

**Food Packaging Technology**  
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**Week – 07**  
**Lecture – 35**  
**Seal & Shrink machine**

We've already gone through a few packaging equipments and machinery that are used in the packaging industry. We first went through the vacuum packaging machines and then two very similar ones, the CA and MA packaging along with the gas packaging machines. We're coming into another topic today, which is the seal shrink packaging machine. Now the technology of using a heat shrinkable film to wrap packages followed by heating quickly taking place everywhere. You must have seen a lot of products where the product is covered with a package that sticks to it or it conforms to its contour.

These are usually the shrink packages and the material that you use is usually a shrinkable PE or PVC films. Now shrinking is usually taking place when you pass it through hot air. It either can be a tunnel or it can be an electric gun. Once you cover the package with your shrinkable plastic and then you allow heat to pass through it, it shrinks and takes the shape of the product.

This is a pictographic representation of shrink-wrapping machine. You can see the reel of plastic, where the plastic is pulled. So, when you see usually in your retail markets, you would have seen a set of beverages, the mineral water. It is usually shrink wrapped or stretch wrapped. In this class I'll also talk about the difference between a shrink and a stretch wrap.

Generally, they go around the product, brings them together, then it goes into the tunnel that you see here, a red color and the heat that produces will help the package to shrink and take the shape of the product. So, this is just written down here. You wrap the product in the shrinkable film, heat seal it. You need to seal it. So, there are different ways.

They're mostly they do seal the ends before taking it for shrinking. Cut the necessary ends that in the end. Package is then put into the shrinkable equipment which produces the heat and then finally cooled and this is the shrinking operation. The product is back in the package. You see the size of the shrinkable film should only be 10 to 20 percent larger than your product size.

If the size is too small, this can result in extra tension, but if it's too big also, it can be too loose. That also affects the overall attributes of the shrinking material. So, see that it is only 10 to 20 percent of the product, a little bigger than the product. Now in the shrink wrap film, I told you all the commonly used materials are polyolefins and PVC. The polyolefin as you all know includes LDPE, HDPE and PP.

So, these are the shrinkable materials that can be used along with the polyvinyl chloride. Coextrusion or laminations are done for better mechanical properties. Coextrusion and lamination are also two terms that you all have learned in your previous modules. Coextrusion where you melt each of the individual plastics and bring them together as one web and in lamination instead of melting it, you will stick them or join them with an adhesive one over the other. So, in both these cases, you're using multiple materials and that only adds to the mechanical and the barrier property.

So, such shrinkable materials which use laminations or coextrusion are the EP/EVA/copolyester/EVA/EP, where EP is the ethylene propylene and EVA is the ethylene vinyl acetate copolymer. Whatever films are there itself, it can be of three different types. It can either be a flat film or it can be a tubular film or it can be a folded film. Now let's look at the properties of these films. It should have good wear resistance and strength.

It should fit closely with the profile of the container, whether it is rectangular or spherical or oval in shape, it should fit with the contour of the product. Number three it should be transparent. It's not necessary, but it is desirable that you can see the product from outside. Good seal strength, waterproofing, anti-fouling and anti-rust. Now this is important.

What is the method of shrink packaging? One method is they will, it's called open at both ends. So basically, the product is wrapped in a sleeve. You just like you have a sleeve, both the sleeves are open, you make it tubular in shape and into the tubular film, you will add your product and then it is heated in such a way that shrinking is done at both open ends. And so, it is closed and takes the shape of the product. The other method is called open at one end.

Here you wrap a number of products firmly without being loose in the transit. You wrap it in a number of products. So, one end will be closed, one end is open so that you can add a number of products in the same shrinked package. And then this is taken to for an open-air heating. So, like I said, the method of both ends open is a tubular film.

The mouth of the tubular film is open. You push the products into the tubular film. The

film is cut, extra ends are cut and then you can make it. This is usually used for batteries, paper rolls, bottles and cans. I'm sure you'll be able to relate to such products which are shrink packaged.

In the other method where you use open at both ends, but a flat film, you can use a single flat film or you can use a double flat film. The single flat film usually you have a pillow type package. being made. I hope you recall what a pillow type is. Just like your pillows you have both ends sealed and the transverse, the middle layer also sealed.

So the pillow package is made. Again, you seal longitudinally to make a tubular form and then the product is pushed in. It is sealed, it's cut and it is taken into for shrink wrapping. In a double flat film, it is similar to this film that is made into a tube except the sealing device is required at both sides of the machine. Now, what's the advantage of using this open at both ends method? Here only one or two seal processes is required and the product has a more aesthetic appearance.

