

Dairy and Food Process & Products Technology
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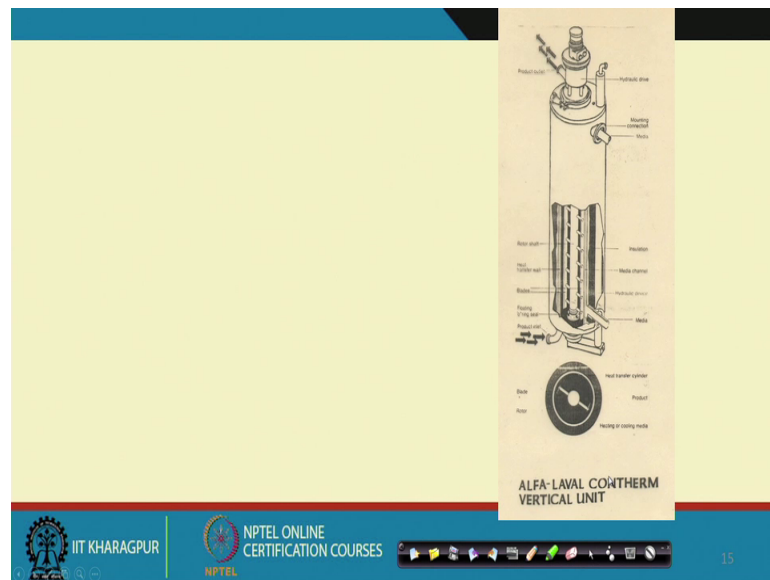
Lecture – 55
Ice Cream Lolies

So, we were discussing about Ice cream right. Now in this class in our earlier of course, we had discuss the ice cream, now we will discuss about the Ice Cream Lolies also right. We have discussed about the cups, then party packs, then gallon packs, different forms which are available right. And how they are manufactured and what is the process etcetera everything, we have discussed.

Now, in this dairy and food process and products technology today's lecture 55, where we will discuss Ice Cream Lolies right. But before that perhaps so for I remember we had told you about horizontal Ice cream freezer right. Generally unless there is a constraint of space if space is not the constraint; then people do prefer horizontal freezer. But in many cases, there could be the space problem. So, horizontal means say 1.5 meter Ice cream freezer along with its accessories all put together maybe 2 meters and people working etcetera everything will take another. So, 3 square meter area you may need for one Ice cream freezer to be handled with the product.

So, if that is too costly for the place where your industry is; then the problem comes and that is why another mode there is the vertical freezers are also developed. And in both these horizontal and vertical now a days in our country Alfa Laval in the earlier APB, they where is to perhaps the only producer. But nowadays it is a now means long back it is not today. Long back Alfa Laval and many others have come up with Ice cream freezers and both horizontal as well as vertical are available right. So, then let us look into the vertical also a little.

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So, this is a typical vertical Ice cream freezer and this is taken from Alfa Laval right. And you see from this a cut size has been shown here right, from where other ways from outside you will not understand anything right. The horizontal one we had shown you the sectional view, but this is a vertical with a cut right. So, what happens? You see your product inlet is this one. So, this is the product inlet through each product is going in right.

Then there is floating, pouring, there; these are all support supporting. Then these are the blades right these are the blades Ice cream that scraper blade. So, that scraper blade is here then this is the heat transfer wall. So, heat transfer wall is this through which the refrigerant is transferring the load, then there is a rotor shaft this is the rotor shaft. So, rotor shaft will rotate your, the enter entire assembly then this is the insulation.

