Dairy and Food Process & Products Technology
Prof. Tridib Kumar Goswami
Department of Agricultural and Food Engineering
Indian Institute of Technology, Kharagpur

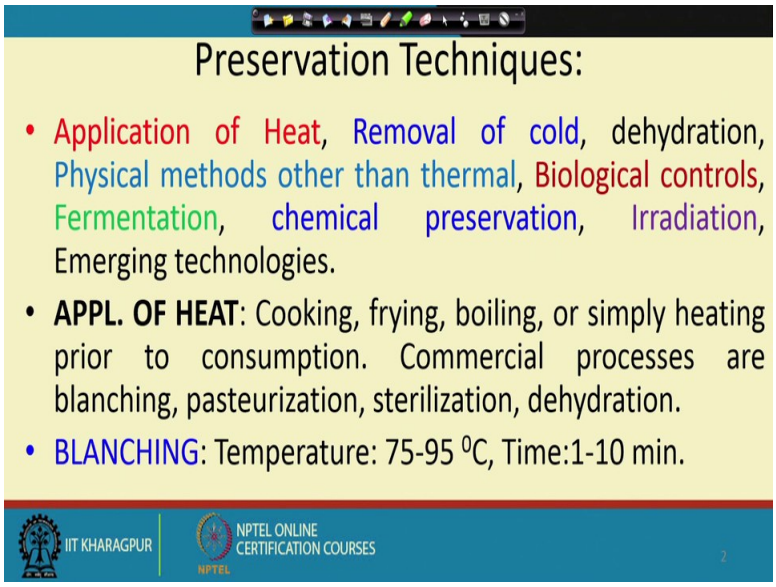
Lecture - 05
Preservation Techniques

In our this Dairy and Food Process and Product Technology course, now we shall move to what are the different preservation techniques, normally followed in both Liquid and Solid food. In the earlier classes, we are also said that this food is a vast course; its width and depth are so high that just not possible to cover everything in one class or in one subject.

However, we also said that we will as and when we will come up with new and new terms and new and new concepts or ideas that time we will try to explain in as much possible and then, proceed accordingly right.

So, that is why when we are saying this we will be coming to this Preservation Techniques right. So, what are the Preservation Techniques which are applied?

(Refer Slide Time: 01:27)



This is by Application of Heat, removal of heat, but generally we are applying cold right. So, removal of heat or by dehydration or by Physical methods other than thermal,

Biological methods including in including some controls; then, Fermentation; then, chemical preservation, Irradiation and Emerging technologies.

So, this is encompassing the big umbrella of a what are the different techniques by which you can preserve your food material for a longer period. Obviously, the processes involved in it will be not identical or similar; it will be also quite different a lot right.

Now, when we are talking about the application of heat, this we are definitely associated with our everyday life. So, whenever nowadays I am not going back to very primitive only this; whenever we are applying heat particularly when we are making food products at home.

So, what do you do? We apply in almost 90 to 95 % cases, we apply heat right and so thereby, we cook or fry or boil or simply heat for some reasons right and these all we do prior to consumption of the food material right. So, application of heat we come across every almost now and then at our household processing or house hold whenever you dealing with food.

So, prior to consumption, if these heat are applied; then, that is for cooking at home, but for commercial processes there are some more things which are associated like what we call blanching, pasteurization, sterilization or dehydration all this processes are commercial process right.

