Dairy and Food Process & Products Technology
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Lecture - 59
Modified Atmosphere Packaging

So, we are discussing about the different packaging right. So, for food materials after it is being produced before it is selling, it is being packed. So, in this Dairy and Food Products, Food Process and Products Technology, in lecture number 59 we now, come to the packaging which is recently coming up as Modified Atmosphere Packaging or that can be told in short as M A P or MAP right.

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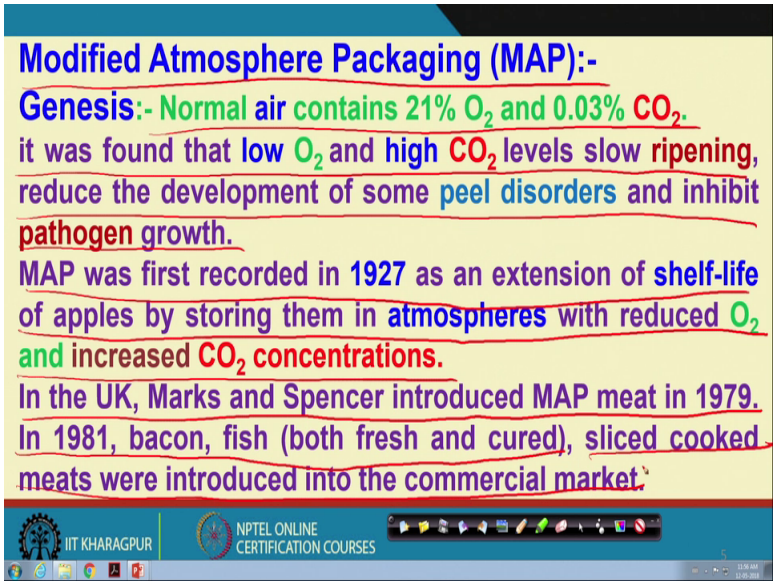

So, this Modified Atmosphere Packaging right, is not very-very age old, though the technique has come up very recently. But, I cannot claim that it was not also available earlier, the same thing was available, but it was not nurtured. So, now a days, it is being nurtured and looked or being looked into in that way right.

So, as we said what is the genesis of this? As we said that, when you are doing vacuum packaging or flushing with nitrogen, that time you are removing oxygen right. Why you are removing? Because, oxygen is primarily it is helping the, anaerobic organisms as well it is doing the oxidative changes. So, this is not desirable right.

Now, you just think this way that of course, I am against using plastic, because that is spoiling the really this is spoiling the entire environment and some alternative should come up. Someday, I believe it will come up, because necessity is the mother of invention. So, for that someday, when all over the world people will be very much like the like people now are cautious about this, zones sphere right and this though a someday and global warming.

These kind of sensational things when it will come to the world, plastic also will be left aside. Some alternative has to come, but yes as of today plastic is a part and parcel of our daily life who just cannot avoid it at the moment. So, in that case, say you have taken one guava right or now it is the mango time. This is the mango time in India. So, you have one mango and you have wrapped that mango with the, with one polymeric film right. So, that polymeric film of course many things are to be said, but from the bird's eye view what we can say that, the chance you have wrapped with the polymeric film.

So, that is making a barrier between the mango and the outside atmosphere. Outside atmosphere what do you have air, what it has 21 percent oxygen and 79 percent nitrogen. Whereas, inside what did you do you have put a wrapper and this mango being a product which respires right, because you have seen that mango where it is in the unripen form it is green and when it is in the ripen form, it is yellow right. So, this stage of ripening is happening, because of its taking respiration. It is doing respiration and that is reading, it is to ripening right.

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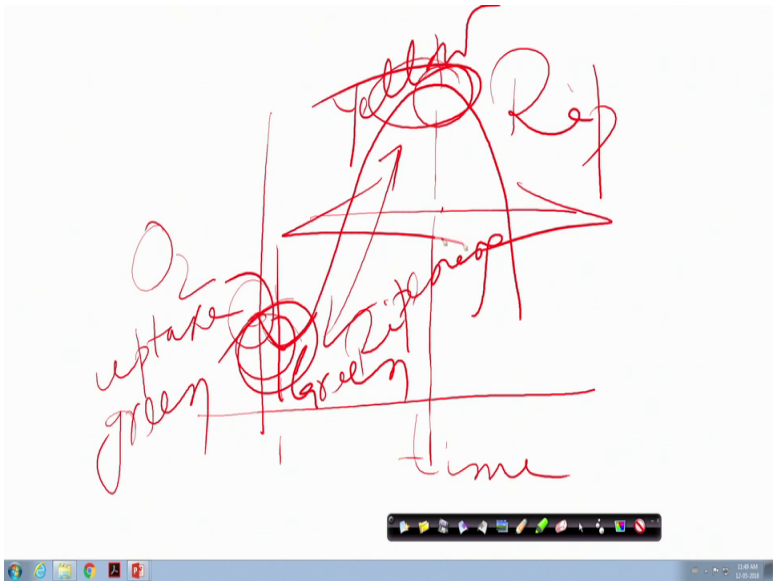