But the disadvantage is it is unable to meet the diverse requirements of the products and you can only apply to one single product which is in a large quantity, you know one product which is in a bulkier thing, you can do it for such kind of open-end methods can be done for this one product which is in a greater quantity. But the problem is another disadvantage is the residual air inside makes the shrinking a little difficult. You will not be able to remove all the residual air that makes it a little difficult. So generally, they have something called a puncture device inside your sealing device so that a small puncture can be made any residual air can be removed while it is shrunk and then that can be closed. So, during heat sealing the needle actually pricks out.

There is a vent hole that is made. So, any extra air that builds up it comes out through that vent and then it can be shrunk and that is a self close hole. As soon as you heat shrink it the hole closes. Now, in the heating channel, this is one of the most important parts of your shrink packaging the heating channel. It's actually a box shaped device with heat insulated material in the wall.

in the wall. So, you cannot have all the heat. It's a very high temperature can go up to 171 degrees centigrade. So, what happens is you need to have an insulated wall for this and there is a forced circulation system to ensure even circulation inside that and the temperature can be adjusted to make it a constant temperature. You have a conveyor belt and the prepackaged product is taken through the conveyor belt into the tunnel. Speed can be adjusted temperature can be adjusted and once the heating is done, there is an automatic shrinking of the package which takes place then it comes out of the conveyor belt natural cooling under fans gives a shrunked package.

**Shrink Tunnel** The shrink tunnel is basically a heated tunnel with a moving conveyor belt. The package with the product is introduced into the tunnel the package shrinks as a result of the heat and takes the shape of the product. Temperature and speed of the conveyor belt can be adjusted depending on the property of the plastic used. Next is the sealing of the products filled in thermoformed trays. Products are filled in the trays and the web of plastic is pulled over the trays.

The equipment seals it properly using a heating bar. Temperatures can be adjusted depending on the sealing characteristics of the plastic materials that is used. This is mostly by a trial-and-error method. Next, we have an automatic cup sealing machine which is very similar to the equipment for tray sealing. Here again the filled cup is placed in the equipment which pulls the web of plastic over the contour of the lid and seals it.

Temperature and time can again be adjusted depending on the sealing characteristics of the material used. The band sealing machine is primarily used for continuous sealing as you can see in the video. The temperature and speed can be adjusted. Low temperature requires slower speed and higher temperature requires faster speed. Here, we can continuously seal over a large length of material.

What are the advantages of a shrink packaging? First and foremost, contour fit. It is the aesthetic appearance that happens when you do a shrink packaging. Any odd shaped packages can be easily shrunken packed to give you a very beautiful product. Number two a very neat appearance. So, whether any product that is neatly packed is more attractive to the consumer.

So tightening the film eliminates anything that is loose in wrinkles and actually makes it more attractive. The third advantage is it improves the see through display. Most of these shrink packages are transparent and the product inside can easily be seen. Fourth one important immobilization. So, you can have one product or more than one product in your shrink package but there is no movement.

That prevents a lot of abrasion, prevents a lot of shocks inside just because it is immobilized, which is an advantage in shrink packaging. And the fifth one is innovation. It improves the product identification with reduced label cost. It reduces the floor area. How? Like instead of having bulk packages, you can actually shrink it to the shape of the product.

So you can stack up. You can include more product in a particular shipment. That reduces the cost, floor area, the shipment cost, there is reduction in labour and it

eliminates damage especially during transit and during opening. There are some new technologies in shrink packaging. Number one is cold shrinkable film packaging technology, vacuum shrink packaging technology, shrink packaging with cushioning and coloured shrink packaging technology.

We just go through these one by one. The cold shrinkable film packaging as the name suggests you do not require heat. It is colder shrinkable. Here it has the advantage of both shrink as well as stretch. So, the material is playing a bigger role in a cold shrink film packaging technology.

The thickness of the material is usually 0.1 mm and the contraction ratio is 17 to 20%. So, you can actually shrink it without being heated, which is an advantage to a great extent. Good transparency, you can save packaging cost because you are reducing the heat that is applied, saving any energy and it is safer. That is the first new technology which is a cold shrinkable film packaging technology. The second one is a vacuum shrink packaging technology.

Now this is a green technology. Green technology are technologies that produce less toxic waste to the environment. Less pollution to the environment. Vacuum shrink packaging is one of the green technologies that are used now. High shrinking rate eliminates all these bag folds that might appear. Very neat appearance, excellent oxygen barrier property it should have because once it is along with shrinking you are assuring that it is vacuum packaged also.

So the package should be a very good oxygen barrier. Good heat-sealing performance and better performance especially during transportation. That was your second latest technology in shrink packaging. Third one is shrinking packaging with cushioning. Now, here we use a double bubble heat shrinking film and this double bubble will actually have a cushioning material in addition to being a shrink package.