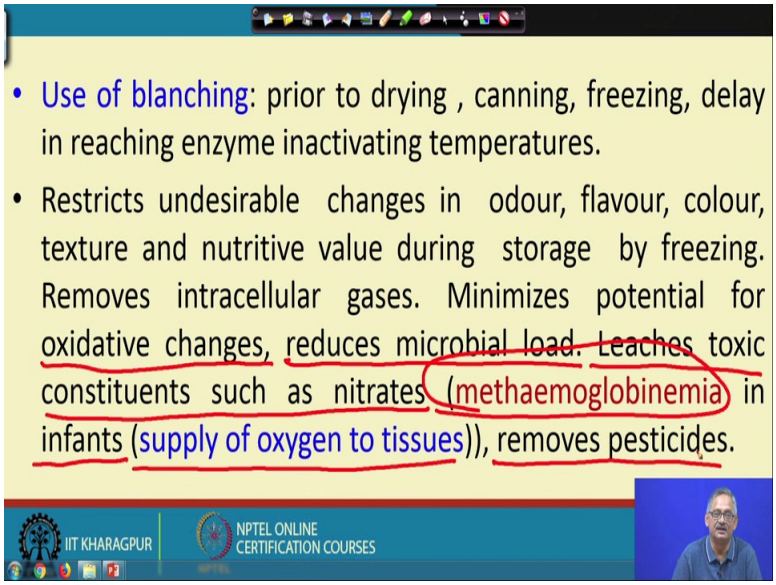
So, these processes we will come across and we will try to explain and understand what they are right. So, if we see in that the first thing which commercially we used is Blanching. So, Blanching is done between 75 to 95°C ; for a time period of 1 to 10 minute.

So, between 1 to 10 minute, we heat the product again depending on the type of product between depending on the size of product all will also where from it is and what is the initial condition of the of the microbial population. All these will dictate what is the time and keep in mind there is no absolute term or absolute word that only temperature or only time, it is always a time and temperature combination. It is always a time as well temperature right.

So, if it is time only specified, it will not be encompassing the situation or if it is only temperature specified, it will also not tell the condition. It is both time and temperature together, that will indicate that what you are doing, what is the benefit or what is the loss? All aspects will come accordingly.

So, generally this is the general term that generally blanching is done by heating around 75 to 90 °C for around 1 to or 95 °C for hour around 1 to 10 minutes that again depends on.

(Refer Slide Time: 06:27)



Now, where we use blanching? Generally, we use blanching prior to drying, canning, freezing or to delay reaching the enzyme in a or to delay the enzyme activities.

So, that enzymes can be kept aside. So, all these will be using blanching, but keep in mind, since processes like drying or canning you are you are doing blaching, you are doing heating drying is done by heating; canning is also by heating at high temperature or depending on again process product all together.

But, there you are you are you are giving heat in general, but look at the other; there is the freezing. There you are lowering down the temperature; there is no application of heat in the freezing.

So, prior to freezing if blanching is done, then that is more advantages in that compared to the other two; in other two already of course, I am not saying that they are not required

for drying or canning. They are obviously required, but more requirement is more in case of freezing than that for the drying or canning or similar kind of heat when you are applying.

So, freezing we should be always associated with blanching right. Now, why should we blanch that thing comes into mind that yes, we are saying that in drying when we are heating as such or in canning when we are heating as such; then, why should we undergo this blanching process. We have said that blanching is nothing but when your subjecting the product to be blanched. This product is the process is called Blanching and the product which call which we received is called blanched product right.

So, there when you are blanching, it rise temperature 70 to 95 °C and for a time period of 1 to 10 minute. Again, I am repeating that this is depending on product from where you are taking size, shape, initial condition of the product whether you have sub lot of microbes available in that source from where it is coming.

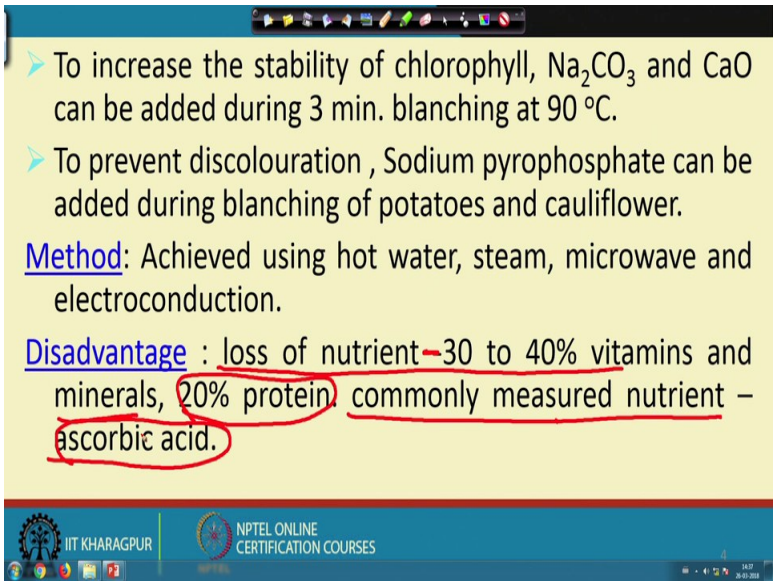
So, all these will dictate what should be the time and temperature combination right. So, what it does? It does the or restricts the undesirable changes in terms of odour, flavor, color, texture and also nutritive value during storage and this is mainly associated with the freezing term. It removes intracellular gases. Minimizes potential for oxidative it minimizes potential for oxidative changes and.

