Modern Food Packaging Technologies: Regulatory Aspects and Global Trends

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Week – 01
Lecture – 05

Welcome friends, to the NPTEL online certification course On Modern Food Packaging Technologies Regulatory Aspects and Global Trends. This is the fifth lecture we are going to cover and before that we have covered the different aspects of packaging requirements about the food packaging. Now, discuss with the printing of the packaging materials. The printing of packaging is a crucial aspect of product design and marketing.

It plays a crucial role in attracting consumers and conveying important information about the product. The basic principle of most printing processes is that ink is deposited on an engraved plate and the inked image transferred to the substrate through contact. In indirect printing the engraved plate transfers ink to an intermediate rubber blanket that then transfers the image to the packaging substrate. In the stencil printing for example, screen printing the ink is passed through a stencil to the substrate.

There are several different methods of packaging printing in use. There are several different methods of package printing in use today. The conventional printing methods of relief like letter press, flexography and flexoprocesses, gravure or intaglio, lithography or offset or planographic and screen or porous and the digital printing methods of inkjet and electrophotography. The whole printing methods can be divided into two types of printing that is the conventional and digital. The digital contains relief printing, letter press, flexography, gravure or intaglio, offset, lithography, screen or porous printing.

Whereas, the digital can be subdivided into two parts that is the inkjet and electrophotography. The inkjet is further divided into two parts that is the there are two types that is the drop on demand and continuous. The drop on demand can again be of two types that is piezoelectric and thermal. Whereas, the electrophotography which is the part of the digital printing is of two types that is dry toner and liquid toner. Now let us go into some slight details in that that the relief printing the images are printing areas are raised above the non-printing areas.

So that the ink rollers touch only the top surface of the raised areas. In letter press three types are common that is platen, flatbed cylinder and rotary. The rotary being the far most common type of printing packaging materials wherein it is mostly used. Plates

must obviously, be curved for mounting on rotary presses. The inks used for letter presses printing are oil based and slow drying and have a pasty consistency which makes the process a difficult one to apply to plastic films unless a slight embossing or denting sometimes appears on the reverse side of the surface, but the letter press image is usually sharp and crisp.

Letter press printing is still used for the printing of folding cartons, labels and all types of bags for dry groots. Whereas the flexography is a relief printing technique and variation of letter press printing is a high speed method that was developed primarily for printing packaging materials. A rubber inking roller fountain roller revolves in an ink reservoir and transfers ink to a cavitated metering roller often called an enilox roller which is engraved such that it can hold ink in its recesses. An optional doctor blade removes excess ink from the surface of the enilox roller so that it transfers a controlled film to of ink to the printing plates which were made of rubber and referred to as stereos and abbreviation for stereotypes, but are now generally made from photopolymer material. The printing plate then transfers this layer of ink to the substrate which is supported by the impression cylinder.

The gravure printing was known as intaglio from the Italian word for incising or engraving reflecting the fact that this technique was first practiced in Florence in 1446 by the goldsmith and engraver Finiguera. Gravure printing commonly known as rotogravure printing and it consists of a printing cylinder, image carrier and impression cylinder and an inking system. The printing cylinder has the image area is to form a series of a small cells of varying depth so that different differing amount of link is picked up. During printing the image carrier is emerged in fluid ink. As the image carrier rotates ink fills the tiny cells and covers the surface of the cylinder, excess ink from the nominal surface of the cylinder.

The lithography printing also known as offset lithography was invented by the Austrian artist Alois Schoenfelder in 1798. The lithography involves printing from a flat surface the image area being neither raised as in letter press and flexography nor lowered as engravure. It is based on the principle that oil and water do not mix. Oil based ink is applied evenly through a series of rollers to the offset plate rollers cylinder usually made up of aluminum. Water or fountain solution is simultaneously fed via rollers to the plate just before it contacts the inking rollers.

The plate accepts ink and repels water in the image areas. The image on the plate is transferred or offset to an intermediate or blanket cylinder covered with a rubber blanket. The material to be printed picks up the image as it possesses between the blanket and the impression cylinder. The soft rubber blanket creates a smooth sharp images on a wide

variety of materials and is used extensively where illustrations are required on the packaging materials. Screen printing also referred to as serigraphy or porous printing is basically a stenciling process which uses a fine mesh screen made of silk, polyester or metal fine wire on which is supported a stencil.

The screen is completely coated on both sides with a light sensitive emulsion and a positive image of the graphics to be printed is placed on the outside of the emulsion screen. On exposure to immense light on exposure to intense light the unshielded emulsion is cured hardens after which the shielded uncured emulsion can be washed away. The non blocked mesh area of the screen allows ink to pass through the fine mesh. Ink is forced through the screen on to a substrate by a rubber blade or squeegee. Although screen printing was originally a hand process and still is in some applications power screen presses with mechanical feed and delivery are in common use.