So, what you do, in control atmosphere storage you extend. Let me just give a tau. What do you do this? You make a plot right. This is oxygen uptake and this is time right. So, the moment you have plucked from the tree your say the mango which, we are talking about it had a respiration rate here right and it was absolutely green in colour right. So, it is not ripen on the tree you have you have plucked it; so, that you can keep it for a longer period right.

Now, from here, when you plucked it what it does, because in the new environment, this fruit that take some time. The same as our all mammalians or our child are coming into the earth when they are taking birth from the mother womb, this is cut right; that empirical cord is cut, that was detached from the mother earlier everything was being supported by the mother. Now it has to be on its own the baby. Same is with the mango, when it was in the tree it, everything was supplied by the mother tree, but when this you have plucked out and you started from here right.

So, it takes some time to acclimatize right that is why the respiration rate comes down and then when it acclimatizes right this how the you cannot quantified unless you do experiment right you cannot quantify unless embarrassment that is why it is a tentative or, or one representative line right. So, it is then going up and then reaches a maximum and then it starts declining right. So, this call resents coming to the senescence and the entire ripening that take this is the process where your ripening is taking place right.

This is the process where your ripening is taking place right and from green. This was green, now it has become yellow and also eatable. That is soft also right. It has become soft yellow and you can eat. So, now, what it is assume that, you have tied this end to one and you have tied this end to another and now you stretch it, right.

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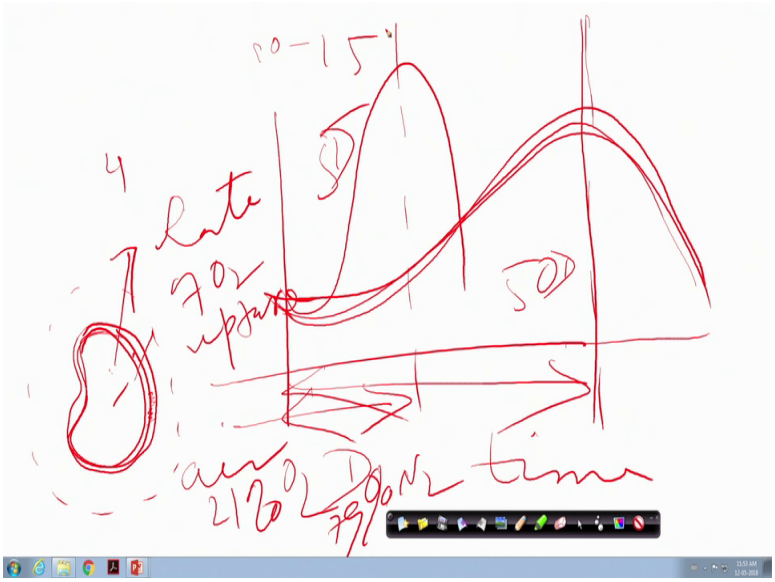

Now you stretch it. So, if you stretch, it then it can be said that this curve, if you can make like this right then the number of days by which it was getting ripened. This is number of say, days by which it was getting ripen. Now, you have made it to that; so, you have extended the life if it was for say 5 days, now if you can make it say, 50 days right. So, 5 days, you have made it to 50 days this is time and this is that, rate of oxygen uptake right.

So, if we do this then that is what you are doing in the control or Modified Atmosphere. So, in Modified Atmosphere, what we are referring to I cannot draw the mango in better way say, this is the mango and you have put to one wrapper right. You have put one wrapper. So, ambient this ambient is with air which contains 21 percent oxygen and 79 percent nitrogen right whereas, this inside it has little oxygen definitely, because the quantity or volume of the air inside is very-very negligible right.

So, that will not allow the oxidative changes in the mango as well the ripening or growth of the organisms or the ripening of the mango. So, what will happen this mango, in respect how this, whatever be oxygen was there you just imagine another similar case

that on this or sea level you have plenty of air and oxygen. So, you are breathing as and when as much you can right. Now you just imagine, if you have been fine, if you have not been then imagine that you are taken to by some means, you are taken to the highest peak say Mount Everest right and in that Mount Everest, Oxygen level is very-very low. So, what you will die?

