Food Packaging Technology
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Week – 07
Lecture – 36
Form fill sealing machine

Hello everyone! Welcome back to the fifth module of Food Packaging Technology Course. In this week, we have already gone through packaging equipment and the machinery. We already discussed vacuum packaging machine, where vacuum is formed inside the packaging material. We discussed about the CA and MA package, where you control the atmosphere within the package. Then we went on to talk about the gas packing machine, which changes the gas that is inside the package.

And today we will be discussing on the form, fill and seal machine. Now this is as the word suggests, a form fill seal machine is a process in which the container is formed, the product is filled in it and it is finally sealed without interruption in the process itself. Whether it is milk or snack foods, every packaging machine nowadays uses a form fill seal machine, where all three processes are done in line itself. So, the most important thing is the form of the package.

The form can be a pouch, a thermoform or bag in box. By now, you would have been very familiar with some of these words, but still, we will be going into the details in the next few slides. The fillers that you use for this form fill seal machine are usually liquid fillers, paste fillers, augers, pocket fillers, vibratory, orifice type and the gravimetric units. And then finally you will seal the package. So, this is the styles of the pouches that you will have.

This is a pillow pouch, which is very familiar to all of you, especially any of the snack foods, biscuits. A pillow pouch gets its name because it resembles a pillow. You will have a seal on the two ends and you will have a seal right in the middle. So this pillow pouch, it can be varied in different styles, the different options. These are not hard and fast rules, but these are options that are given based on the design that you want and based on the attraction for the package that you want to incorporate.

So this is one, you have got one slanted pillow bags where one side is slanted, which is a design. A flat gusseted bag. So, what is a gusset? A gusset is extra space that is given on the two ends of the packaging material. When you put in the product, it can expand or it can flatten based on the need. So when you want to pile it up, you flatten it.

When you fill it with a product, it expands. This is a flat gusseted bag. This is a slanted pillow bag. This is a flat gusseted bag with a bottom rock bottom where you can place it flat on the surface or you have a center seal moved to side. These are options that you can have.

In the pouch seal, you can have a three sided fin seal where you can have top, bottom and middle portion sealed. So that is called a three sided fin seal. A four sided seal. A four sided seal is when you have two webs coming together and all four sides are sealed. You can have a single gusset or you can have a double gusset.

A double gusset gives in more expansion space to the pouch. And you have got a pillow pouch shape. The first thing is to form the package, you want to know which form you want the package to be in. And based on that, the packaging machinery is designed. Now in this itself, the words fin seal and lap seal.

Fin seal is when you have the two ends come together. It is with an adhesive, you will stick them together and it is folded. But at the same time, it is loose enough for you to hold. So that it is called a fin seal. But an overlap seal or a lap seal as it is called in short form, one end is overlapped with the other and it is joined together.

So you can't open it. It is closed, joined, bond together. And this is a style, it can be either left over right or right over left. Basically when you fill a product, before you fill a product, you need to put in fin seal or lap seal. Once that is done in the tubular form, it goes into the packaging machine and gets filled with the product and it is sealed.

I hope you understood the fin seal and the lap seal that we just discussed. These are just different styles. And similarly, depending on the type of pouches, there are different form fill seal packaging machines. There is inline single lane intermittent motion, that is they go one after the other in a single lane, but one after another, one is cut and then the next goes in. Or you can even have a continuous motion one after the other.

Rotary, that is, especially for filling certain kinds of powders and things like that, you will have rotary, it goes in a rotary motion. The first one was like in a vertical horizontal motion, the second one is the rotary. Or you can have a single lane continuous motion or multi-lane continuous motion. You can have a number of lanes where you can form, fill and seal the different products. This is for larger production lines.

Now this form, fill, seal machine, this is important that it is in three types. You have got vertical machines, horizontal machines or a sachet forming machine. In a vertical

machine, as the name suggests, the whole thing is in a vertical form. The web of plastic that comes, flexible material that comes in, it goes over a collar and forms a circular tube. Once it forms a circular tube, it is sealed at the bottom layer and the product is filled and is sealed on the top layer.

So this is a vertical form fill seal machine as you can see. These are different portions. This is a film roll. It is continuously taken off.

