Dairy and Food Process & Products Technology
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Lecture – 58
Packaging of Food Materials

So, in our this 58th class of Dairy and Food Process and Products Technology, we should cover also some packaging because processing and other things we have already discussed a lot and packaging storage this we have discussed, but may not be so elaborately.

So, let us also look into the Packaging of Food Materials with typically with respect to dairy and food materials both right, because liquid and solid in that liquid milk we had shown you more or less elaborately liquid milk packaging and distribution. All these we have discussed elaborately, but since it is also a part of the food that is solid, we have also covered a little of solid.

So, this both liquid and solid we should take care of the packaging right. So, first you see nowadays, those which you get from the market like your keeps or this and that. So, all of them you must have seen that they are filled with some gaseous right had it been only chips. The volume would have required very little, but your material is only this much, but the packet is so big right.

So, that is primarily because, the environment around the product you got it changed. Why? Definitely to give its shelf life much more than what it would have been otherwise. Depending on the product, depending on how you are preparing, depending on how much fat content are consistency or constituents of the product; the packaging type, packaging variety everything changes.

Because nowadays, you have seen the market is primarily dominated by the packaging and the better the packaging, the attractive the packaging inside product because, you are not able to see what is there inside unless you take spend money take and then test, you do not know what whether that will suit you would like that or etcetera etcetera.

So, packaging is a primary or important step for your product both storing as well as selling right. It is also storing mind it because you might have seen that in the packets it

is written best before 6 months or some packets best before 1 year or in some packets may be best before 3 months etcetera or directly it is given date of manufactures such and date of expire is such right. And that time could be 1 month or even more depending on obviously, the product you were handling or you were packing.

So, for that different types of packaging will come across and also in this regard would like to highlight or discuss a little above the storage through that right. We have already discussed a lot about the cold storage that the ice cream and many other frozen products. They are stored in the cold store and we have discussed a lot within the in the purview of the course right.

So, it is not that whatever you have discussed as the end of the entire thing know within the purview of the course whatever cold store we have discussed. Because, cold store when you do, you have to also design it is not that you make a room and you go and dump your material. The primary reason is that; your purpose is to supply to support with a definite temperature.

So, that definite temperature and constant definite and a constant temperature it should not fluctuate that to make it you have to design and that cold storage design not only on thermal that is on refrigeration part, but also civil part is also there. Because, that to if it is a sub 0 1 type, if it is a above 0 another type. In all the cases, there is also some vapor barrier because your insulating material that should not be affected by moisture.

So, in the room like in this room, moisture is there according to the relative material of this room and that moisture if that is cooled and if that is getting deposited on the insulating material, then the performance of the insulating material will go down. So, to avoid that, civil part is also and not only that, but also for the structural strength civil part is also equally important. So, refrigeration civil mechanical, then our food all put together we will design a cold store either above 0 or sub 0. So, both the cases; obviously, the design consideration parameters will be different.

And unfortunately, this is not within the purview of this course because where to start and where to end right. So, I have been giving you these inputs and then you think you thought give you thought and then, you design or you know you develop yourself.

So, that you can also become a one good designer, but that course is different. I do not know whether in future I will be able to float such like a cooling technology in agriculture and food engineering. Let us hope we can and if we can, then at that time all these will come into right. Obviously, we will not repeat this whatever has been.

And, there is always a little overlapping of the subject of the topic of the understanding that is unavailable right. But, as far as practicable, we will try to do that. However coming back to the cold store that when you are designing you have also to look into that like in this room suppose, if it is a cold store and suppose this is a this is a ice cream cold store, there is sub 0 minus 20, then and you imagine that all ice creams are being stacked one over other throughout the room. And then, that should be cooled because from the evaporator the cold layer has to circulate. So, there has to be a force circulation through fan.

So, that uniform temperature throughout is maintained because sub 0 minus 20 if it is going up. So, minus 10 as such you will get this water not completely not completely transformed into ice completely transformed into water that part will not be; but definitely some temporary and localized this transformation will go up which we discussed about the freeze and thaw that thing will appear or happen which is never desirable for the product.

So, you have to be cautious about that circulation of air stacking, stacking density right. Like at home, if you dump say your garments one over other right, the lowest one is obviously, totally gone and that way you are not able to keep your garments in good condition for long time right.