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No, you will not die the moment you reach there, because there you will try to acclimatize with the changed condition and your rate of respiration will go down right your breathing also will go down. So, here since, oxygen is not available. So, what do you do; your breathing then becomes less. So, here also since of train is not there available. So, it is breathing will be reduced so; that means, you are stretching like this right you are trying to stretch the curve like this right and. The moment you are doing that then had this mango you bought it from the market today green maybe by 3, 4 days it has become yellow, but if you have kept it like this then it maybe instead of 3, 4 days it could be 10, 15 days after it is becoming yellow.

So, you have extended the life. So, that is the crunch of the entire modified atmosphere packaging this is the basis right. So, now, let us look into, all detail what we are saying. So, actually not so, much, a custom; so, that is why now let us look into actually how Modified Atmosphere Packaging is being done right. So, Modified Atmosphere Packaging or MAP, the genesis we have already said normally air that contains 21 percent oxygen and 0.03 percent carbon dioxide. It was found that low oxygen high carbon dioxide levels slow ripening, reduced the development of some peel disorders and innovate pathogen growth.

So, MAP who was first recorded in 1927 as an extension of the shelf life of apples by storing them in atmospheres with reduced oxygen and increased carbon dioxide concentrations. In UK Marks and Spencer introduced MAP meet in 1979 in 1981 bacon fish both fresh and cured sliced cooked meats were introduced into the commercial right. So, gradually it is coming up to the market and maybe someday it will be also extended to many-many other products.

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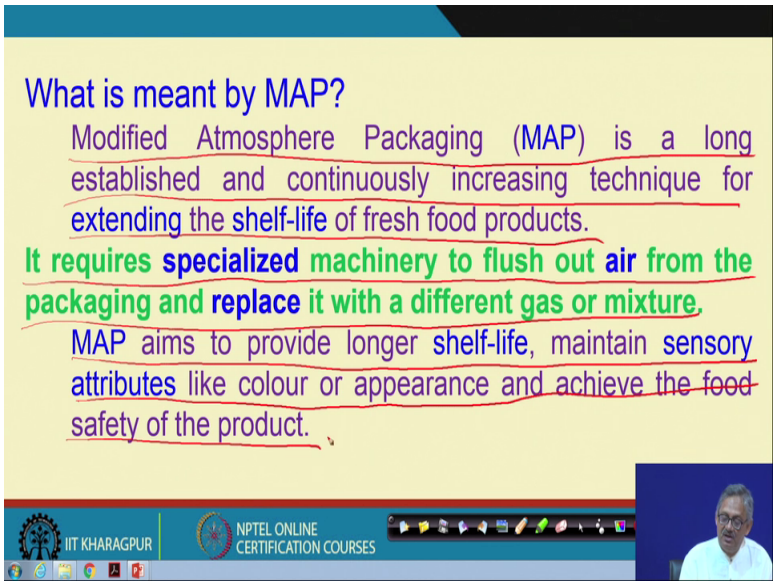

So, what is then meant by MAP which we have already discussed in detail let us see what we are trying to say here we are saying that modified atmosphere packaging or MAP is a long established and continuously increasing technique for extending the shelf life or fresh food products. It requires specialized machinery to flush out air from the packaging and replace it with the different gas mixture MAP aims to provide longer shelf life maintain sensory attributes sensory attributes like colour or appearance and achieved the food safety of the product.

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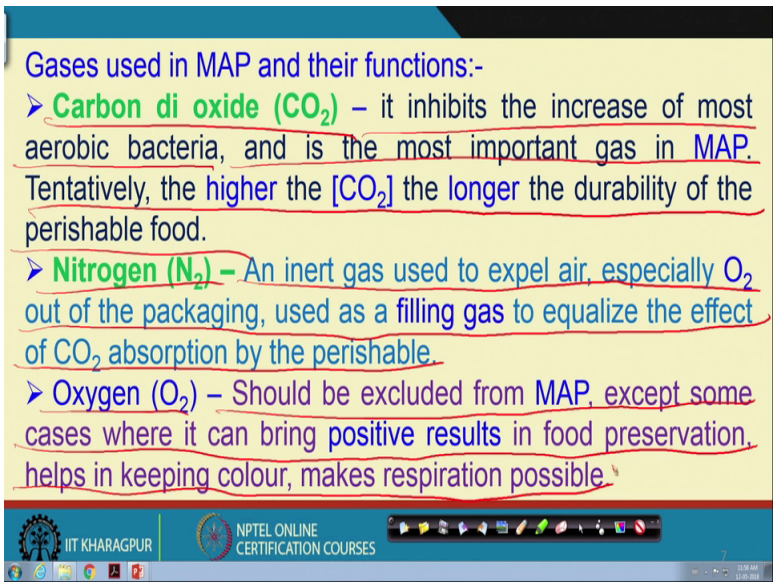