It is pulled off. It comes as a film web. This is the forming shoulder which forms the circular tube and the product goes in through this tube, gets, fills into the pouch that is already formed by the machine and this is a sealing unit that seals the top portion, cuts it off and the next process takes place. Okay. So it is a continuous process. In this, you can see there are two types in which the seal operations can take place.

This is, we already learnt about the four sided and the three sided seals. So this is supposed to be a three sided seal. This is a vertical in a vertical form fill operation. Here the product is filled. You will seal the top portion, the bottom portion and the mid portion.

Okay. And the product is pouch is cut off from the continuous roll. On the other hand, if you notice this, all four sides, first the three sides are sealed, the product is filled, vertical seals on both sides are done and the bottom seal is done. Once the product is filled, the top horizontal seal is done. Okay. It is just the way in which the design takes is deferred but at the same time the machinery should be designed in such a way that you get the package that you require.

Now if you look at the package styles that you have, like we already said, we had pillow packs where you have a fin or overlap seals on the base of the pack. You use it for candy bars and biscuits. Another one is the sachet packs. We already talked about the sachet packs. You would be more familiar in sachets with your small pouches of shampoo or any other 'Tang' or any other powders that you use where the four sided fin seals are used.

Okay. Occasionally, they do have three but generally it is four sided like instant soup and desserts. Another style is the strip pack. Strip pack is more familiar in medicine but you do have the same thing in food packages where you will have different products in the strip. You can take off the portion that you want and leave the rest intact. The next time you want to use that you can take that.

So this is just an upcoming one in the food industry but it is very common in the

pharmaceutical industry. Here two layers are sealed together. The product is in individual pockets inside this web. Usually used for pills and capsules but it is fast moving into the food industries also. So this is a principle of a blister packaging or a strip pack here.

You have the thermoform pockets that you have here. You have your product inside. The preformed blister package is filled with the product and then it is finally sealed. The top portion can be the cardboard, paper cardboard and plastics which is heated and it is sealed.

The second design of form fill. The first one was vertical form fill seal machine. We talked about the way in which it is done, the different styles of the pouches. The second one is your horizontal form fill seal machine. In a horizontal form fill seal machine, you have the web of film that is again pulled but this time instead of going vertically down it is pulled horizontally. So you will generally have thermoform trays forming the bottom portion.

So the continuous thermoform trays come in. It is filled with the product and the top portion you will have your web of plastic which covers and seals the top portion and it is discharged in the end. So here the operations are one, pack is formed shaped that is where your thermoform trays are formed. Number two, the product is added into the thermoform trays. The pack is closed with a web of flexible film and the styles can be either pillow or sachet.

This is a flow chart which shows you the thermoform fill seal packs and the process through which it goes through. In a horizontal form fill seal operation you need not have a thermoform trays, you can also have your pouches like we said, sachets and pillow packs where your packets come in a more horizontal way. So the film comes in, the side seals are formed, again horizontal, it is moving horizontally in the line. Once the seals are produced, the pouch is cut off, it is formed. There is something that will open up the pouch, fill the product inside the pouch and then the top seal is made.

So it is very similar to your vertical one except line moves in a horizontal direction. It is only the line that makes a vertical form fill seal machine differ from a horizontal form fill seal machine. Now what are the materials that they use for thermoforming? They use rigid PVC film, polystyrene film which is PS film, PP which is polypropylene film, PVC - PVDC, polyvinyl chloride and polyvinylidene chlorine, PVC-PVF, PVC-PV, PVC-PE, PVDC. These are all laminated ones which can be used for the thermoforming. Now in addition to using the plastics and the thermoform trays, it is very common nowadays to have the paper bags or paper bags which are more environmentally friendly.

So these prefabricated wrappers in which the product has to be filled and closed and commonly it is used for flour, sugars and rice. There are two types like we said, there are paper bags and there are film bags. The paper bags are usually can be made with either sulphite paper or with Kraft paper. This Kraft paper has got increased strength. Sulphite paper is used for general purpose and in addition to that they use grease proof paper, vegetable parchment paper, glassine paper.

These are more oil resistant especially for products which are high fat. These do not let the fat permeate through it. So they are more oil resistant. Just like the film bags, you have got paper bags which are of four styles. It can be flat, gusseted, self opening sachet or rose bottom sachet.