So, here also, if you are dumping absolutely with full volume of the room, then there will be very difficult for the air to circulate and the temperature to be maintained. So, these things that come in and you have to look into in detail right. So, let us go now to the packaging right. So, if we go into the packaging, the first thing is coming as vacuum packaging right.

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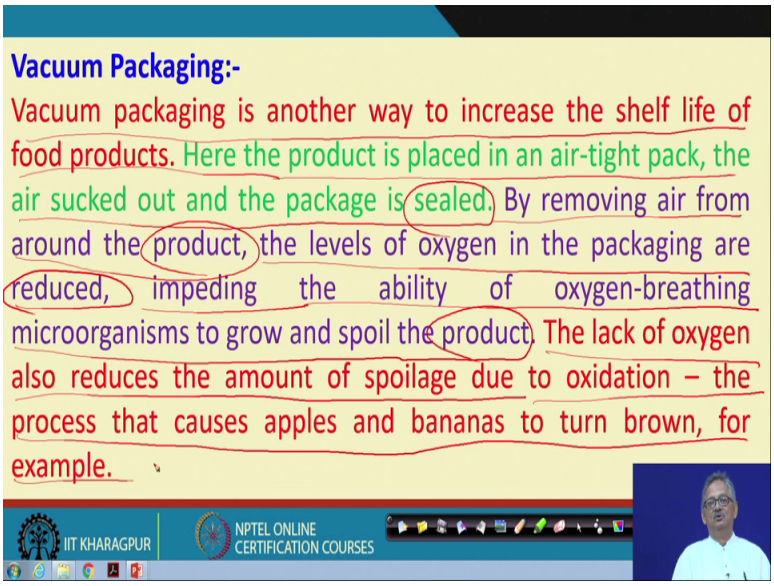

Vacuum packaging and in this vacuum packaging what you do? You take the product in a container. Whatever be the container, that could be a plastic container. Nowadays, plastic has taken up even though it should not be, because some days we will come because this plastics are not recyclable as well they are not biodegradable. So, the soil of the earth is getting really affected badly throughout the world. So, maybe some substitute alternative of the plastics are supposed to come and they someday will be developed and will replace these present status but, as of now those kind of plastics if they are there.

So, what is happening that inside whatever content is there, but the air from the inside is sucked off right. That sucking is done by the vacuum pump right to this effect, let me tell you there are primarily 2 types of vacuum pumps which are working one is up to 10 to the power minus 3 or that is normal household or laboratory or commercial where your vacuum level is up to 10 to the power minus 3 torr.

But, so, I hope you understand torr right 1 torr is 1 millimeter 1 torr is yes 1 millimeter of mercury. So, 1 torr yes so, that you please check and that 10 to the power minus 3 torr you can do with normal rotary vacuum pump, but if you need more than that of course, for this food application you do not need that is good enough.

But, if you need since it has come, there are some diffusion pumps also and the with the diffusion pump you can go up to 10 to the power minus 6 millimeter of mercury right 10

to the power minus 6 torr. You can go to that level and this high vacuum is in many cases required for leak detection and others right.

So, you have a pipeline and you have very very costly gases going through that pipeline. So, if there is some leak, you are losing huge amount of that gases which are costly. So, that is not and as such like ammonia, you can you can detect easily because of its odor. But, in many cases, there is no like Freon there is no chance you cannot you cannot do that you cannot feel that if Freon is getting leaked because there is no flavor, no odor, there is no odor.

And, since it is odorless, then your leak is very difficult to recognize or identify for that your in many cases, those deficient pumps are used right. Say, like we have in our transgenic center one called division pump or 10 to the power minus 6 which can detect that leak of helium; helium gas is very, very costly. So, earlier helium is to be produced there. So, that helium gas leak detection is done by this vacuum or deficient pump right ok. We have deviated a little. Let us come back again to vacuum packaging right.

So, this from this, we see that vacuum packaging is another way to increase the shelf life of the product and here the product is placed in an air tight pack. The air is sucked out and package is sealed by removing air from around the product. The levels of oxygen in the packaging are reduced, impeding the ability of oxygen breathing microorganisms to grow and spoil the product. The lack of oxygen also reduces the amount of spoilage due to oxidation the process that causes apple, banana to brown or for example, right.

So, lot of things we have said; number one, you are removing air there by air contains 21 percent oxygen and 79 percent nitrogen by enlarge we can tell. So, out of that 21 percent, whatever damage is being done, that is through oxygen, not the nitrogen. So, oxygen when you are removing air, you are also removing oxygen.