Then cases used or sorry gases used in MAP and their functions are like this carbon dioxide gas is views it reveals the increase of most aerobic bacteria and is the most important gas in MAP tentatively. The higher the carbon dioxide the longer the durability of the perishable food then nitrogen and inert gas used to explain here, especially oxygen out of the packaging used as a filling gas to equalize the effect of carbon dioxide absorption by the perishable oxygen should be excluded from MAP except some cases where it can bring positive results in food preservation helps in keeping colour max resolution possible.

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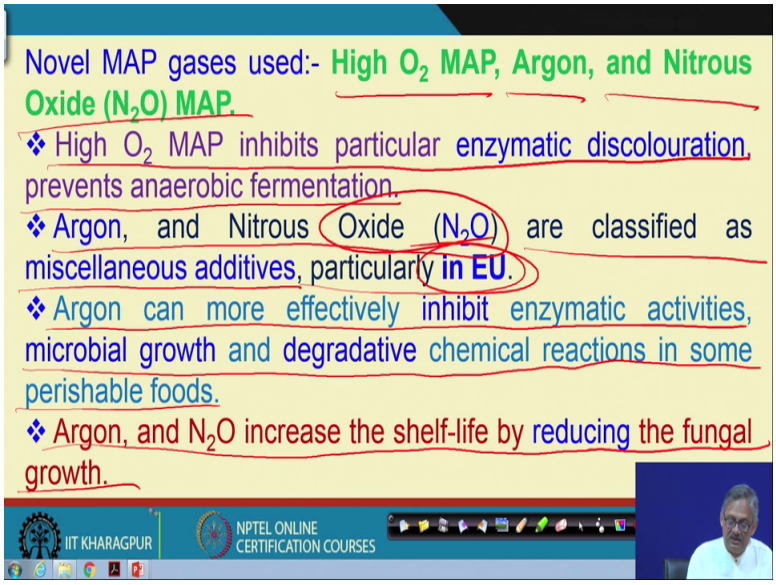

Then Nobel MAP gaseous used are like this high oxygen MAP argon and nitrous oxide N2O MAP. These are some of the gaseous which can be used instead of oxygen and extend the life, but; obviously, argon is not available everywhere, but this is one technique which can be used right. If it, if argon could be made available everywhere is good, but it is the scientific process where you can do it right. High oxygen MAP inhibits particular enzymatic discoloration prevents anaerobic fermentation argon and nitrous oxide nitrous oxide by the by you know in school you have seen nitrous oxide you call it to be laughing gas you know.

So, these are classified as miscellaneous additives particularly in European countries or European Union's right. Argon can more effectively inhibit enzymatic activities microbial growth and degraded deep chemical reactions in. Some of the perishables

argon and nitrous oxide increase the shelf life by reducing the fungal growth right. I am moving a little fast the reserving a lot of things that we show time is very limited.

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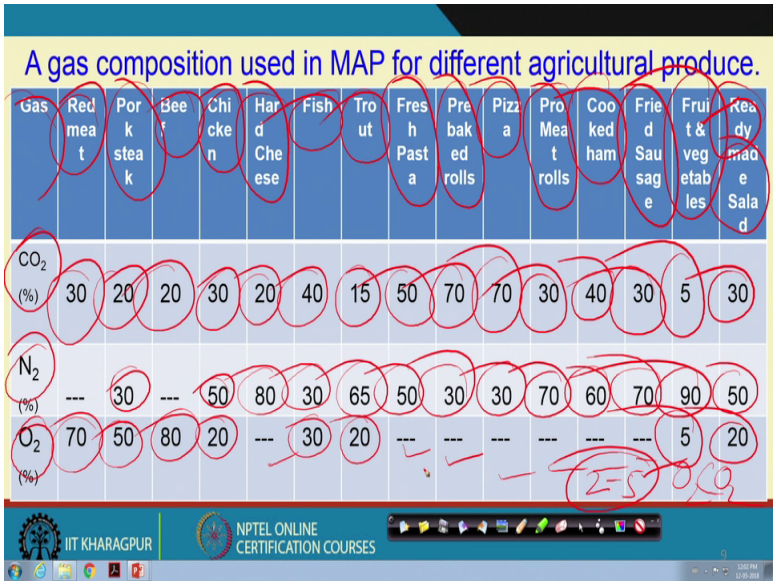