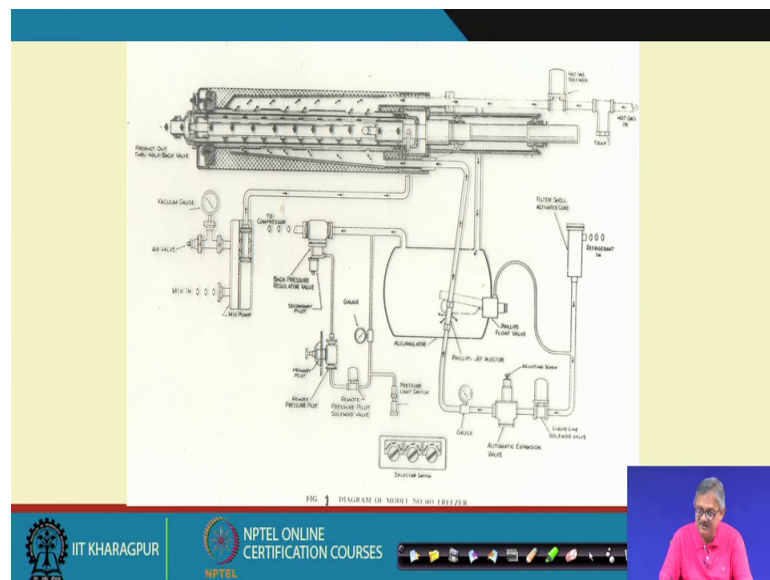
So, insulation that comes through this black wala the insulation. Then media channel that is through which it is moving that is the channel. Then the media that is by which you are cooling goes through this right. And if you look at this is the vertical view or front view and if you see the top view it looks like this right. So, blade, rotor and heating or cooling medium and then product and the heat transfer cylinder, all these are there ok. And this media that is heating or cooling media that comes out through this.

And again it is subjected to if it is compressor, condenser, expansion device. All put together, they are associated with this that is why this is a cut figure down below these

things do content and that is not visible. And near mounting connect this mounting connector here ok. How they are being connected? And this is the hydraulic drive by which your product is going out right. And this product when it is going out before that you can you can incorporate your nuts and fruits or whatever you would like, those things are possible.

But the thing is which is of interest is that this length right there is the frizzle length. And if you look into the horizontal one I would like to show you that also that visible this length that this is the frizzle length say it is L vertical. And you see that from the geometry it appears; from the geometry it appears that this one is the horizontal right and the horizontal length is this L_H right.

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So, this L_H is much less than for the same capacity. We said generally 300 to 700 liters per hour that is available commercially right. If this is true then, this L_H is less than is V the reverse this L_H is much much less than L_V , yes this is much much less than L_V for the given capacity, say three hundred liters per hour in that case this L_V is much much bigger than L_H right. So that is what one thing to be kept in mind. Another thing which is why it is required? Because here your thing is being pumped and going like this.

So, all the time it is also acting against the gravity right. Generally this product would have a tendency when going up gravity will pull it down right. So, the inlet to us in

earlier case, also 4 degree centigrade and the exit to us at minus 5 degree centigrade; if you remember that inlet was like this and exit was like that right.

So, the retention time in this has to be such that that 4 degree to minus 5 degree this conversion because this is a continuous. So, this conversion has to take place according to the height on according to the frizzle length right. If this is the frizzle length, then according to that this conversion of 4 degree to minus 5 degree; where incorporation of this is the product in later along with the same it was a dual pump there. Here also it can be a dual pump and product will go, air also will go so both will go together and they will go pass through this and this is the scrapper blend right.

So, these scraper blades where you remember what I said that if this is the wall right. If Ice cream here is getting frozen Ice cream mix here at 4 degree and here it got frozen because your outside is minus 30 or minus 40 depending on whatever you have chosen the pressure and the refrigerant right. So, and this dependence this depends on your inlet pressure of the refrigerant and the exit pressure that is called Discharge pressure and the Suction pressure right.

So, discharge and suction pressure that will dictate what temperature it will be liquid? And at how much you will get in terms of enthalpy right? So, how much ΔH you will get that will be dependent on how you are keeping it, how at what pressure of inlet and exit of the refrigerant you are keeping right. Then this and we also said that the refrigerant is getting boiled up right this is called boil off boil off heat transfer. So, what is happening that the moment this liquid came to this, it gets frozen and this scraper blades when they are rotating like this scrapper blade is scrapping off and then it is mixing with rest of the thing. So, plus 4 that became say minus 5 or even lower. And this plus 4 when interior, they were there will be a mixing between this plus 4 and minus 5 and a resultant temperature will come.