Ink jet printing non contact pressure less printing process in which tiny drops of ink are projected directly on to a surface for printing without physical contact between the printing device and the substrate. The two main techniques used in ink jet printers are continuous and drop on demand and this drop on demand can again be of two type that is the piezoelectric type or thermal type. The continuous ink jet technique the ink droplets are continuously generated by pumping liquid ink to the ink chamber and creating high frequency acoustic pressure where acoustic pressure waves using a piezoelectric crystal. The piezoelectric drop on demand the droplets are formed when an electrical signal causes a piezoelectric crystal to expand which creates a pressure wave forcing a droplet out of the print head nozzle. Thermal drop on demand works in a similar manner, but the pressure wave is generated by heat and vaporizes a small quantity of ink causing a large pressure increase that propels a drop of ink on to the substrate.

The electrophotography the oldest of the non impact printing technologies and was invented by Chester F. Colson in 1938. Based on an image carrier surface that is photoconductive and can be charged electrically. Typically a selenium coated photoconductive drum is positively charged using a laser on LEDs a negative of the image is beamed on to the drum concealing the charge and leaving a positive charged replica of the original image. Dry or liquid toner attaches to the image areas of the photoconductive surface and electrostatic forces transfer the toner on to the substrate where it is fixed to the paper.

The final stage is fusing which uses heat and pressure. Pressure alone are light to cause the toner binder to melt and permanently adhere to the paper surface. Electroprint photography is the electrophotography is the printing technique used in copy machines laser and LED printers and is the most complex digital printing technology as well as the

most widely used of the plate less printing technologies. Now the another important part of packaging is the labelling or of the packaging material. Label is the first point of contact between the consumer and the producer.

It allows the consumers to know what exactly they are buying in terms of calories, proteins, fats etc and thus enables them to make a health conscious selection. It informs the consumers regarding weight of the product best before date, storage conditions and cooking recipe if any. It allows consumers to compare food products by value for money. A label is a piece of paper, polymer, cloth, metal or other material affixed to a container or article on which is printed a legend information concerning the product addresses etc. A label may also be printed directly on the container or article.

Labelling acts as a silent salesman through distinctive branding as well as facilitating identification at check outs through the universal product code. While almost all paper based packaging and increasingly metal and plastics packaging is pre printed many glass plastic and metal packages still require labelling. Labels have many uses, product identification, name tags, advertising, warnings and other communication. Special types of labels called digital labels printed through a digital printing can also have special constructions such as RFID tags, security printing and sandwich process. This is a particular example of labels which contains different types of figures which represents different things like this is estimated sign shows that the product is filled using average filled system like this is highly flammable, this is reusability or recyclability of the packaging materials, this is the disposable of carefully and thoughtfully like that these symbols are generally made on that packaging symbols like the last one denotes that this can after opening the container it can be used or finished within the 6 months.

Now, the let us compare the labelling versus the packaging. The packaging is the process the of designing and using materials to wrap, protect and kept products safe for shipping, storing, selling and using is known as packaging whereas, the labelling the process of printing identification marks on the package is known as labelling. The purpose of packaging is to safeguard and maintain a products quality during transport, storage and sale. So, it reaches consumers in excellent condition whereas, the labelling is to share important details about a product with consumers assisting them in making knowledgeable decisions about their purchases. The various packaging materials are used based on the product and its need.

Common options include paper, cardboard, plastic, metal, glass and wood each offering differing levels of protection and sturdiness whereas, the labelling the label material can be paper, plastic or metal. The choice in is influenced by aspects like products surface, environmental conditions and the required durability of the label. About the function the

packaging's main role is to protect a product from harm, contamination and external factors preserving its quality and freshness. Whereas, the labelling the primary function of the labelling is to inform consumers about the products specifics such as its ingredients, usage directions, safety measures and production information. The packaging design concentrates on the containers shape, size and structure considering elements like product protection, convenience and visual appeal.

The labelling design involves choosing suitable text, images and graphics to effectively convey product details and create an attractive display. The packaging is vital in marketing as eye-catching and unique packaging can help a product get noticed on store shelves drawing potential customers attention. Labeling strengthens brand identity by displaying logos, colours and distinct design features making it a simple for customers to recognize and recall the product. Packaging guarantees product safety by shielding it from damage, contamination and tempering during transport, storage and safe. Labelling promotes safety by providing warnings, cautions and instructions for proper uses helping consumers avoid potential or incorrect use of the product.

The packaging must follow specific standards and regulations regarding materials, size and weight depending on the product category and the country where it is sold. Where the regulatory regulations for the labelling, the labelling must meet various regulations that dictates how product information such as ingredients, expiration date and manufacturing details should be displayed ensuring transparency and consumer protection. About the environmental impact the packaging can significantly impact the environment if not designed with sustainability in mind leading to waste and pollution. Where the labelling typically has a similar environmental effect compared to the packaging that is all about the today's lecture. Thank you very much. .