

Food Packaging Technology
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Packaging accessories and advances in packaging

Hello everybody. Welcome back to the fourth module of the Food Packaging Technology course. In the last few weeks, you have been studying about the different packaging materials, the way it is formed, the tests that are performed. This week we will be continuing with another new topic which is on packaging accessories and the advances in packaging technologies. The topics under this week will be packaging accessories and advances in packaging technologies like active packaging, modified atmospheric packaging, aseptic packaging and biodegradable plastics and edible coatings. So, these are some of the new topics that are very different from the other modules that have been already covered.

Let's start with packaging accessories. A recap into your previous module. We talked about the different types of packages, primary, secondary, tertiary. And today I will introduce a new word which is ancillary packaging.

Under primary we talked about the packages that are in direct contact with the food like the laminated pouches, the tin cans, cling films, shrink wraps, anything that comes in contact with the food. Coming to secondary, it was the outer covering of the primary package which were your plastic crates, plastic trays, wooden crates etc. And the third one which is tertiary, is actually used for your shipment and that includes the corrugated fiber boats, your plastic pellets, wooden crates etc. Now what are these ancillary packaging materials? If you look at the examples under these, they are adhesives, printing inks, polypropylene straps, tapes, labels and cushioning materials. So, what can these be? These are actually essential commodities in the packaging industry which actually helps to efficiently and securely store your products.

It helps to organize and customize the products in the packaging material. So, ancillary compounds enhance the properties of the initial material. In food packaging, all the ancillary materials it actually should receive clearance from the food regulatory authority. For example, you are printing ink. You should have it in such a way that there will be no migration from the package into the food.

There should not be any unnecessary migration of the ink. So, it should adhere to the food safety rules that are existing. We will start with adhesives which is an important

ancillary material. Adhesives are chemical compounds that join two materials of objects together. So, what are their functions? They are needed for forming and sealing corrugated cases and folding cartons.

Number two, they are needed for winding of tubes in your cores and composite cans. Needed for labeling in your bottles, your jars, your packages. Needed for lamination. You all should have already studied by now that lamination is a combination or joining together different packaging materials and for this lamination process you will require your adhesives. Now this adhesion is a process of bonding these two surfaces together and the surface are usually referred to as adhesives.

So an adhesion is any substance which is applied as a thin layer between two adhesives that bonds them together. And this adhesion is because of an intimate intermolecular contact between the two materials. There is usually a force between the two surfaces. And the most common surface forces that are involved are your Van der Waal's forces. In adhesion you will have the acid base reaction and hydrogen bonds.

So these bonds actually help to adhere or join these two objects together. Adhesion itself are of two types. You have mechanical adhesion and you have chemical adhesion. Now mechanical adhesion, if you have two porous materials and they can be bonded together by the adhesive entering into the pores and giving a mechanical structure. For example, paper to paper.

So the porosity is very important to determine the degree of penetration into the surface. So too little or too much porosity will affect the bonding. So generally, materials like paper are coated so that they can control the penetration of the adhesive into the surface. The second type is the chemical adhesion. In chemical adhesion there is a chemical bond that is formed between the adherent and the adhesive.

So many adhesives are strongly polar. You have strongly polar adhesives like the starch, PVA, casein. And paper is a polar adherent. Whereas plastics like LDPE, PP, glass, they are non-polar adherents. So many adhesives they work in both mechanisms.

You have mechanical as well as chemical adhesion that is working in most of the adhesive. Now there is two terms that is shown in the screen here. One is wetting and one is tack. Wetting is the process of establishing intimate contact between the adhesive and the adherent. So wetting is very important.

You should bring them in close contact. And to be for an effective wetting, the surface number one it should be clean. And number two the surface tension of the solvent that is

used should be in such a way that wetting is possible. So sometimes they do add wetting agents to bring these two materials together also. And the term tack is actually the ability to form a bond of measurable strength immediately.

Basically it is the stickiness of the adhesive. So, if your tack is more, the adhesive is better sticky or it can bring the materials together in a better manner. So, tack is the property of the adhesive and it allows to adhere to another surface. That is what I said. It is the stickiness of the adhesive.

So we talked about two types of adhesion, the chemical and the mechanical. Now we are going to talk about two types of adhesives itself. Adhesives itself can be divided as a water borne or solvent based adhesive. Water borne adhesives are the oldest and still the largest class of adhesives that are used.

Very commonly used. So, they are slow drying compared to your solvent based. They require three times more heat and more time also in order to dry up completely. Another problem is water borne adhesives. They generally do not provide the shear or the peel strength that the solvent based will provide. And they do not have a moisture resistance once it is dry.