So, like that the temperature of the Ice cream is gradually decreasing. And all the time this surface is getting some quantity of Ice cream frozen and the then it is getting scrapped off right. So, that is possible that is why and how this plus 4 is coming at minus 5 and some quantity of the Ice cream is getting frozen right. And one more thing which we should also tell here is that; for the vertical for the vertical one, this length being

higher for the same capacity the problem which normally is encountered is the people who are working because it is not that all the people who are working will be tall.

So, that becomes a difficulty for the short heighted people to handle to get this output right. So, it becomes handling problem nothing else right. As far as heat transfer, as far as product quality, these things are concerned, there is no such deviation over there is no such discrepancy between vertical and horizontal. But this problem of handling that is over that could be one consideration if the people who are working workers are not tall enough then it becomes difficult for them to handle.

Otherwise as for you see that flow readier requirement is not more than 1 meter square whereas, there it was somewhere 2 to 3 meter square. So, that flow radius having is very very high and where it is a costly place there it becomes mandatory right. Of course, I have seen both this vertical as well as horizontal once in yeah where I used to work there all the things were horizontal. I had shown you that earlier the lay out plant layout I had shown. But here in Bengal I have seen that in some of the Ice cream manufacturers do have this though there is there may not be the space consideration so much but they do have this vertical so I had opportunity to see. And one with to work with horizontal where I was and the other one is with the, our students who had visited number of times and seen it right seen it to working also ok.

So, with this the Ice cream freezer let us come over to another that the lolly preparation right. So, this is the lolly preparation tank, I do not know how many of you are from the cities or from the villages. And those who are in urban may not be, but those who are in villages I hope they might have seen that the stick lolly sticks only water colored water red lolly sticks colored water and sweet sweetened colored water.

They are prepared in many villages right typically I was lucky enough again to see in just by the side of our school it was. And it will not be out of place to mention and that when you were also school children of that age our parents also used to tell of course, we did not have money to buy like today's children they have lot of pocket money etcetera, but we did not.

However I have no idea with what with what I mean thing in mind they used to tell that do not take that lories from the Ice cream. Because those lories are being made from dirty water [FL] or [FL]. So, this [FL] or [FL] that is dirty water that was one thing imposed

on the mind. Such that you get afraid and you do not get the desire though you do not have money. But your friends may have and they may buy and give you so, to prevent that this kind of things used to be told.

But so, far I know and I understand that there is no such, but because why your person will use [FL] [FL]. Yes, he may not have a good source of water, but at least some tap water or some drinking water they should use and they use. So, there is no question of using the [FL] or [FL] right. So, because that is loss for him because ultimately if the product is giving some bad name or it is, if it is the consumer is getting affected; then definitely their cell will be affected right.

But we use to see how the things were prepared right and so for I remember that there was a pond kind of thing. And to my memory and that pond kind of thing was around say 10, 12 feet in length and 6, 7 feet in width and around 4 to 3 to 4 feet height. And it was full of water full of that we did not understand why and what, but it was full of water. But also we saw the inside there are some machines. Now we understand that those machines are nothing, but the evaporator heat exchanger right.

So, heat exchanger is there and we used to hear the compressor sound. We did not understand that time some sound was coming from outside and that compressor is making that refrigeration cooling and all these right. And of course, since it was by the in the I do not say city, but semi city since it was so there was no question of using ammonia as the refrigerant.

So Freon was used I suppose, now because it was long back 30 40 years back. So, I do not remember the whether we asked what was the, or we understood what was that. But now I understand that was definitely Freon only and in our country though Freon has been banned. But not to that extent I as it is still being used right.