A gas composition used in MAP for different agricultural product is like this normally the gas is nitric carbon dioxide nitrogen or oxygen right. For red meat is 30 percent carbon dioxide 70 percent oxygen for pork stick 20 percent carbon dioxide 30 percent nitrogen and 50 percent oxygen for beef 20 percent carbon dioxide 80 percent oxygen for chicken 30 percent carbon dioxide and 50 percent nitrogen and 20 percent oxygen.

For hard cheese 20 percent carbon dioxide and 80 percent nitrogen no oxygen for fish 40 percent carbon dioxide 30 percent nitrogen and 30 percent oxygen for trout 50 percent carbon 15 percent carbon dioxide 65 percent nitrogen and 20 oxygen. For fresh pasta: 50 percent carbon dioxide and 50 percent nitrogen no oxygen, for pre-baked rolls 70 percent carbon dioxide and 30 percent nitrogen no oxygen for pizza.

Again, 70 percent carbon dioxide and 30 percent nitrogen no oxygen for product meat rolls 30 percent carbon dioxide 70 percent nitrogen no oxygen for cooked ham 40 percent carbon dioxide 60 percent nitrogen. Again, no oxygen for fried sausage 30 percent carbon dioxide 70 percent nitrogen no oxygen, but for fruits and vegetables generally 5 percent carbon dioxide 90 percent nitrogen and some 5 percent oxygen.

Generally it is said 2 - 5 oxygen and carbon dioxide now 2 - 5 that depends on what fruit, because fruit vegetable is a wide market wide variety right. So, ready readymade, salad readymade salad is 30 percent carbon dioxide 50 percent nitrogen and 20 percent oxygen. So, these way different gas compositions you can maintain and you can provide, the extension of the life accordingly right.

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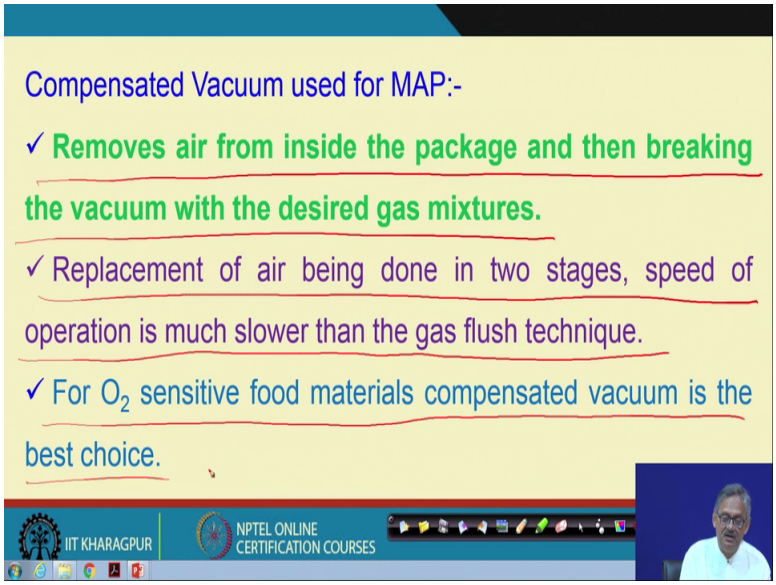

Now it comes how you will make it right compensated vacuum use for MAP is like this. That removes air from inside the package and then breaking the vacuum with the desert gas mixtures replacement of air being done in two stage stages speed up a speed of operation is much lower than the gas flush technique.

