

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 beverages in the present lecture we will be discussing about the overview to modern food packaging. And we will be discussing in this class introduction evolution of food packaging technologies, drivers of modern packaging techniques, packaging and agent for change. In today's fast paced world and highly competitive market effective packaging plays a vital role in capturing consumers attention, communicating brand values and ensuring product safety and convenience. Modern packaging techniques have revolutionized the packaging industry offering innovative solutions that meet the ongoing demands of consumers and businesses alike. After having elaborated on the functionalities of packaging we will elaborate on the most impactful modern packaging techniques for an effective and efficient approach.

Our society's major innovations are increasing being incorporated into packaging trends. Packaging reflects developments in technology, design, materials, handling and eco friendliness. People use packaging every day it must provide intuitive answers to expectations requirements and functions. Mega trends from communication, sustainability, individuality and experience have long since determined the packaging development for tomorrow.

According to the latest report by market and markets the global food packaging market size is projected to reach about 606.3 billion US dollar by 2025 growing at a compounded annual growth rate of 4 percent during the forecast period. Among the bakery and confectionary share is 37.3 percent. The US food packaging industry holds a significant share of this market and is expected to continue to grow in the coming years.

The use of advanced materials and technologies in food packaging has helped reduce food waste and increase product self life contributing to improved sustainability efforts. Consumers are also demanding more environmentally friendly packaging options leading to an increase in the use of biodegradable and compostable materials. Food packaging can also serve other purposes beyond protection and preservation. It can also provide information to consumers about the product including nutritional information, ingredients and usage in instructions. Food packaging can also serve as a marketing tool to attract consumers and differentiate products from competitors.

Sustainable packaging has become a growing trend in the food industry in recent years. Many manufacturers are seeking eco friendly packaging options that reduce waste, minimize the use of non-renewable resources and lower the carbon footprint of their products. Examples of sustainable packaging materials include bioplastics, compostable packaging and recycled materials. Overall food packaging is a critical aspect of the food industry that plays a vital role in ensuring food safety, extending self life, facilitating transportation and distribution, providing information to consumers and serving as a marketing tool. The choice of packaging material and design depends on various factors including the type of food product, self life, desired level of protection and packaging process.

The industry is also evolving to prioritize sustainability and reduce its environmental impact through the use of eco friendly packaging materials. Next food evolution of food packaging technologies. Food packaging has come a long way from its humble beginnings of wrapping food in leaves or animal skins. The evolution of food packaging technologies has brought about many benefits in terms of preserving food, enhancing convenience and reducing waste. Here are some key points about the evolution of food packaging technologies.

The first is historical packaging materials. In the past people used natural materials such as leaves, bark and animal hides to package food. Later materials such as grass, metal and paper were used for packaging. Modern packaging materials. Today food packaging is made from a wide variety of materials such as plastics, paper, cardboard and metal.

These materials have been developed specifically to address food safety, shelf life and convenience issues. Active and intelligent packaging. Active packaging involves the use of materials that actively interact with the food to extend shelflife. For example, oxygen absorbers can be added to packaging to reduce the amount of oxygen that comes into contact with the food. Intelligent packaging incorporates technologies such as sensors that can detect changes in the food environment such as temperature, humidity or gas levels.

Sustainable packaging. There is a growing concern about the environmental impact of packaging waste. Sustainable packaging is a term used to describe packaging that is designed to be environmentally friendly such as using biodegradable materials or reducing the amount of packaging used. Convenience packaging. Convenience packaging refers to packaging that is designed to make it easier for consumers to use or consume the product.

Examples include resealable packaging, single-serve packaging and microwaveable packaging. The drivers of modern packaging techniques are the technology enabled smart packaging, emotional engagement, transparent and clean labeling, personalization, minimalistic design with colors and sustainability. Out of these, the sustainability, minimalistic design with colors and technology enabled smart packaging, we will be discussing in details. Sustainability. Interactive and smart technology and minimalistic but functional approach.

The first sustainability. The sustainability has undeniably emerged as a driving force behind modern packaging techniques. As society becomes increasingly conscious of its environmental footprint, businesses are responding by prioritizing sustainable practices especially in their packaging. Sustainable packaging techniques aim to minimize the ecological impact of packaging throughout its life. This involves using biodegradable materials, incorporating recycled content and adopting eco-friendly manufacturing processes.

