent brown polyethylene has got good light barrier and moderate oxygen and ranked third. The unpigmented glass it is moderate light protector and perfect oxygen protector and got ranked 4.

Whereas, the unpigmented polystyrene has got bad light barrier properties and moderate oxygen barrier properties and it is the poorest among all that is the ranked fifth. Curd or dahi is a dairy product made by curdling the milk with edible acidic substances such as lemon juice or vinegar. Packaging of dahi is mainly done to protect the dahi from outside environment especially after the completion of process. So, that it can retain moisture, flavor, freshness for a longer period of time. The packaging materials LDPE low density polyethylene is heat sealable inert odor free and shrinks when heated.

It act 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. Now, the HDPE or PP high density or polypropylene high density polypropylene or polypropylene cups has been also used for packaging of curd. The benefits include the water resistance, malleability, light weight, it is economical, hygienic recyclable and it is FDA approved. Now, the polystyrene the most popular material in current used for fresh dahi or yogurt is thermoform titanium oxide pigmented high impact polystyrene with either an aluminum foil or plastic laminate or a paper plastic laminate heat seal lid or closure.

The packaging of butter. The butter consists primarily of about 80 percent milk fat, 16 percent moisture and in table butter up to 3 percent common salt because of high moisture content butter is susceptible to mold growth and lipolytic rancidity. Characteristics of butter due to high moisture content butter unlike solid fats is susceptible to mold growth. Flavor and odor are easily absorbed by butter from its environment. Deterioration of the butter may take place due to density.

Butter has tendency to lose moisture. The importance of packaging maintain product integrity. The taste and smell of butter is changed when it absorbs chemicals from environment. Thus packaging is necessary for preserving the product integrity. The second one is improve shelf life.

The packaging is suitable barrier against moisture and oxygen which can otherwise react with fats in butter and cause their rancidity. By offering protection against these environmental agents which in turn result in improved shelf life of the butters. Prevention of weight loss butter is composed of water and oil which on high temperature

vaporize resulting in weight loss, but butter packaging prevents evaporation of oils and waters. Brand appeal butter packaging is integral in product differentiation on retail shelves. Brand owners often use original and innovative packaging to stand out on grocery stores as and to catch the eye of their consumers at first glance.

Packaging and communication attractive design butter packaging plays a significant role in advertising brand. Moreover food levels and butter packaging tell consumers about benefits and nutritional value of packaged butter. Now packaging materials the butter paper and or parchment paper it is mostly and widely used material for butter packaging. It is found by treating plant based cellulose with sulfuric acid and zinc chloride and afterwards this process paper is coated with silicon. Moisture and fats cannot move across this paper material.

The second important material for butter packaging is cellophane. This material is formed by regenerated cellulose. It is thin clear sheet that has been minimal permeability for air fats and moisture. It is good for inhibiting growth of bacteria. Now the plastics it is good barricade against environmental chemicals such as oxygen and water.

It has high tensile strength and is readily available at low cost rates. It has weight cutting advantage and is ideal material for storing butter products. Plastic is used making butter wraps, trays, tubs and jars. The aluminum foil laminates 0.009 millimeter thick aluminum foil is processed with lacquer on external surface for giving better protection against rusting and corrosion.

It provides barrier against moisture, gas and UV light. It has low penetrance against unwanted smells thus can maintain the taste of the packaged butter. The another important packaging material for butter is tin plate. This metal is durable, ductile and malleable and is often employed for manufacturing cans for packaging of dairy items like butter. The differences between butter paper and wax paper, the heat resistance of butter paper it does not melts or ignite in baking oven.

Therefore, it is used for lining baking sheets whereas, the wax paper found its use in many fields. However, wax paper should not be put in ovens for baking since it can catch excess flames. If we consider price then butter paper is comparatively more expensive than the wax paper which is available at reasonable price. The coating the butter paper is generally coated with silicon for giving it high resistant properties whereas, the wax papers are produced using paraffin or soybean wax. Non-stick nature the butter paper or parchment paper does not stick to the surface whereas, wax paper due to their waxy coating it can stick with the surface.

Type of plastic in butter packaging, the first is polypropylene. These plastics are used for making tubs and trays. Most options of polypropylene containers are heat resistant so, can be used in microwave. Moreover they are suitable for refrigerating and freezing butter. These are unbreakable and can be reused for storing other foods.

The high density polyethylene this plastic type used for packaging large amount of butter in heavy duty trays and buckets. They have more tensile strength than PP and are more flexible. Now, the high impact polystyrene it is quite brittle and is used as copolymers in butter packaging wraps with aluminum and parchment paper. It is shiny, clear and has good printing capabilities. Now, the PVC the polyvinyl chloride has superior resistance against oil and grease.

Furthermore it is low priced and durable. However, this material is difficult to recycle and negatively impact on the environment. Now, the polyethylene terephthalate this kind of plastic has high tensile strength and is increased toughness. They provide package butter protection against deteriorating effects of heat moisture and air. The requirements of butter packaging, it is absolute grease barrier.

The packaging material should be completely grease proof for preventing the leakage of butter from container that can otherwise create mess in the surroundings. Wetting strength it should have resistance against moisture. This water vapors in environment promote growth of bacteria, oxygen protection. Butter packing must be impervious to oxygen molecules because later can react with fats in butter and cause their rancidity.

This rancid butter is unsafe for eating. UV light protection materials in butter packaging should not transmit UV light. UV light can promote oxidation of oils in butter and lowers itself life. The non toxicity the butter packaging material should not be composed of toxic materials that can pose this to human health. Low metallic content it should have low metallic content as metals increase butter fat degradation. Thank you very much.