So, when you are sucking of that air, oxygen is depleting and moment oxygen getting depleted, there are organisms which we have said earlier that it could be aerobic or it could be anaerobic right. There is facultative and many others like that can grow both in or in presence or in absence. So, this we are not just going into those because this is not the microbiology class.

So, this aerobic organisms they require oxygen for their sustenance as well as growth and activity. So, when you have removed this oxygen, then you are keeping aside or you are throwing those organisms out because they will not be able to survive right. That is one step which you have taken for the long term storage of the material you have packed.

So, your packet is now there is no oxygen right or if it cannot be, where to no oxygen it could be at least very little oxygen which is not sufficient for the organisms to survive; that is number 1. Number 2, that as we have said earlier also that when you cut apple or potato or things like that, then what is happening? They are getting brown right.

So, that browning is because of the enzyme in presence of oxygen or oxidative or enzymatic both could be right. So, when you have removed these oxygen so, oxidative browning you are or oxidative changes oxidative or oxidation you are removing the chance. So, you are protecting your food material by 2 ways right. So, this is one way of maintaining of long time or packaging material with vacuum, you are extending the life of the product right.

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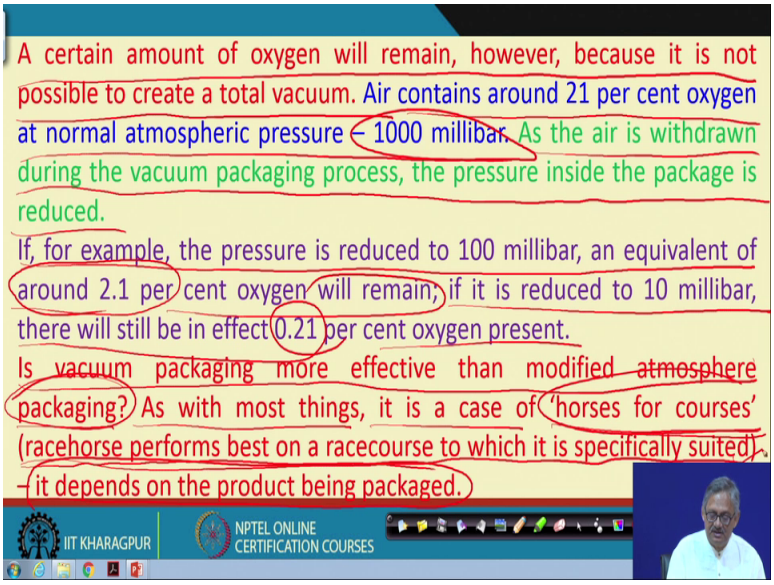

So, a certain amount of oxygen will remain as we said that it may not be possible to clean or clear all the oxygen present; so, that is why a certain amount of oxygen will remain. However, because it is not possible to create a total vacuum ok air contains around 21 percent oxygen at around atmospheric pressure that is 1000 millibar as the air

is withdrawn. As the air is withdrawn during the vacuum packaging process, the pressure inside the package is reduced.

If for example, the pressure is reduced to 100 millibar and equivalent of around 2.1 percent, oxygen will remain. If it is reduced to 10 millibar, there will be an equivalent of 0.21 percent of oxygen present.

So, we are not able to remove entire oxygen right. So, depending on how close how much you are doing your vacuum right, we gave example that if it is 1000 millibar, if it is 21 percent, then if you make 100 millibar, then you got bringing equivalent to 2.1 percent of oxygen. If you are making 10 millibar, that is vacuum level to that the pressure is 10 millibar, then you are making the oxygen equivalent to 0.21 percent. If you are making 1 millibar, then you are making equivalent to 0.021 percent right.

So, you are not making 0 making 0 is very difficult. So, it that depends on to what extent you are reducing your pressure that is you are making vacuum. So, that will dictate how much you have oxygen present in the container. However, the smaller, the better it is right is vacuum packaging is more effective than modified atmosphere packaging. This is a question which I am throwing to you. The answer should be that as with most things, it is a case of horses for courses. This is said that that racehorse performs based on a racecourse to which it is specifically suited right it depends on the product being packaged.

