

Food Packaging Technology
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Week – 08
Lecture – 38
Retort Pouches

Hello Every One! Welcome to another session in the Food Packaging Technology course. Last week we were dealing with the different packaging equipments and machinery and this week too we will be continuing with the different machineries that are used in the food industry. We will start with the retort pouches. Retort pouches, you all are very familiar with the canning technology and today the rigid cans are being now replaced by flexible pouches and these retort pouches will be dealt with in detail in this present session. If you look at a retort pouch, it is a rectangular, flexible, laminated plastic.

These words are important. Laminated plastic is when you have two different plastic materials which are joined together so that you get the benefits of each of the materials. Four-side hermetically sealed pouch, again a very important term, because all the seals are such a way that it will not allow the ingress of any gas into the pouch in which the food is thermally processed. So, just like you do in cans, in a retort pouch you are thermally processing your product in such a way that it is sterilized and has a long shelf life like your cans of about one year.

If you look at the picture here, it shows you some of the retort pouches that are there. They are flexible. You can see the four sides are hermetically sealed and it is a rectangle, that is the shape that they usually have in a retort pouch. Originally, it was developed in the 1950s and the 1960s in America through research and encouragement from the US Army. In fact in India too, these retort pouches were first used by the defence food research laboratories for the Army purposes.

And these kinds of foods, of course they are much lighter in weights because you are reducing the weight of the can to just these flexible pouches. And it has the same benefit as what you have in your cans. So, if you look at these, they are inert, heat sealable, dimensionally stable and heat resistant to at least 121 degrees centigrade. Sterilization has to be done at 121 degrees centigrade for at least 15 minutes. At 15 psi, it is sure that the product is going to be commercially sterilized.

If you use this word two or three times this time, and I am sure you know this word by now, commercially sterilized is when a product is heated in such a way that if there are

any spores remaining, they will not germinate at the normal storage temperature of the can or the pouch. So, these retort pouches, very important that they should have low water and vapor pressure or they should be a good barrier against oxygen water vapor. Permeability, it must be physically strong and it should have good ageing properties. What are the products that you have? Almost anything that you can in your rigid cans can be packed in your flexible retort pouches. Whether it's tuna, salmon, chicken patties, vegetable curries that are in supermarkets, different chicken curries, the chipped beef, chilli, ground beef, even payasam, among others are the ones that are retort pouch.

The advantage of this is especially it can be kept at room temperature for at least one year. So just like aseptically packaged products, retort pouched products cannot have any extra storage needs like chilling. any extra storage needs like chilling. Most of these cases the pouches are reverse printed on the PET film. I told you they are laminated.

So, laminated means one of the film's outer layer will be PET. So this PET is usually reverse printed. once it is reverse printed and then there are other layers to make sure that this print does not come in contact with the food. thereby, trying to make the migration as low as possible. All these laminates that are used are having stringent requirements to ensure that no undesirable substance is going to enter into the package.

We've already studied how overall migration test is done and what are the limits for these. This is a picture of the tomato paste that has been retort pouched at KUFOS. It has a shelf life of around one year. You can see that it is transparent. You can see the product.

And if you do print it, it's usually printed on the reverse side of the first layer which is the PET layer. This is important that the materials that used for the retort pouches. Of course, there is aluminium foil. If it's required, it is important that aluminium foil as a barrier, oxygen barrier and a water vapor barrier. And, you can either preform it or it's an inline form.

Just like a form fill, it can be inline form or you can preform it before. And the common pouches, look at the laminations. PET, nylon, foil and PP. PET/nylon/EVOH or PVDC/PP. They withstand the high temperatures.

They have good barrier properties and some of them are transparent. You will be able to see them. The structure again, if you look at this, it's more clear in this picture here. where you will have inner layer polypropylene. I mentioned in the other videos that inner layer is usually polyethylene because of its heat sealable property.

Polypropylene is used here because it has to withstand the higher temperature of 121degrees for 15 minutes. So, the inner layer is going to be the polypropylene. Nylon, a grain which is abrasion resistant. Aluminium foil for barrier properties. Protects it from light, gases, odours and helps to extend shelf life. And polyester or the PET which is the outer layer.

which is excellent printing surfaces and it provides its overall strength to the pouch. So, this is very important that what are the different layers in a retort pouch and what are the properties of each of these layers which is contributed to the final pouch. This again shows you combination. It's taken from the Nippon printing company from 2002 which was published. You have the aluminium type like I told you and transparent type.

See these aluminium types, they do have the aluminium foil kept in one of the layers. They are used in small pouches for anything, curries and sauces. A lot of products you use the aluminium foil but at the same time you can have transparent ones. In the transparent one you avoid the aluminium foil. You will have your PET, Oriented PA and your CPP.

