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. In the last lecture we have seen the different testing methods for the food packaging materials. Now, we shall be taking special packaging methods and in the first the form filled sealed machines. And the topics of discussion in this lecture would be special packaging methods form filled sealed machines, working principle of vertical form filled sealed machine, vertical form filled sealed machines, machine parts and working, advantages of FFS, disadvantages of FFS and applications of FFS. The special packaging methods that we will be dealing with the form filled sealed machines, the almost every industry today relies on form filled sealed packaging machines. These pouches, these pouch packing machines are fast, accurate, economical and versatile.

Solutions that automatically boost efficiency and profitability, greater speed and versatility are the major benefits of FFS systems. For example, snack produces demand systems that have the versatility to package different products and provide fast change over between many different packaging formats. Form filled sealed refers to packaging processes that form the package usually form a flexible material, fill it with product then seal it all on one machine. It is also sometimes used to refer to machinery that molds a plastic bottle from resin fills then seals it.

These are outside the scope of this white paper which will focus on form filled sealed with flexible materials. These flexible materials can be plastic film, metal foil, paper or combination. The word film will be used generically here regardless of actual material. All of the machines discussed here use continuous film supplied on rolls. It starts with a large roll of film that is formed into a shape of a bag.

It use a reel of flexible material that is paper, film or laminates of paper, film and foil and either form it into a tube and then seal and fill it at regular intervals or fold it lengthwise and seal it at right angles to the fold to form a series of packets which are filled and closed. Packaging equipment like a form fill and seal machine put a stop to human error and mistake inconsistent quality, the increasing labor, increasing labor cost and inefficiency in the process. The form filled sealed process typically involves the following steps. First is the forming. The packaging material which is usually a roll of

flexible film or a pre made flat bag is fed into the machine.

The machine forms the packaging material into the desired shape such as a pouch or a bag by folding, heat sealing or both. After that filling, once the packaging material is formed the product is dispensed into the formed package. This can be done through various methods such as gravity filling, auger filling or liquid pumps depending on the nature of the product being packaged. After filling, sealing comes. After the product is filled, the machine seals the package that is typically done by applying heat to the edges of the package, melting the film and creating a secure seal.

Now the types form filled sealed machines come in six varieties that are widely used in the packaging of process items. Vertical form filled sealed machine, horizontal form filled sealed machine, thermo form filled sealed machines, stick pack filled sealed machine, pre made pouch filled sealed machine, aseptic filled sealed machine. Among these vertical and horizontal form filled sealed machines are most common. Now the vertical form filled sealed machine, this particular vertical form filled sealed machine. This particular machine performs different operations like film formation, bag seal production and making top and bottom cross seal simultaneously.

Vertical form filled sealed machines are particularly suited for material that drop freely on its own weight. These are fed by fillers that are normally positioned at the top of the machine. Fillers are gravimetric where a cup is filled, labeled and discharged to the pouch or auger filler where product volume is measured by a number of revolutions of a screw within the tube or weight fillers based on a scale system where precise quantities by weight are accumulated and released to the bag machine. Fuel oil, milk, sugar, cereals, pan masala, spices, tea powder, grains such as rice etc are packed by this machine. Now the horizontal form filled sealed machine, this type of machine is extensively used for the packaging of processed food products.

In this machine the flexible film is moved horizontally through the machine which form or fold it into a simple V shape. Once V shape is formed proportional heat control dies make the side seals and the pouches or bags are separated. Horizontal film advancement is intermittent continuously. Horizontal this machine has a control device based on electro mechanical, electronic or microprocessor. Products like chocolates and other confectionery items, sauces, salt, sugar, tomato ketchup, pickles etc could be packed by using the machine.

Thermo form filled sealed machine TFFS machines utilize thermo forming technology to create packages from a roll or sheet of plastic. The machine forms the plastic into a cavity or tray fills sheet with the product and then seal sheet. TFFS machines are often

used for packaging products like medical devices, blister packs and food items. The stick packed filled sealed machine, this specialized FFS machine is designed to produce stick packs which are long narrow packages commonly used for single serve powders, liquids and granules. Stick packed machines form the packaging material into a tube shape fill it with the product and then seal it longitudinally.

Pre made pouch filled sealed machine, in this type of FFS machine pre made pouches are used instead of forming the packaging material from a roll. This machine opens the pre made pouch fills sheet with the product and then seals sheet. This type of FFS machine is often used for packaging snacks, liquids and powders. Aseptic filled sealed machine, aseptic form filled sealed machines are especially designed for the packaging of sterile or aseptic products. These machines incorporate advanced sterilization and contamination control measures to measure to maintain product integrity and ensure aseptic packaging of pharmaceuticals, injectables and other sensitive products.