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So, a similar one here we are showing you that Ice cream lilies are being made in this kind of this was one where I used to work it was there. So, a pond circular pond like that right and you see the height as it is sorry, height as it is around 3 to 4 feet right, around 3 to 4 feet.

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OVERRUN

BY VOLUME

$$\text{Overrun \%} = \frac{\text{volume of ice cream} - \text{volume of mix}}{\text{Volume of mix}} \times 100$$

e.g., $((9.5 - 5.0) / 5.0) \times 100 = 90\%$

BY WEIGHT

$$\text{Overrun \%} = \frac{\text{Weight of 1 gal mix} - \text{weight of 1 gal ice cream}}{\text{Weight of 1 gal ice cream}} \times 100$$

e.g., $((8.85 - 5.06) / 5.06) \times 100 = 74.9\%$

1 gal = 3.7854 Lit.

And this diameter can be somewhere around 10 to 12 feet right, around 10 to 12 feet. And there are some these are called a molds there are some molds in which, if this is the

mold right. If this is the mold you are putting you are putting some colour remains same colour does not change yeah colour is not changing however.

So, there some Ice cream mix is being put here and up to this it is filled right. And a stick is also inserted right. So, in this on the wall on this wall this Ice cream when it is frozen that will get stick. So, what they do they put this say if this is one mold of course, there is no such individual mold. At least, 10, 12 Ice creams are there and things are arranged in such a way, that minimum 8 to 10 lollies could be placed in one.

So, when it was it is frozen this side gets stuck so you cannot take out this stick outside. So, what happens they put this in another after lifting from this after lifting from there. They put in water this is the water right. The moment it is put on the water because this is made of made of made of solid that is metal. So, this heat transfer is very high and the adjacent to this the ice of this lolly gets melted right or gets loosened. So, that time they make the thing upside down and during that period the stick comes out and we get a stick of Ice cream lolly like this right.

So, this is and not only that I gave only one example so you if you have this kind of thing and you have you might have seen that lollies are with different layers multi layers. So, this is a single layer of say vanilla, this is another layer of say chocolate and this is another layer of say another thing chocolate and pineapple say. So, what they do first and for that you have to have different molds like this because first one will correspond to this volume.

So, according to this volume, this mold is prepared right and first you make this lolly and this stick is there put it inside and then it you get it frozen. So, once this is frozen and then you take out from that to water system right. This water system you loosen it and then take it out right. Then you have this new volume right. And this one is made in such a way that your, this volume minus this volume equal to that one right. And this of course, will go in and this extra this extra layer will only be adhering up to this right. So, that layer will be this.

So, like this second layer you have put it into this and you got it this second layer present. Similarly you have put in this water and take we took it out. And the 3rd one this layer is then according to the volume of this and this you are making another one where your ultimately the lolly becomes like that right. So, this way multilayer lollies being also

made, but the primary thing which is that you have to keep you have to keep these lilies inside.

And not only that these lilies inside you have to keep for maybe 2 to 3 hours depending on, depending on whether you are making single layer or you are making multiple layers right. If you are making single layer timing requirement will be more. If you are taking multiple layers for each layer, you may have to have a less time. And then some together will be a little bigger than that the reason being you are taking it out and then putting it to another mold, then again putting it back again taking it out again from defrosting all these will take some time.

So, total time requirement may in this case if it is 2 to 3 hours in that case, it could be 3 to 4 hours. Obviously, that single layer one the price if it is 10 rupees, say your this multiple layer that will be 20 rupees. So, in that case this additional time investment is paying you back through the price and also the customer you will have more and the consumption also could increase because you are giving many varieties to the to the consumer right.

So, here also what we have inside of it which I cannot show, why I did not have that time that much of today's cameras. So, if there is your inside there is your heat exchanger so that heat exchanger throughout is this tank. And this heat exchanger is being cooled by the refrigerant generally this is by Freon right generally this is by Freon. And this refrigerant is making this heat exchanger cold. And in turn this heat exchanger is cooling inside there is the water that water. And this is not a simple water plane this is called brine solution right.

