

Modern Food Packaging Technologies: Regulatory Aspects and Global Trends

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Dear friends, welcome to the NPTEL online certification on Modern Food Packaging Technologies Regulatory Aspects and Global Trends. This is the in continuation to the previous lecture, this is lecture number 4 in the introduction to food packaging. We were discussing about the history of the packaging from ancient times to the future. So, in this the industrial revolution packaging, the industrial revolution brought changes to every one's way of life. It consisted of an age where products began to produced by machines instead of by hand.

Many rural residents moved into towns and cities to obtain steady jobs and increased wages. This era is starting from about 1760 to 1840 gave way to major technological advancements. As the demand for better quality packaging increased, this demand for quality was fueled by a sudden surge in new products that were now available for the masses to consume. The change in the level of production and the increased disposable income encourage producers to develop durable, dependable and efficient packaging methods.

However, it should be noted that many of the packaging materials that arose in this era were expensive meaning that the use of these materials were typically reserved for storing and transporting luxury goods. The increased product production resulted in a large rise in demand for storage and transportation bins, bags, food packaging methods, primary packaging materials and e-commerce in store packaging options. The storage and transportation bins were developed for the bulk transport bins and storage structures became more readily available with cardboard, corrugation and plastic polymers. The bags made from a variety of plastic polymers enabled companies to close and seal products. Printed and branded bag packaging becomes popular.

The companies and governments began to focus on increasing the shelf life of consumable products, militaries strived for methods to preserve food storage times and troops in the field. Primary packaging comes into direct contact with the product. New methods and materials continue to evolve. Initially petroleum based plastics were desired and now more economic environmentally friendly options continue to gain traction. As purchasing habits evolve so do packaging options.

Bulk basic packaging for local five and dime stores was normal. As grocers grew and stores grew packaging became more vibrant and appealing. As purchasing habits move online packaging for e-commerce items to survive shipping stresses has become important. Here are some of the more notable packaging advancements that occurred during this era. In 1795 Napoleon offered a prize of 12000 francs to anyone who could invent better methods of food preservation.

This push the innovation was due to Napoleon needing to find a way to feed his army who was in the midst of a war. However it would not be another 15 years until this prize was claimed by a man named Nicholas Appert. Nicholas Appert also known as the father of canning invented a method to preserve food for an extended period of time by boiling them in water and then sealing food in air tight glass containers. We still use this method today with canned foods. In 1810 Peter Durant an English man patented the use of tin coated iron cans instead of bottles to preserve food.

Over the next 20 years tin would become one of the most popular packaging materials for packaging things like cookies and tobacco. Though cardboard itself had been invented several hundred years earlier in China the cardboard box was not created until 1817 by Sir Malcolm Thornhill. The paper bags these boxes were not corrugated yet that would not be invented until 1871. Cardboard boxes were popular among silk manufacturers to transport moths and eggs from Japan to Europe. Packaging in late 1800 and early 1900s several years after the first commercial paper bags were created in 1844 Francis Wall invented a machine capable of mass producing paper bags.

The first paper bag machine was invented in 1852. These paper bags then did not exactly look like what we had think of as paper bags today they resembled large mailing envelopes. Robert Geier a Brooklyn printer developed a first carton by accident. Geier was the owner of a paper bag company one day one of the gas machines malfunctioned by slicing through rather than creasing a stack of paper bags. It was then that Geier realized that cutting and creasing cartons in one operation could make prefabricated cartons.

The first cereal box was invented in 1906, but before that the Kellogg brothers known for the inventing invention of corn flake cereal in 1877 began using cardboard to distribute and market their cereal as early as 1906. Initially the cereal box was wrapped in a heat sealed bag with the cereal loose on the inside of the box. Eventually however a plastic bag was placed inside of the cereal box to contain and protect the cereal. The bubble wrap was invented in 1957 by a skilled air's founder Al Fielding and Mark Cavens, but it was not first utilized as the protective packaging material we know it as today. Initially Fielding and Cavens were trying to create textured wallpaper by scaling

two shower curtains together to make air bubbles.

However, this interior decor tent did not take off. They later decided to market the material as greenhouse insulation though this proved to be an unsuccessful endeavor as well. Three years after bubble wrap was invented Frederick W. Bowers, a sealed air marketer made a pitch to IBM to use bubble wrap as a protective packaging material for their computers. The pitch went well and IBM began purchasing bubble wrap for all of their fragile products.