That is a problem. But water borne adhesives are still has its own advantage. They can withstand high temperature ranges and they are easy and safe to handle and of low cost which is a big advantage. Now in addition there is something called pressure sensitive adhesive. Now that is understandable. These pressure sensitive adhesive they actually bring surfaces together when you apply a light pressure.

So there is no chemical interaction going on here between the substrate and the adhesive. There is no curing of substrate that is required. Intimate contact between the substrate and the adhesive is what is required. And if you give a slight pressure the surface will be joined to the adhesive. Now coming here in this slide, I have shown you all the different types of adhesives in terms of whether it is natural or synthetic.

You got number of natural adhesives that are there. Starch is a natural adhesive. Proteins are used as additives. Certain natural rubber latex is used as a natural adhesive. For example, starch is used generally for your corrugated fibroids.

CFB is the corrugated fibre boards. If you want to join them together generally, they can use starch. For sealing cartons, winding spiral tubes, forming bags, labeling metal cans. Protein you generally use casein or you can have animal glue. Animal glue is usually made from collagen.

Collagen is the most abundant protein that is formed in the human and animal sources. And these can be made into glue. And you can actually be using that to make rigid set up boxes. Natural rubber latex is another naturally formed adhesive. It forms bonds with pressure that you use in your self-sealed candy wraps.

Similarly you have synthetic adhesives. Synthetic adhesives are water borne adhesives. You got hot melt adhesives, solvent based adhesives and pressure sensitive adhesives. So, what are this water borne adhesives? They are resin emulsions generally of PVA or EVA and it is used to form, seal and label cartons, tubes and bags. Hot melt as the term suggests you need to give some kind of heat.

So there usually these adhesives are thermoplastics. They can be melted and reformed, melted, reformed again and again. And the bond forms when the adhesive re-solidifies. Solvent based additives are usually they use organic solvents are used but generally these have got less application in the food industry. Last one is the pressure sensitive adhesives.

They are bonds that form instantaneously in light pressure. There is no solvent, no water or heat required. This in general are the different kinds of adhesives that are used as an ancillary packaging. The second type of ancillary packaging is your printing inks. Printing inks are indispensable today in your labels and there are various kinds of printing inks and varnishes that you use in the food packaging.

And these printing inks are usually a mixture of a number of substances. You have color, you have binders there, you have solvents and additives including plasticizers. And together with other colored and non-colored overprint varnishes, they are applied to the material to form graphics or decorative design. And this is very important because all of us know that any package has to be attractive in order to woo the consumers. And there the printing inks are a very important role.

The choice of the ink depends on the printing methods. Now in food packaging you have generally have four different types of printing technologies that we will be studying in the next module. We will be going into the details there. But usually, the four different types of printing technologies used in food packaging are offset, flexography, grave printing and inkjet printing. So, depending on the technology, the choice of the ink will vary.

And it is usually applied on the non-food contact surface. That is important. Or it is between one of the outer layers. Why? Because you want to reduce the migration of the ink as far as possible. So in that case, you will try to keep it as far away from the food as

possible.

So we talked about your adhesives, we talked about the printing inks and the third ancillary material is labels. Labels, as we know, has got a number of functions in a food package. Number one function is communication function. And it informs the consumer about the nutrition content of the product, the net weight, the product use, the brand, anything.

Everything is conveyed through the labels. It acts as a silent salesman through distinctive branding. It helps in identification through a universal product code. You all know, on the labels, you will know what kind of product it is, your barcodes. As you all know, most of your labels are paper based, but though there are metal and plastic based also coming up, while almost all your paper packages or even your metal and plastics are pre-printed, it is indispensable to use labels in glass and metal packages. So that is where labels are still an important part of the packaging industry.

What are the different types of labels? You have glued on labels, which as a name suggests, you will have a printed sheet where the adhesive is attached to the non-contact area and it is attached to the packaging material. It's used for large volume substances like your beer, soft drinks, wines, canned foods, where high speed applications require. Second one is self-adhesive labels. Self-adhesive is again pressure sensitive, which you all use book covering and things like that. It's made from paper or plastics and it's laminated usually to paper or plastics and it can be used to adhere to a wide range of materials.

Now here what they do is this pre-adhesive applied labels, they will be mounted on a release paper. So as a meant required, they're released and they added to the food package. It's called a self-adhesive label. Third one is interesting, which is called in-mould labels. These are applied to the containers during the formation of the container, during thermoforming, during your injection molding.

They are attached to the packaging at that time itself. So, in contrast to your glue applied labels, these are very different. Glue applied labels are on the surface of the object, while in-mould labels are in the walls of the object, but it's of higher cost. Fourth one is a sleeve label. Sleeve labeling is like a shrink labeling where they will penetrate into the geometric or the design of the package. The preformed, pre-printed sleeves are put onto your containers and then they're shrunk either by heat or some other means.