Now, the forming, form filled sealed machines utilizes a roll of flat packaging film or a web of packaging material. The film is unbound and guided through the machine where it passes through a forming section. In this section the film is shaved or molded into a desired package configuration such as pouches, such as or bags. The forming process can involve the use of forming collars, forming shoulders or mandrels. Now the filling, once the packaging material is formed the product to be packaged is introduced into the formed package.

The filling mechanism varies depending on the specific application and product. It can involve volumetric fillers, auger fillers, weirs, liquid pumps or other types of filling systems. The filling mechanism accurately dispenses the product into the formed package ensuring precise dosing and consistent fill levels. In the adjacent figure it is clear that the roll is coming from here and then here it is in this section the packet is formed and when it is formed then the product is filled and here it is sealed and cut. In the when it is cutting and separating the filled items at the same time it is sealing which makes the bottom of the incoming packet.

Now the sealing, after the package is filled the form filled sealed machine proceeds to the sealing stage. The sealing process is essential for maintaining product integrity and preventing contamination. Various sealing methods are employed including heat sealing, ultrasonic sealing or band sealing. Heat sealing is the most commonly used method where heat is applied to the packaging material to create a secure and temper evident seal. Now the cutting and discharge, once the package is sealed it is cut or separated from the film roll or web.

This can be done using a rotary knife, gelatin or other cutting machines. The completed packages are then discharged from the FFS machine ready for further processing such as labeling, cartooning or case packing. The control and automation, FFS machines are equipped with control systems typically based on programmable logic controllers or PLCs or human machine interfaces that is HMIs. This is the working principle of vertical form filled sealed machine. Here we can see that this is the flexible film which is in the form of roll it is coming here and it is a sealed vertically and then filled automatically and then it is cut and then it is discharged on a conveyor belt which is proceed for the further packaging.

The vertical form filled sealed machines, the machine parts and working. Film formation starts at the forming shoulder in this process. The flat film passes over the shoulder to form a round tube shape with side overlapping each other. Once the tubular shape has been formed the overlapping edges of the flexible packaging materials are sealed. This is normally done with the help of a pair of heated jaws which come together and press the overlap edges of film to make the back or central seal.

Once the tube has been formed with back or central seal cross sealing and filling takes place. The bottom of the pouch is then sealed with the help of heating elements in the horizontal jaws and then the seal is cut at the middle and allow to drop the filled package freely. This the different parts which have we have already seen in the previous picture that is depicted here the different parts of the sealing machines. The advantages of form filled sealed machine. Efficiency The form filled sealing machines are capable of high speed production offering significant productivity gains compared to manual or semi automated packaging methods.

It is cost effective by integrating multiple packaging processes into a single machine form filled seal reduces labour cost and material wastes. It also product protection the automated process of form filled seal ensures consistent and reliable packaging minimizing the risk of product damage or spoilage during handling storage and transportation. Versatility form filled sealed machines can be adopted to accommodate various packaging sizes and formats making them suitable for a wide range of products including powders, granules, liquids and solid items. Form filled sealed technology has undergone significant improvements over the years driven by advancements in engineering, automation and materials. Some of the notable improvements include the increased speed and efficiency, enhanced flexibility, modern FFS machines can handle different types of packaging materials, advanced control systems, precise control over parameters such as temperature, pressure and speed ensures consistent and accurate packaging results, improved packaging designs, enhanced safety and hygiene.

There are certain disadvantages also which are associated with form filled sealed machines that is it cannot handle paper, not economical for short production runs, cannot handle multiply packaging materials, cannot remove trapped air quickly, not economical for low density aerated powders such as wheat flour, talcum powder, whey powder at medium speeds. Now, the applications of form filled sealed machines. The application of FFS packaging machines are endless. Almost any product that can be packed and marketed in flexible pouches can be packaged by such machines. FFS machines can be used to pack a whole gamut of food, pharma and other products ranging from grains such as rice, pulses, sugars to granules such as detergent, fertilizers, snacks such as chips, dry fruits, namkins to ready to eat foods.

Bulk goods such as nuts and cookies and bolts and screws. Powders such as spice powders, milk powder, ground coffee, nutraceuticals and liquids such as water, milk, juice, liquor to viscous such as edible oil, ghee, ketchup, mayonnaise, salad dressings, bath gels etc. Thank you very much.