The pop type was invented by Ermel Freis founder of DERT manufacturing company after forgetting a can opener at a picnic which was also known as a church key. Freis embarked on a quest to design a can that did not need a separate opener. In the following years after some trial and error Freis had finally, developed a can where the user only needed to pull a removable tap to access the drink by 1965 over 75 percent of brewers in the US were using Freis can. In 1977 after pop tap waste began to increase Freis patented the top pop tap we use today a push in and fold back tap. Polyethylene terephthalate that is popularly known as PET bottles were first patented in 1973 by chemist Northanil Vith.

At the time these were the first plastic bottles capable of containing carbonated drinks and they soon become the material of choice for manufacturers who wanted a cheaper alternative to glass. The history of packaging materials reflects the advancement of technology changes in the consumer preferences and environmental considerations. Packaging materials have come a long way from simple natural materials to the sophisticated and sustainable options available today. And they continue to evolve to meet the demands of the modern world. These are the list of development of different packaging materials year wise.

Now, let us define certain words which is invariably used in the production and marketing of packaging world. In today's society packaging is pervasive and essential. It surrounds in enhances and protects the goods we buy from processing and manufacturing through handling and storage to the final consumer. Without packaging materials handling would be a messy inefficient and costly exercise and modern consumer marketing would be virtually impossible. The packaging sector represents about 2 percent of the gross national product that is GNP in developed countries and about half of all packaging is used to package food.

Food packaging lies at the very heart of the modern food industry and successful food packaging technologies must bring to their professional duties a wide ranging background drawn from a multitude of disciplines. Despite the important and key role that packaging plays it is often regarded as a necessary evil or an unnecessary cost.

Furthermore, in the view of many consumers packaging is at best somewhat superfluous and at worst a serious waste of resources and an environmental menace. Such views arise because of functions that packaging has to perform are either unknown or not considered in full. By the time most consumers come into contact with the package its job in many cases is almost over and it is perhaps understandable that the view that excessive packaging has been used has gained some credence.

Lockhart in 1997 defined packaging material as a social scientific discipline that operates in society to ensure the delivery of goods to ultimate consumer of those goods in the best condition intended for their use. The new defunct packaging institute international defined packaging as the ensure of products items or packages in a wrapped pouch, bag, box, cup, tray, can, tube, bottle or other container from to perform one or more of the following functions that is the containment, protection, preservation, communication, utility and performance. If the device or container performed one or more of these functions it was considered a package. However, Kohl's and Kirwan in 2011 gave a definition of packaging which include a coordinated system of preparing goods for transport, distribution, storage, retailing and end use. A means of ensuring safe delivery to the ultimate consumer in sound conditions at optimum cost and a techno commercial function aimed at optimizing the cost of delivery while maximizing sale and hence the profit.

It is important to distinguish between the word package, packaging and packing. Package, packaging and packing are related terms, but they have distinct meanings and uses in the context of handling and preparing items for storage, transport or sale. A package refers to a final assembled unit or container that holds a product for sale, a packaging refers to the final assembled unit or container that holds a product for sale or distribution. It is the end result of the packaging process. A package can be a box, bag, bottle, jar or any other container that holds and protects a product.

It can also refer to the act of putting items into containers for shipment or storage. Packaging is the process and materials used to design, create and assemble the protective and promotional elements surrounding a product. It encompasses the entire system of materials and techniques used to in case and present a product. Packaging serves various functions including protection, information, dissemination of information, branding and marketing. It involves the design and production of containers, labels and other elements that make up the package.

The packing is the act of placing product or items into containers or packages for storage, transport or sale. It is the physical action of placing goods into suitable packaging or containers. It can also refer to the material used to cushion or protect items

within a package. For instance, packing materials like bubble, bubble wrap, foam or paper are used to prevent breakage or damage during transit. In summary, package is the final container holding a product.

Packaging encompasses the materials and design used for this container and its associated functions and packing is the action of placing items into containers and may involve using additional materials for protection. All three terms are interconnected in the process of preparing and handling products for distribution and sale. A distinction is usually made between the various levels of packaging. A primary package is one that is indirect that is in direct contact with the contained product. It provides the initial and usually the major protective barrier.