Second one was the film bags which is made of PP, PE, PLA, starch based material. This has got more protection, visibility is more important. Your paper bags it is very unlikely that you will see what is inside the bag. But in the film bags it is more transparent and you will be able to view the product that is in the bags. And again there are three types, you have got the flat, gusseted where you give a space on the side or you have the sachet type.

These are the open mesh bags which is very common in the retail markets that you will see especially for your fruits and vegetables. We mentioned when we did MA and CA storage that vegetables need to respire. They are not dead. They are still living even though they are in a bag. So unless you allow the respiration to take place, it is very difficult.

They decay faster. That is why in a package, in modified atmospheric package, you generally do not reduce your oxygen level to zero. You need to give. So sometimes as a fresh produce, they usually put it in an open mesh bag. Where you have a mesh where the vegetables and fruits can continue to respire.

At the same time it is contained in a particular way. So these are used for products that need complete ventilation. Usually they are meshes made of tough resilient plastics. And the PE film bags with perforations can be used up to 3 kgs of weight. It is very common nowadays in all supermarkets and hypermarkets. And in these baggings, you have to feed the flat bag into the loading point, open the bag, load the product and make the closure.

And one of the other styles that you will have nowadays is bag in a box. So if you look at ready to eat cereals, morning breakfast cereals, generally you will have carton boxes

which is your secondary packaging material. Once you open it, you will have another plastic flexible bag pouch which contains your products. That is a bag in box package. And these strong bags are made of several layers of metalized film.

Also can be made of plastics and they are placed in your corrugated fibre boards. There are three types in which these can form. Bags which are loose inside the box. Or bags which are glue spotted, sometimes on the packaging material.

In one spot they glue it. Why? So that it doesn't move around. Or bags which are firmly secured to the walls of the carton. So these can be used for not only cereals, even for tea bags. Many of these bag tea comes in such kind of boxes. So here is a pictographic representation of a bag in a box system.

As you can see, the box comes from a different line. The bags come from a different line and they are filled together and they come out. This is a horizontal carton. I just take it from the Robertson book. Now that we have completed the different pouches that are used in the form fill seal machine, let's move on to some of the product fillers that are used.

Which is again an integral part of the form fill seal machine. There are umpteen choices for the measuring and filling equipment. For example, there are net weight scales, auger fillers, volumetric fillers, counters and liquid fillers. We will just go through a few of them in this before we conclude. Because the rest of it will be taken in the bottling machine section which is in the next module.

Coming to the net weight scales. So this actually weighs the particular amount that you need for each package and fills it in the package. It is one of the most accurate means of doing it and it is a multiple head computer based system. The package weight control can be at least held up to 71 grams regardless of the size of the piece or the particle size. That was the taking the weight in each package.

There is another way of doing it by using auger fillers. As you see in this diagram, augers are present in the fillers. So each time the product is filled in the augers and the measured quantities are filled in the packages. These are usually meant for products which are in the powder forms. Another way of filling the package is by using a volumetric cup filler.

In a cup filler, it is just like you take your medicines. You need 5 ml or 10 ml. A cup filler will have a particular volume. So the product is filled in the cup of a particular volume and that cup is emptied into the pouch. So this can be used for a wide range of

products and it is usually used for very inexpensive products.

Counters are another method in which you can fill it. Usually used for confectionery items or products in which you count the number of products that are there in your package. For example, you buy a package of confectionery sweets. You say 100 packets. So you actually need to count the number of 100 items that are going into the package.

So in such cases, they use a counter filler machine. Be aware of the bucket elevators that are there. Bucket elevators are usually elevators to convey the product from one point to another. Generally a bucket elevator is eliminated and you just mount the filler directly on top of the vertical bag machine. So to conclude, form fill seal technology is an automated computer operated technology to prepare sterile products. And there is a lot of constant development going on in this area and the manufacturer requires modern and reliable packaging machinery in order to achieve the best profits from his product.

So this technology reduces the rate of contamination to the final product. Number two, it increases the production rate in very low operational cost with high assurance of sterility. With that, we come to the end of the form fill seal packaging machine which is another advanced technology that is used in the packaging industry. In the next class, we will continue the last topic of this week, aseptic packaging. Thank you and have a great day.