So, it minimizes oxidative changes, reduces microbial load or leaches out if there be any toxic constituents such as nitrates. So, this is this is a compound which is very detrimental that methaemoglobinemia.

So, this is a very toxic in the stage of infants, where supply of oxygen to the tissues are getting affected right and it also removes pesticides if they are associated right. So, by blanching we are protecting flavour, colour, odour and nutritive value and also we are escaping we are we are removing some dissolved gases, some toxic materials and also maybe some pesticides.

So, all these will be associated with the term blanching right.

(Refer Slide Time: 11:55)



So, what why then we use? We use to increase the stability of chlorophyll, sodium carbonate and calcium oxide also can be added during 3 minute blanching at 90 °C. In many cases chlorophyll, what? The color of chlorophyll is green; So, those for green material, green food material.

If the original is green; obviously, you would like to have more green or close to the greenness as it is available in the normal or natural fruit food. So, while processing or while making some products, if your green color is maintained; then obviously, the attraction or the commercial application will be more beneficial.

So, this will help you to minimum to keep the green color of the material right and then, in that sodium carbonate or calcium oxide all may be added as supplement.

So, that the color retention is very easy right. So, then we can we do it for to prevent the discolouration, we add sodium pyrophosphate right and this is mainly done for the case of potato, cauliflower those who are susceptible for the temperature also.

Subsequently, we will come to something or since it has come let me also tell here that you have seen that potato at home, when it is cut it gets brown right. Like apple, it gets brown when the movement it is cut and you are not taking care of that and it starts getting brown right. There is a reason for that we may come subsequently because since it has come here, let me tell that these browning is known as enzymatic browning right.

The enzymes present in potato or apple they convert this color to brown and unnecessarily those extra colors which are not acceptable by the consumer is coming in. So, you do not want that. To prevent that this blanching helps you a lot that this enzyme can be inactivated and to do that you are also adding some chemicals like sodium pyrophosphate that can be also added so that the color is not getting brown.

So, how then we can achieve the purpose, we have said that why should we? Now, next come why how should we? We came to first, what shall we; then, we came to know why should we and now, how should we perform this blanching process right. So, method is to achieve this normally either hot water or steam or micro wave these can be used or maybe some electrical conductions that can be used right.

So, majority in cases in commercial scale, it is steam because that is more easy and economy also compared to any other mode of heating. But again, as in the some previous classes we said the same shirt cannot be given to everybody because it also depends on your size your shape your appearance everything.

Here also some factors will come that will dictate whether that same thing can be used that whether steam can be used everywhere or water can be used some places or maybe microwave or maybe some other methods right may be heat conduction in many cases, it is also being used. But in majority it is the milk; it is the it is the steam which is being used for blanching or heating right and every dark there is also a bright or every light there is a dark.

So, any good thing also it is associated with bad. See if you only talk about good; then, you do not know what is the bad part of it. So, bad part of it is the blanching disadvantage that we can call the disadvantages of blanching is that since again, it is a time and temperature. This you can appreciate afterwards when we come to another parameter called temperature coefficient. We will define perhaps we have given some introduction.

We will come more in detail there and that temperature coefficient will tell you or make you more understand that why there will be disadvantages. Since, we are heating it 75 to 95; 70 to 95°C . So, within this range of temperature to at time of around 1 to 10 minute.