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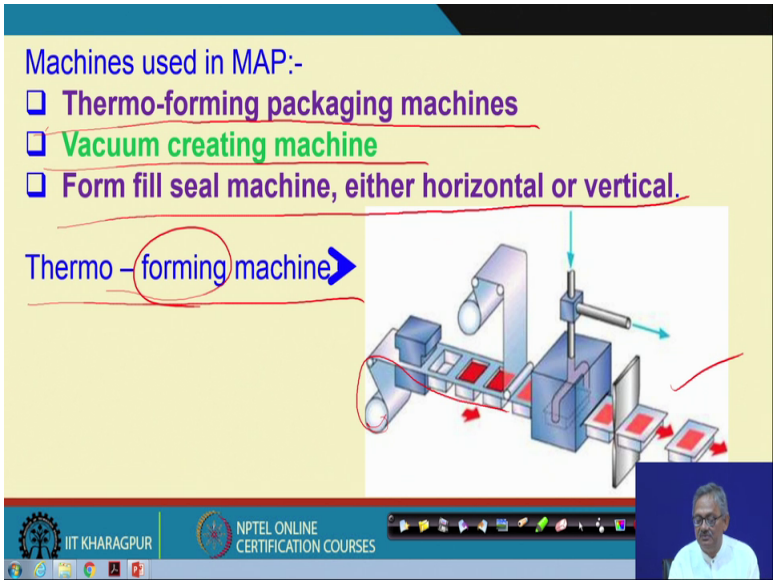

For oxygen sensitive food materials compensated vacuum is the best choice. Then the machineries which are involved in MAP are like that thermo this is the Thermo Forming Packaging machine, then vacuum creating machine then form fill seal machine either horizontal or vertical. So, the thermo forming machine looks like this right. This is the schematic of course; this is the schematic one right. So, it is, forming right. So, thermo forming, this is going like that and then ultimately with the product it will come out right.

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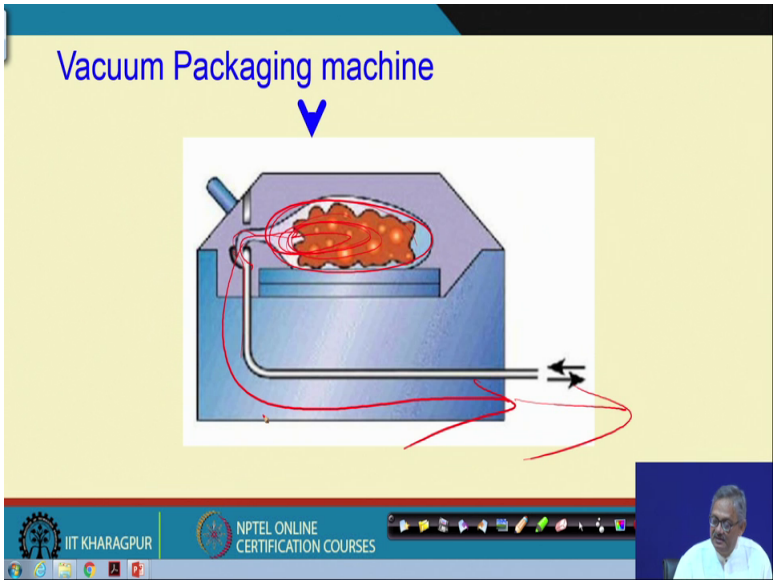

Then, some other like vacuum packaging; here, you are you are keeping this thing and that is connected to a, vacuum right. That is connected to a vacuum. So, it is sucking and

the composition air is from there is being sucked right. And then form fill seal machine, it can be horizontal or it can be vertical.

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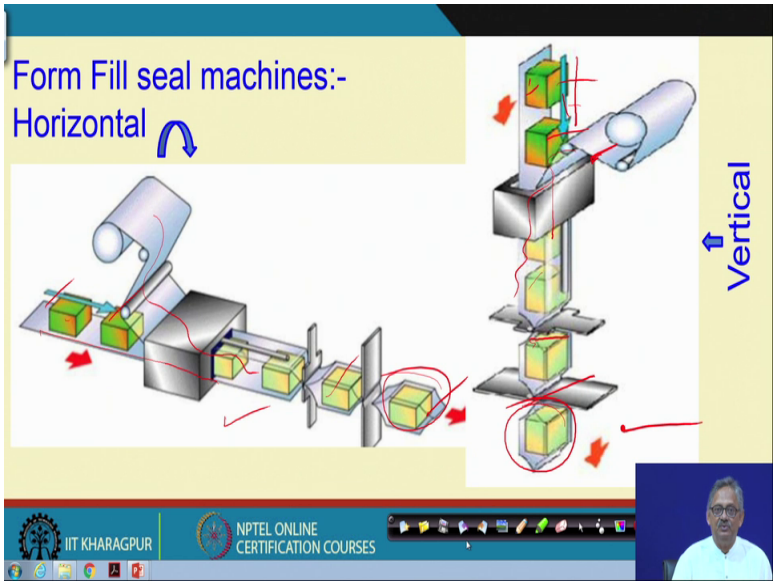

So, vertical is this one and the horizontal is this one. So, you see it is going like that and then, this part is also coming along with it and making the selling and this is the seal product right. You see, how it is coming out and that seal product is going like that. So, this is horizontal. Similarly, for vertical your packets are coming like this packets are coming like this and then this form making, this is from their role it is coming and making this and getting it cut, here and you get the similar product like this is the form seal fill and seal machine right; both horizontal as well as vertical right.