They shrunk to get the shape of the product. You can see that in this picture here. There's a picture of a self-adhesive label compared to a sleeve label. In a self-adhesive

label, you glue it onto your glass or bottle, but in a sleeve label, you put it onto your package and this is then taken to a heat tunnel. So, it can be covering the package or for tamper-proofing, it can be only over the caps or if you want to contain two or three, it can be multi-pack or it can be partial.

So this is what a shrink sleeve label is. And this picture also shows you an application of a shrink sleeve where you'll print it. Pre-printed ones are slit. It's covering the bottle here and again heat shrunk to get the shape of the bottle. And the last type of label is called a holographic label. A holographic label is so called because it includes a hologram into the label.

Okay, so this is very important in order for branding. Now this is very important for authentication. Diffractive optical variable devices, they will give you complex images when you tilt your label. So that helps to know the authenticity of the product. You do have a number of duplicate products that are coming in market and the holographic label helps you to identify the authentic ones. Coming to the next ancillary packaging material, it is a PP strap.

A PP as you all know stands for polypropylene strands. You all should have seen these straps that are used to tie, bundle your goods. So, this strapping is usually done in the warehouse during the shipping process and they require specialized hardware which allows the strap to bind the good and keep it securely in place. Another very important ancillary packaging material. So, by now you all will understand that ancillary means helping, you know, helping in overall packaging.

Another ancillary package is tapes. Now tapes can be both used as a packaging as well as a packaging customization material. They come in different materials, size, color and they have different advantages. Now, generally they use plastic tapes. They used in the packaging industry in gift wrapping. But they also use paper tapes but they are less used than your plastic tapes.

Now these tapes, depending on the way in which it is applied onto your surface, it can be of different types. You can have an etch taping which is very clear from the picture here where you will have it on the two sides and in the middle in the form of an etch. Or you can have C taping from one end to another so it looks like a C. So, this is another ancillary packaging. This is just additional information to show you the styles in which the tapes are usually applied on your packages.

Another very important ancillary packaging material is your caps and closures. Indispensable in your food packaging because this allows you to close your open jars and

bottles. It can be made of tin, aluminium or plastic. You see that in all your household goods, you will see that in all your food bottles and beverages.

There is indispensable part. It makes it easy to dispense the product. It provides child safety and improves the shelf life of the product. You cannot keep a product open and expect it to stay for a long time. Another word that we already mentioned was hermetically sealed. So, when you close everything properly without ingress of gas, you are making sure the microorganisms also do not enter into your package. You must have seen these different types of caps that are used in the industry.

Crown caps that you see in most of your beverage bottles which you need a cork to open. You have screw caps where you screw it onto your bottles or your jars.

R.O.P.P. It's called Roll-On Pilfer-Proof packages. Another one that is used in many of your beverage bottles. Medicine bottles and the lug cap that you usually use for your pickles and jam bottle which have the slits so that they can be opened. At the same time, all of these provide a tamper-proof mechanism for your food package. You might have also seen something called wads under these caps. What are these wads? These are usually made of cork, paperboard and PVC or paperboard and pee.

And this white color soft cushioning material under your seal, it helps to prevent an interaction between your cap and your food, number one. Number two, it helps to prevent leaks. So, wads are an important part of your caps and closures which is again an ancillary packaging material. Coming to our last one which is the cushioning materials. This is another indispensable especially for shipping to a large distance and on rough roads.

So these are soft materials which protect fragile items during the shipment. That is the one that absorbs the impact on the roads, on the rails and reduces the chance of a damaged product. Another thing is it makes the packaging more aesthetically appealing. The material is based on the weather resilience, resistance to shock and vibration. So, if your package is more sensitive, depending on that you choose your cushioning materials. Now you are familiar with some of these cushioning materials that are generally used in the food packaging industry, not only the food packaging, almost all the consumer goods where you need to transport over long distance.

You have the bubble wraps, cushioning material, air pockets which is larger than your bubble packs but at the same time provides a cushioning to the fragile material. You have molded polystyrene which can take up the shape and especially protect the edges of your product. Last one is your crinkle packed paper or your packing peanut. This

actually fills in the space so the product doesn't move too much in your tertiary packaging material and does not get damaged. So, we have now gone through all the ancillary packaging material which is again a very important part of your packaging which is just like your primary, secondary and tertiary packaging material.

I hope you have understood these different ancillary packages and how important these are in the packaging of foods. In the next class this week we will move on to different advances in food packaging technology which again is quite different from what we have done till now. So, I hope to see you all in the next class, till then take care. Thank you.