Or you have the transparent barrier type which again can be used for a number of other kind of products. We already mentioned where these are applied. You can use it in gravies, high quality drinks, fish, sauces, soups, vegetables. Anything can be retort pouched. Anything that you have, you need for a high shelf life and which you need to be ready to cook.

Most of your ready to cook meals nowadays are retort pouched. So, the retail packs are usually up to 450 grams for home use. You have these standing pouches. The one, the picture that I showed you earlier was a stand up pouches where the bottom is a gusseted layer. You can keep it as a flat bottom so that you can keep it on standing.

These stand up pouches are usually used for fruit juices and other drinks, for soups and sauces. If you need a larger quantity, for catering size pouches for industrial trade, then you can go up to 3.5 kg. For already prepared vegetable products like carrots, peeled potatoes, potato chips, you can go in for these kind of bigger quantities.

Advantages. What are the advantages? Number of advantages are there for retort pouches. One of them is less energy is required, less space is required compared to cans, weight is less, packaging is much cheaper. The filling lines are usually changed for different size. You know, each time you change the size, you need to change the lines. But these lines are much easier to change when you have pouches.

Rapid heat penetration and fast process. I'm sure you all know there is something when you do a sterilization in a can, you've got something called cold point. That is the center point of the can. And you need to ensure that even the centre point of the can where the heat will get transferred last, it's heated up to the desired temperature. The same thing in a retort pouches, you want to make sure that your center point or the cold point is heated to the desired temperature.

But it's much easier to reach that temperature when it is a pouch. Rapid heat penetration is there. No refrigeration required, which is one of the advantage of the retort pouches. It's more compact. You can pack and stack as many as possible.

You save a lot of space in this. The pouches are lower in mass. That is understandable, much lighter in weight than cans. So, it's much cheaper to transport. Once it's much cheaper to transport, the cost, naturally, the packaging cost also comes lower. And retort pouches materials are non-corrosive.

A number of advantages are there for the retort pouches compared to the rigid ones. Disadvantages are there. One of them is to achieve the equivalent cannery production efficiency. A major investment is needed. So, most of these products advanced as though they are, you need a good capital cost.

But once it is done, once it is in sync, you will have a lot of return also, which is the other side of it. The production speed is less than that of a common can seamer. The new handling techniques have to be adopted. Trained personnel for this, which is also important. Heat processing is more critical and more complex.

See, many of these things, canning also, when you have studied canning, you would know that under-processing is also a problem. Over-processing is also a problem. So, if you process it to ensure that it is really completely sterilized, you might end up changing the color and the nutritional value of your product. Sometimes even the flavor changes. So you should be very careful with that portion.

But at the same time, under-processing is another problem. If it is under-processed, because of the anaerobic conditions, you know that very toxic components are maybe produced by anaerobic organisms like *Clostridium botulinum*. These things are more complex than a retort pouch rather than the other heat processes. And being a non-rigid product, some of the fruits, they lose their shape. There are a few disadvantages, but on the whole, retort pouches are much more advantageous to use.

The production of these pouches. They can be formed from reels. You've already seen

in the videos and all, you've got reels of these laminated materials. These reels can actually be taken up and you can go into the form fill seal machine in the plant itself. Or you can individually pre-form these pouches. Separately you get it, you can pre-form it, fill it with the product and then take it for your retort processing.

Now, the forming consists of folding the laminated material in the middle, polyester side out, heat sealing at the bottom. Basically, when you have it, these are the aluminium layer containing pouches. So when it is pre-formed, it's very simple, you just have to open it up, fill it with the product, seal it properly. Sealing is the most important and then take it for heat processing.

So, this shows the diagram. You can either have, for the filling and sealing, this filling and sealing can either be in the vertical, we already talked about form fill seal machines, vertical FFS and horizontal. So vertically or horizontally, you can fill in the products. Sealers can be there, which may either be the hot bar or it may be the impulse sealing. So, this is a representation of a filling and sealing machine in case of a retort pouches. These are all pouches that can be kept for a long time.

So, one thing that is very important is, here you are subjecting your retort pouches to high temperatures. And this heat system that you are using, heat is either going to come from, one, from the steam heated water with compressed air overpressure or you can use a mixture of steam and air. Basically, you need to reach the 121 degree centigrade for 15 minutes at a pressure of 15 psi. Now process determination, we do have process calculations. It's beyond the limit of our session, but canning process calculations are there where you have to calculate the time required so that you can ensure 12D process or commercial sterility for your product.