So, the answer to this is that, we have said horses for courses; that is, racecourse performs that racecourse horse performs best on a racecourse to which it is specially suited right. Definitely, 1 horse in a 1 racecourse from the air if you take to another where it was there may not perform to that right. So, depending on which one what you are doing, that will dictate whether vacuum packaging is better or some other packaging is better right.

So, there is no comparison that is not absolute also comparison it comes always because, comparison will come when your product with (Refer Time: 25:39) the cost involvement that comes in. So, if the cost is too big, definitely even though the quality of the product will be better we will not go for it right. So, because, I ultimately you have to see whether the consumer will go for it; that is, they will buy or not otherwise you would not try to do such activities right.

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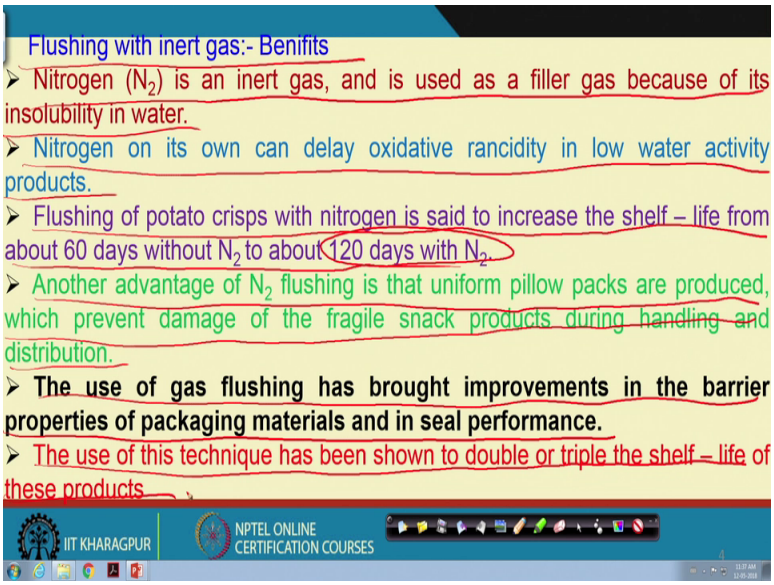

Then, flushing with inert gas right; this is done in most of the cases, as I gave the example of the chips, potato chips that flushing with your inert gases. That is one of the best packaging right. An inert gas, the most available inert gas is the nitrogen gas right because, that is the most suitable one. The nitrogen which is plenty available price is not so high. So, what happens? The inside of the packaging material the air is purge. This is called purging; air is purged of by nitrogen.

And as I said, nitrogen you may have depending on the purity it is 98 percent pure, 2 percent oxygen; 99 percent pure, 1 percent oxygen; 99.99 percent pure 0.01 percent oxygen. The one which you need for your laboratory purposes typically for HPLC or JC or things like that, instruments there you need 99.9999 percent of purity of the gas right.

So, they are oxygen is as minimum, but price is also very high. So, you have to compromise between the price availability and your utility. So, in that case, this nitrogen which is available in the market that can be used very effectively, purging the air and you can produce an inert atmosphere right.

So, let us look into that that flushing with inert gas that benefits what nitrogen is an inert gas and is used as a filler gas. Because of it is insolubility in water, nitrogen on its own can delay oxidative rancidity in low water activity products. Flushing of potato crisps with nitrogen is said to increase the shelf life from about 60 days without nitrogen to

about 120 with nitrogen, another advantage of nitrogen flushing is that uniform pillow packs are produced.

So, pillow packs can which I said that it is bulged. So, that bulging is also protecting your food material those which are crispy, like see, if the get some kind of impact. So, that will break that which may not be sold or buyer may not like it right.

So, that will have it will protect, it will give a pillow kind of protection right which prevents damage of the fragile snack products during handling and distribution. The use of the flushing has brought improvements in the barrier properties of packaging materials and in seal performance. The use of this technique has been shown to double or triple the shelf life of these products right.

So, flushing with nitrogen is definitely beneficial, not only from the point of view of the shelf life, but also from the point of view of the protecting the product from such kind of impact or the fragility of the product can be protected. So, we today discuss this 2 packaging; that one is vacuum and another is the flushing right.

So, in the next class, we will try to bring some other and this is of course, not only for not only for dairy products, but also for any solid products right. Definitely not the liquid products; normally, liquid milk is not is normally liquid milk is not packed under neither vacuum nor with nitrogen right. So, there their game plan is altogether different, ok. So, with this, we finish today's class because time is up.

Thank you.