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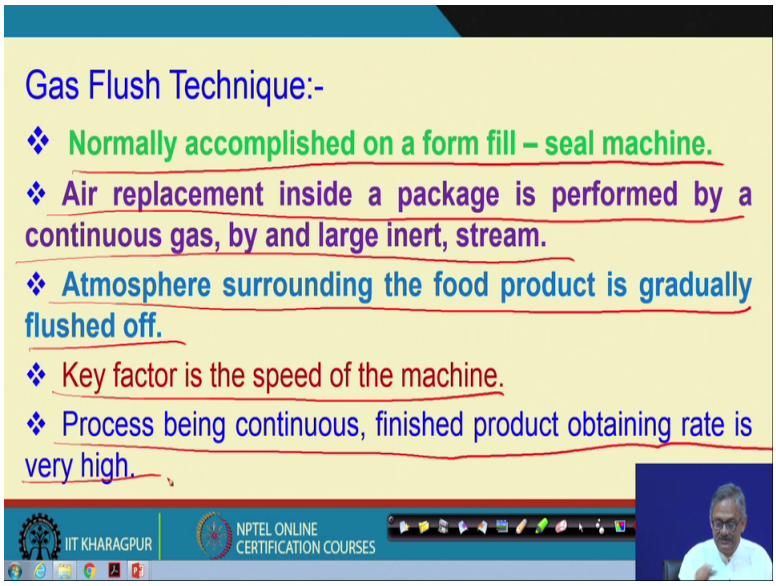

So, when it is coming like that, then what you need, what you need is that, this fill and seal. Once, that is done, then the flush gas flush technique is another one. So, which we have already said that with the nitrogen gas you are flushing off right. So, gas flush technique that comes in like this the, that normally accomplished on a form fill seal machine air replacement inside a package is performed by a continuous gas by and large inert stream atmosphere surrounding the food product is gradually flushed off. Key factor is the speed of the machine and process being continuous finished product. Obtaining rate is very -very high right.

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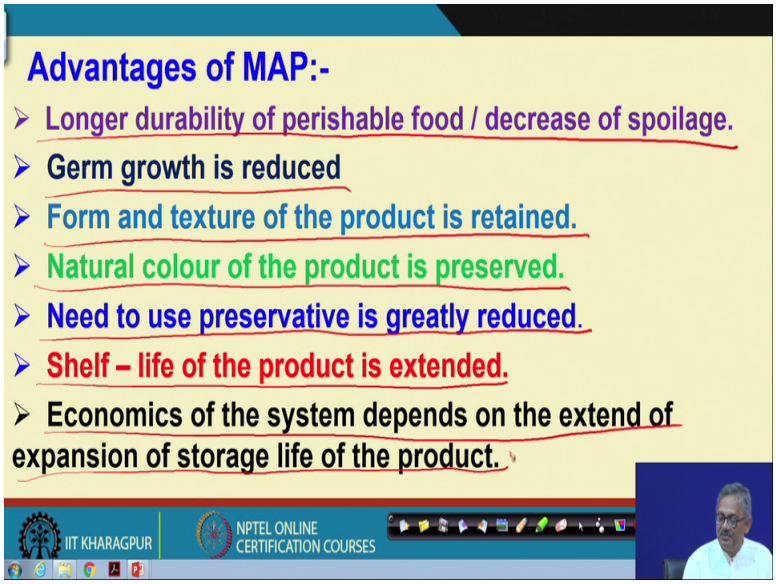

Then we come to this level that, the what are the then advantages of the MAP the advantages of the MAP is like this longer durability of perishable food or decrease of spoilage germ growth is reduced for when texture of the product is retained. Natural colour of the product is preserved need to use preservative is greatly reduced shelf life of the product is extended and economics of the system.

That depends on the extend of expansion of the storage life of the product. Now, how much you are extending that will dictate how much money is going to be involved. Some disadvantages are always there, because any advantage has to have some disadvantage light with dark that is a must right.