Sustainability is no longer just an ethical choice but a business imperative. Brands now recognize that demonstrating their commitment to sustainability not only reduces their environmental impact but also enhances their appeal to growing segment of environmentally conscious consumers. Interactive and smart technology. The fusion of interactive and smart technology with packaging techniques has opened a new frontier in

product branding and customer engagement. Brands are harnessing the power of technologies like QR codes, augmented reality and near field communication to make the packaging interactive and data rich.

These technologies enable brands to offer immersive experiences, provide real time product information and even gather valuable consumer data. From temperature indicators that ensure product safety to freshness sensors that guarantee product quality, smart packaging techniques are transferring how businesses interact with their customers and retail environment. Now, the minimalistic but functional approach. In today's cluttered retail landscape less is often more. The minimalistic approach in packaging techniques is resonating with the consumers who appreciate simplicity, sophistication and clarity. This approach emphasizes the essence of the product and the brand through simple but powerful design elements.

Minimalistic packaging often features clean lines, muted colors and a clutter free design that conveys the products quality and the brands identity effectively. The appeal of minimalism lies in its ability to stand out amid chaos, draw attention with its understated elegance and cater to consumers seeking a simpler more mindful lifestyle. Now, the packaging an agent for change. The current and expected change in the packaging industry is impressive and the boost to innovation enormous. Ground breaking changes are occurring in many sectors, read on to find out which mega trends have the greatest influence on packaging development and product marketing. The sustainable packaging. There is far more to it than just less plastic, the demand for sustainable packaging is on the rise.

Plastic components are gradually being replaced by renewable eco friendly raw materials such as cardboard, glass cardboard or cardboard made from agricultural waste. Smart packaging designs reduce material uses, the steadily growing number of zero waste shops in Germany illustrates that more and more consumers are looking at packaging with a critical eye. Where packaging cannot and should not be avoided solutions that meet both the buyers and retailers needs in equal measure are required. Less plastic is what consumers and industry are demanding. Plastic windows are alleged are being

fundamentally changed for sustainable alternatives or the packaging as a whole is being made of other materials.

Responsible manufacturing processes are gaining even greater influence. Energy efficient and eco friendly production avoiding or cutting and compensating the production for carbon dioxide emissions responsible handling of implies and resources and sustainability management are becoming standard now a days. Oversized packaging is out. The bigger the better is a thing of the past as small as possible is in more and more packaging solutions are aiming to reduce transport volumes and that approach is paying off in terms of the number of trucks needed that is reduced transport cost being a positive side effect. Carbon footprint and the reduces resources used even for a small volume orders reducing packaging without any detriment to the products visual appeal saves 40 truck journeys in just 3 months. This is a scale that is truly surprising the strain on roads and the environment is being relieved in a sustainable way.

Now, a natural look and feel. For a growing number of consumers the feel of packaging is playing an increasingly important role in addition to its visual appearance. Naturalness material and manufacturing all being naturalness to the four packaging developers can enhance this effect even further by intelligently combining the material printing varnish and design whether it is a wood look coupled with the genuine wood feel or a natural feeling modern craft paper there is hardly any limits to the imagination. Minimalism and transparency. Consumer awareness is changing tomorrow's consumers will focus on making conscious and careful sacrifices and concentrating on the essentials as a result of the culture of prosperity and over supply in western society. Sustainability is at the very heart of a new culture where less will be more this has an enormous impact on packaging which in the near future will come with reduced discrete clean colours and shapes. The typography is simple and strong at the same time and the design is straight forward. This new found simplicity is becoming a strength this is precisely because trendy brands are well presented in a simple fashion.

So, they catch the eye at the POS for all the right reasons. Now, the maximalism as a counter trend. The trend towards maximalism is a counter trend maximalism is becoming apparent with pompous designs and a colourful mixtures of styles. Maximalism is freer

and more shrill, personality is desirable often in bright striking colours or with shiny elements. Take gold as a very bright colour and a very beautiful colour it is eye catching elegant shiny and opulent the more of it the better. Gold finishes such as hot foil embossing will pick up again on a small scale by refining individual elements to large scale use of gold foil.

Depending on the quality of the product and the target group it is important to make a statement. Illuminated packaging. Packaging is becoming increasingly emphatic. It fits with consumers and there is lifestyle while some industries such as the food retail or natural cosmetic sectors are increasingly looking for packaging solutions that are stripped back to the essentials and produced using sustainable materials and finishes. Others favour spectacular packaging that attracts attention and sparks the impulse to buy. Light that is integrated into packaging is primarily still an eye catcher for presenting the brand and there are many ways of activating it including light choreography when the packaging is picked up the light switching on when the packaging is opened or shining on the shelf and many more besides. Thank you very much.