It has a mesh structure on one side and the other side it will be a smooth structure. I am sure most of you have seen the bubble wraps that are used and that we have already discussed in ancillary packages. That becomes a part of the shrink-packaging technology. In the formed layer, the main ingredient is PP, polypropylene.

non-formed layer is made of the LDPE. So, the production process you stretch the film more than three times along the portrait and the landscape. You just stretch the thing, burst the bubbles to form a mesh and then you shrink it. And one of the last ones is the coloured shrinkable film packaging. These colour shrinkable packaging are high efficiency, they have got low cost, attractive appearance, environmental protection is

there and for display effect this is one of the best materials.

For better attraction this is one of the best materials. Better promotion of sales, it is colour, thick coloured shrink films are used here and it is mainly used for beverages, beer and water. There is another term which I told you we will also be discussing along with the shrink wrapping which is stretch wrapping because these two terms can be interchangeable but they are two different terms. In stretch wrapping it is also known as pallet wrapping. So, if you look at this picture here, you all must be familiar with this kind of transportation where these carton boxes are brought together on a pallet which is this wooden platform that you see at the bottom.

The whole thing is unitised with a stretch wrap. So, there you generally use a stretch wrap rather than a shrink wrap. In shrink wrapping you will be using heat. Here you stretch it and contain the products together. So, these kinds of wraps are very stretchable, tightly wrapped around these items.

Elasticity is what makes this more important. It can be elastic or as stretchable as possible. There are different types of stretchable films which includes bundle stretch films, hand stretch films, core stretch films, machine stretch film and static dissipative film. We won't be discussing this in sessions but just understand there are these kind of different stretch films that are available. Now let's look at the materials used for stretch wrapping. You can use LLDPE which is the linear low-density polyethylene or polyethylene itself.

You can use PVC, polyvinyl chloride. But for a higher stretch, especially for pallet stretch wrapping, where you have a bulk quantity and you have to stretch all around it, not the small collations that you have of bottles but a big pallet collation. In that case you need to use a special grade film which will be LDPE mixed with EVA Ethylene Vinyl Alcohol. This will give you a stretch of at least 300% which is a good thing. It actually reduces the cost of material while giving you a very good stretch. Functions of a stretch wrapping are it improves the stability, dust and moisture protection of course.

Number 3, tamper resistance and pilferage. So, tamper resistance if anything if you see a cut, you know it has been tampered with. And number 4, sun protection. So, these are the advantages or functions of stretch wrapping film. There are different devices, we'll just look at the names of it.

You've got some manual or hand wrappers are there. Semi-automatic and even automatic wrappers. In the manual wrappers you will have extended core, mechanical brakes, pole wrappers. So, these are done by human beings manually. The second one is semi-

automatic.

Half of it will be done by the machine and half by the humans. You have turntable wrappers, orbital wrappers and the rotary arm wrappers. But automatic which is done in the huge production areas. There you have again turntable wrappers but completely done with the machines. Rotary arm wrappers again machine and the rotary ring wrappers. Before we conclude let's just point out the difference between a shrink and a stretch wrap.

You've got a fairly good idea about these two. Let's just point out the differences. In shrink wrapping it depends on the reactivity of the film. You need the film to shrink based on the heat that is given. And this will create a compression force on the product. On the other hand, in the stretch wrap it depends actually on the elastic property of the film and produces the same effect, compression, it gives the shape of the product.

But only thing the principle is a little different. Number two, in the shrink wrap it's mainly used to display the product along with the protection. You know consumer attraction is its main function. While in stretch wrap it is usually used for the transit packaging or we talked about pallet. So, it also needs to protect the contents during transportation and wrapping them together will help in unitizing them on the pallets. The third difference is a shrink wrap it depends on the reactivity of the film like I said and it requires special grade film.

But stretch wrap you can use ordinary LDPE film if you want to go in for a stretch wrap. Similarly in a shrink wrap you can sometimes waste 20% to 50% of your wrap. The reason is that you know sometimes when you pass through tunnel and heat is applied you can have small pin holes that is formed and these pin holes will eventually become big holes that has to be reprocessed which again leads to a loss. But in the stretch wrap you have fairly less wastage. Number four in the shrink wrap the minimum gauge (the thickness of the film like we have explained before) the thickness of the film the minimum is usually 150 gauge even for lightweight products.

But in stretch wrap a thinner gauge is used for lighter packs while for heavier packs the bigger ones which needs more thickness a stretch wrap, it depends on thickness; you increase the thickness based on the bulkiness of the product in a stretch wrap. And shrink wrap only products (This is very important to note) only products that are not heat sensitive should be shrink wrap. If a product is going to be destroyed in the underheat never going for a shrink wrap. Stretch wrap is more widely used you can apply it in beverage industry for preparing collations of small bottles with or without cartons and no heat is required. So, both shrink and stretch wrapping technologies are widely used in the food industry for their specific functions.

There is a steady growth in the demand and the use of these technology is foreseen. So, I hope you got a fairly good idea of these two very important technologies which is used for unitizing your product making it more appealing to your consumer. So, we'll continue in the next class. Hope to see you then. Thank you.