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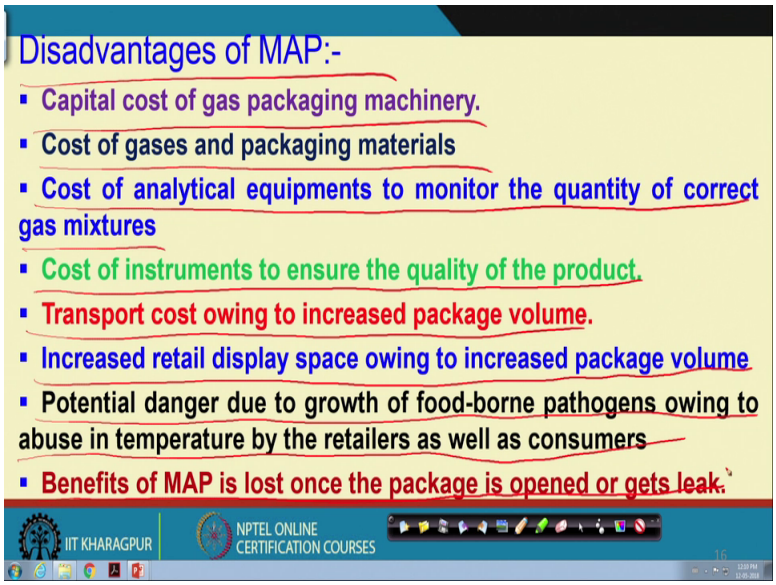

So, it is not that, it is always one way both way generally in sometimes both are equal, sometimes one predominates very high and sometimes the other one predominates; so, depending on the situation. So, disadvantages are like this that capital cost of the gas packaging machineries right. Cost of gases and packaging materials are also high. Cost of analytical equipment's to monitor the quantity of the recorded gas mixture or correct, correct the gas mixtures that analytical equipment's are also costly.

Cost of instruments to ensure the quality of the product transport cost going to increased packaging volume, because you have given a wrapper. So, that is increasing the volume. So, that in turn will increase the transport cost of the material which comes under the total cost of the material is being sold, right. Then increase a increased retail display

space going to increase package volume potential danger due to growth of food borne pathogens. Going to abused in temperature by retailers as well as consumers. So, this I have been saying, that this is the a prevention of all the scientists.

All the people, that abused of the process that abused I gave the example of these, our normal malls and others where frozen materials are kept in the freezer, but the top is opened right. So, this is simply abuse of the system that is not desirable here also. Like that benefits of MAP is lost once the package is open or gets leak, because you have put one wrapper as we have shown. So, in that wrapper, once it gets leak then the external, ambience that goes in. So, your entire effort entire packaging entire cost that goes out. So, you have to be careful that there is no piercing of the material packaging material right.

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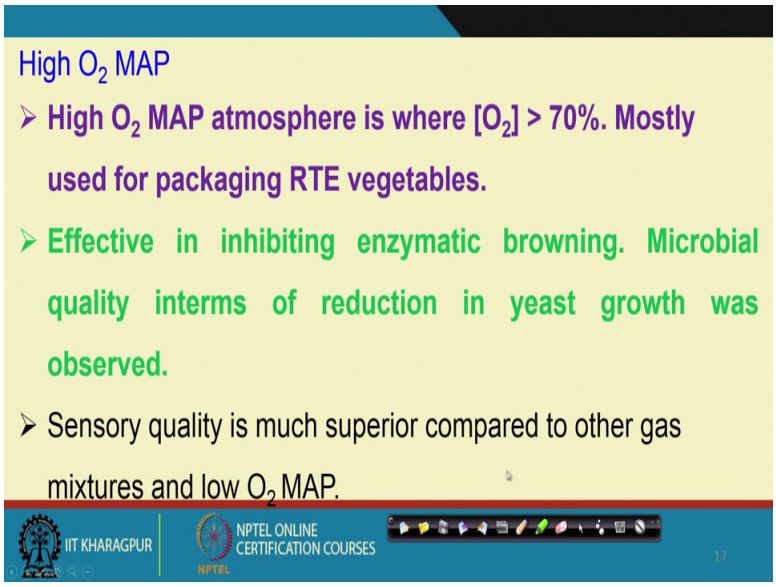

So, hopefully with this high oxygen MAP with this we come to the end of this class. And, we say that packaging can be of different now packaging industry has come up to the market into the way, that more than the product packaging is, I mean dominating rather.

So, I do not feel personally as scientists that should be, but packaging definitely improves the life. So, the way packaging is getting developed the way new and new packaging techniques are coming in, hopefully someday that will replace the use of the plastics or polymers ok.

Thank you.