So, this is a solution who brine means salt solution, but this is not simply sodium chloride. It can be chlorides of many things and many others because the composition I is I also did not come to know because it is very much company secret. If I would have worked for a long period then obviously, I could have come across. But I did not try also because I did not have that intention to break the norms of the company. So, I did not try to know, but this I know from theory that number of chlorides, number of many other salts are there and that is being produced. That is that is keeping the water solution very cold and may be around plus minus 30 degree centigrade it this water temperature inside is there right.

So, if that is true then you are keeping your moles inside and mold is such that in this if this is the mold and if this is the stake and if up to this your liquid right. If this the stick of course, goes down if up to this it is the liquid then in what are this tank this is such that it is floating just like this, up to this it is underwater, beyond that is above the water right. It is just it is dipping and floating.

So, what dipping and floating are together? Dip is only up to the portion, where you have this stick lolly up to that portion this is underwater. And beyond that is not in the water system or branch solution right. And it is kept for that 2 to 3 hours or like that and the lollies are being ready. And then after taking out is the wrappers and other things are being put and then kept in the cold room. This does not need to go to the hardening that hardening which we had seen earlier is only done for cups cones and other which is coming out from the freezer.

But lollies are directly prepared and they are cold enough and this goes into the cold room. And in the cold room things are kept under different I mean that the storage temperature as we said is minus 20 or below. So, minus 20 degree centigrade; it is being kept and you are then supply to the tip different people right.

So, for like this you are keeping your lollies prepared right. One thing you should also keep in mind that one thing, you should also keep in mind that when you are making lollies you should prepare, you should be ready with the present lolly has to be defrosted to unload right from the mold. So, you are defrosting system also should be somewhere very close to this right. That defrosting system also should be somewhere very close to this otherwise if you are freezing system is air and you have to move around and then find out the lolly how it is to be dipped then unnecessarily you will be losing time which you cannot effort to do.

And if it is for multi layers if it is for multi layers then this gives lot of trouble lot of problem to the workers right. And which in turn will decrease the throughput or the production rate. So, it should be very close to this and of course, there the this floor as you are seeing that floor also that is true for any food industry. That the floor is always under all time it is being wiped off. So, that there is no residual or there is no dirt or any other things. That is the basic of the any in basic of any industry about the hygiene.

So, hygiene has to be such that you do not have any problem of that water dropping or Ice cream makes dropping. So, all the time if there we some people are always there who are all the time cleaning the floor; such that it becomes very clean as well it is hygienic right, because hygiene is the primary thing and these are all frozen material. So, afterwards you have no scope to heat or deans infected this infection is not possible afterwards. So, that is why the primary thing is the hygiene and that will minimize the chance of getting contamination because there mix is very highly as a highly susceptible to be infected by the organisms because it contains all the materials.

So, that should be hygienically very very good. So, that the chance of contamination you remove right. So, this way lories are being made and this is called the brine tank. And brine tank the brine solution is from the chlorides and many others chloride nitrates which can which can one thing which I did not say that is the eutectic point eutectic point.

So, the eutectic point of say pure sugar right pure sugar which we take that is C6 C12 H22 O11 right the sucrose. So, that is somewhere if I remember correctly around minus 5 degree centigrade. Sodium chloride has an eutectic point of say minus 21 degrees centigrade right. So, like that when they are making the brine it is taken in such a way that even at minus 32 degree centigrade. The brine solution remains liquid because liquid has the highest heat transfer.

So, heat transfer will be very good and it will be liquid and this pond you can keep it is closed that will that will minimize the heat loss right. Because once you have loaded it with the Ice cream lories and then for to our 2 to 3 or it will be there. So, you can keep it closed so that the unnecessarily open is the top is not open and heat is being transferring from the top to the water brine right. So, this way you can minimize the loss and maximize the profit ok.

Thank you.