It is the primary layer like the plastic pouch, cardboard box etc containing the finished product that protects and preserves the finished product from contamination and tempering while including aesthetic elements that make the product stand out. Besides adding identification, differentiation and consumption, primary packaging also acts as a promotional tool to attract more customers at the point of sale by making the product look more appealing. Some examples of primary packaging are laminated products for dry fruits, plastic containers for fruits, tin cans for soft drinks, laminated tubes for beauty products, composite cans for chips etc. Often removing the primary packaging of a product affects the products quality or attribute. The secondary packaging surrounds primary packaging serving as a supplementary layer for a product grouping protection during distribution and transportation.

Its main use is to group and hold together individual units of the product to deliver large quantities of that product to the point of sale. Usually it is discarded or thrown as soon as the product with primary packaging is taken out of it. The purpose of secondary packaging is to safeguard the product as well as the primary packaging. Secondary packaging is visible to the customers when the product is displayed in the retail store. It is mainly designed for the retailers rather than customers.

It mainly contains the brand name and logos instead of detailed information such as nutritional value warnings etc. Such packaging ensures safety of the product during its shipment. Some examples of secondary packages are plastic rings that holds soda cans together and cardboard box containing multiple individual boxes of cereals etc. Removing secondary packaging does not affect the products quality or attributes. Tertiary package holds the secondary packages which meant for shipment purpose.

Such packaging is especially intended for recognition storage or shipment of the product. Tertiary packaging ensures the safe and efficient movement of products within

the supply chain and provides a foundation for logistic processes such as stacking, lifting and securing goods. Some example of tertiary packaging are wooden pallets used in freight shipping, a stretch wrapped pallet containing a large quantity of secondary packaged goods. And, let us discuss the functions of the packaging materials and packages.

Contains the product the most product need to be contained either during transportation storage or consumption. Packaging makes sure the product is contained as and when required. It protects the product packaging plays a crucial role in safeguarding products from various external factors such as impact, vibration, temperature, moisture and tempering. Techniques like cushioning materials, shock absorbing components, moisture resistant coatings and temper evidences contribute to the product's safety and integrity throughout its journey from manufacturer to consumer. It is also used for the preservation of the product.

Packaging aids in preserving product's freshness, quality and shelf life. Techniques like vacuum sealing, modified atmospheric packaging and intelligent packaging system help maintain optimal condition such as controlled oxygen levels and humidity thereby extending the products viability. It also aids product handling and usage proper packaging aids product handling and makes it easy to transport ship and even use the product. The next important function is attractiveness the packaging is an integral part of the product's brand name and marketing. Unique packaging can enhance the products attractiveness and impact the desire to purchase the item.

About two-thirds of customers believe that packaging can influence the purchase decision. Packaging can also convey a complete story of the company behind the product as well as the products social environmental and economical impact. Packaging is a means to convey the company's value as well as the many benefits this product can bring to the consumer. The marketing and branding packaging acts as a powerful marketing tool attracting consumers and communicating brand identity. Visual design elements, color schemes, logos and product information and packaging help distinguish products from competitors and create an emotional connection with the consumers.

Packaging design can evoke positive associations influencing consumers purchasing decisions. Now, the convenience and user experience packaging design incorporates features that enhance convenience and improve the overall user experience. Resealable closures, portion control, easy open mechanisms and applicators are examples of packaging innovations that prioritize user friendliness allowing consumers to effortlessly access use and store the product. A positive user experience contributes to consumer satisfaction and loyalty.

It acts as a communication medium. Packaging along with the labeling helps communicate the brand identity, brand message and product and company information to the consumer. It adds to the aesthetic value. The packaging can make a simple product look attractive or a unique product look ordinary. It is an important aesthetic touch point that can make or break a sale. Now, the sustainability and eco-conscious packaging.

Consumers are increasingly looking at the carbon footprint of packaging materials recycling, reuse and recycling before making a purchase. The more sustainable packaging is perceived the greater its positive effect on sales figures. The packaging design significantly impact the ease with which it is possible to distinguish the different materials from one another and consequently how simple the packaging can be reused or recycled. Making more from less helps conserve resources and makes it easier for the user to manage correctly. The requirements for a good packaging material it should be non-toxic, it should protect against contamination from microorganisms, it should act as a barrier to moisture loss or gain an oxygen ingress, protect against ingress of odors or environmental toxicants, it provides resistance to physical damage, it should be transparent and be tamper resistant or tamper evident.

It should filter out harmful UV lights, be easy to open, have dispensing and resealing features, be disposed off easily, it should meet size, shape and weight requirements, it should have appearance and printability features, be low cost, it should be compatible with food, it should have special features such as utilizing groups of product together ok. For the time being thank you very much we will be continuing in the next course. Thank you.