So, this is a mathematical approach to determine the heat transfer in the retort pouches, that of a transfer in a thin slab rather than in a cylinder. So when you calculate heat transfer, you do the calculation in such a way you will see the heat transfer through a thin slab. Do not take that in cylinder one as in the case of can. In the case of can, you will always consider it shaped to be cylindrical. So ideally, the variation in temperature should be from point to point in retort it should not be greater than 1 degree centigrade.

As you increase, it should be point to point not more than 1 degree centigrade. Another very important thing which they do in the retort which is a continuous process, you heat it up to you have to immediately cool it also. See that it doesn't go beyond over cooking is a bad thing. So see that it is cooled. So following the pressure cooling and removing the racks and trays from the pouches they must be dry, inspected and then placed in some kind of outer packages.

This is the retort process that is done in our laboratories. The retort, the steam or a mixture of steam or air which can be used for heating it up to that particular temperature. This is the picture of when you open the retort you have the space where the racks in the retort with the cans or with the retort pouches are kept. This shows you the cans which are kept in those trays but at the same time like we said instead of the cans you can replace it with the retort pouches very easily. This is one of the flexible pouch retort pouch that has been used.

It can be kept into your retort and used for processing. Now if you want to see that your pouch is, what is the quality assurance? So, you need to monitor this continuously generally you have a thermocouple kept inside the retort to see that the temperature is reached and every point, this cold point in the can or in the pouch it reaches to the desired temperature. Regular testing of the formed pouches is important you need to carefully select, maintain and control the filling, sealing, processing and handling machinery. Now post sealing, once you finish sealing you have to test the closure seals because post process contamination is also a very important problem in the industry. You might reach the temperature but post processing if there is any kind of leakage you can easily have the microbes entering it.

If it's under process also it's another problem. So post processing you inspect the seals and see that everything is intact. Careful selection of the staff and training at all levels is also required. Because retort pouches in ripped cans though the product stays for a long time if you are not careful it has led to a lot of problems especially in the case of toxins from the anaerobic Clostridium bacteria. The temperatures that you have to have it should achieve required lethality. Lethality is the degree to which a particular process is dangerous.

So you have to reach the lethality to see that the disease causing organisms or see that all the organisms that are there are destroyed and the spores also are reduced to such a level that they will not be able to germinate in the normal storage conditions. You need to regularly inspect your retort equipments and ensure uniform heat distribution. And routine checks have to be done 10 to 14 days prior to the distribution. Shelf life. If the package that you have chosen has a good barrier properties if the processing is done properly you can be assured of a very long shelf life for the retort packaged products.

The self stability can sometimes be above 2 years at room temperature which is the advantage of this. In the US rations, they had tested 2 years at 20 degree centigrade and showed no significant change for products. So some products interestingly have been stored up to 7 years without any problem. Safe and it is edible also. Foil free laminates,

the ones that I told you are transparent that you showed the tomato paste in.

Those will demonstrate a shelf life stability depending on the oxygen permeability of the laminate. So if your product is very sensitive you see that you have a layer which is very much oxygen impermeable. The commercial experience shows that product stability is usually from 4 to 6 months is obtainable if you use foil free laminates. If you include the foil it will of course have a very very long shelf life.

Nitrogen fluxing of the outer container is also very successful. So, once you have your retort pouch you need to keep it in outer pouch also. If this can be you keep it in atmosphere of nitrogen you have success in extending the shelf life of the product. Now look at this the types of retort pouches. Pre-formed pouches we already said it is made earlier and you just have to fill the product. In-line form pouches where you take the web of plastic and in the line itself you are going to seal it and form it and then you go in for your filling.

You have pillow packed pouches. These pillow packed pouches can be 3 side seals or 4 side seals. This is already explained and you have got the stand up pouch. These are different designs that you have for your retort pouches.

These are your pre-formed pouches. They are not filled with the product. You can choose from the size, you can choose from depending on the weight of the product. You can choose your material and then go in for sterilization. So these are your pillow packs. It can either be 3 side sealed where you can fold it and seal the 3 sides. Basically before you are filling you seal 2 sides, fill it and then seal the 3rd side.

Or you can have your 4 side seals. 4 side seals like your sachets, these are sealed on 3 sides, filled and then the 4th side is sealed. These are the stand up pouches, very common in the retail market nowadays. These again can be used as stand up retort pouches. So I think we have gone in detail with the different retort pouches. Why are they used? What are the advantages and disadvantages? What are the materials that are used in retort pouches? And moreover what are the machineries in which these can be formed? Either in the line or it can be pre-formed.

Lot of disadvantages for the retort pouches which is the technology of tomorrow also. I hope you have understood this portion and I will see you all next class with another video. Thank you.