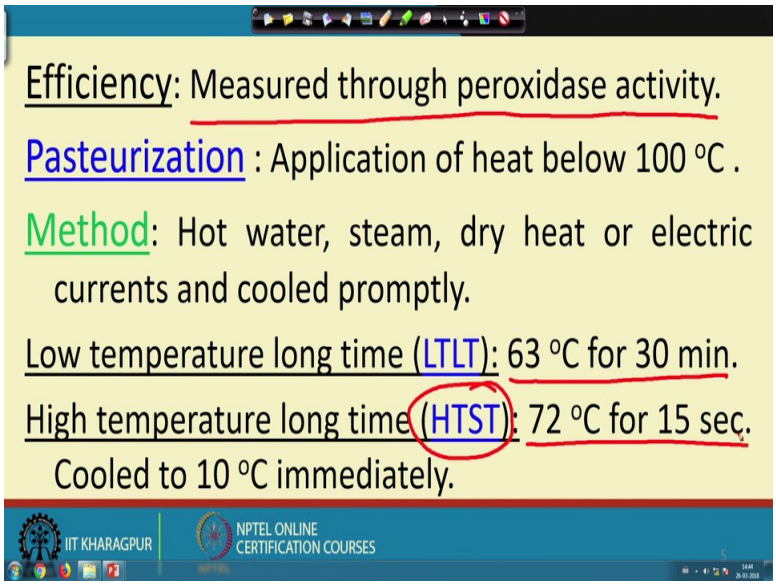
So, depending on this time temperature combination, there may be some losses of the nutrients, some discoloration or extra coloration color fading all these problems may be associated. So, generally around 30 to 40 percent vitamins and around 20% protein are destroyed. So, this loss we go that generally we lose around 30 to 40 % this is not minus. 30 to 40 % vitamins and minerals we lose and around 20 % proteins we will loss.

So, 20 % generally at the most a good source of protein food containing protein; we will have at the most around 15-20 % protein. So, out of that 20 % one-fifth is if it is lost, that is definitely a good loss right. So, this is one of some of the disadvantages which are associated with blanching.

This is commonly also measured by the nutrient content say the change in ascorbic acid this is a parameter by which we can tell that change in ascorbic acid will dictate how good or how bad the blanching was. How much we lost the nutrient that can be right.

So, we have removed this and let us go to the next page.

(Refer Slide Time: 20:17)



So, this then we have come some of the disadvantages. Obviously, by I mean case to case advantage or disadvantage will vary and if when you are considering one trip typical case; then you can mode in detail not this is in general mode in details this can you can you can find out or you can establish that whether advantages or disadvantages.

Obviously, you will not go where everything is or advantage is less; disadvantage is more. Obviously, you will go for where advantages are very high compared to that of the disadvantage otherwise without doing that would have been good enough. So, why should unnecessarily you incorporate some more things which will destroyed or deteriorate the quality or the product available product acceptability right.

So, in that case disadvantage is there, we have we have comes we have come across and now how to measure whether it is good or bad or it has been achieved; there is advantage disadvantage we have already said. But, how to how to measure that whether we have achieved or suppose we have for a typical case, we have seen that this if we do blanching it will be good for the product right.

Now whether the blanching was accomplished or not how to know; obviously, that will depend on that is measured by the term called Efficiency right. This Efficiency is measured with the help of two parameters called peroxidase activity right.

So, peroxidase activity is one measure by which we can say whether our blanching was sufficient or not whether you have correctly performed blanching and achievement was made or not that can be measured by determining the peroxidase activity right. Now, in blanching if that peroxidase activity is one, some other this is a blanching where time and temperature combination we have given and said, but another application of heat can be for Pasteurization.

Now, nowadays whatever milk we get commercially right nowadays those milk man business is reduced drastically and mostly we get it from the some co-operative systems like may be Amul or may be from this milk what we get from Mother Dairy right.

So, this kind of cooperatives units they are making the unit very very successful, collecting from different parts. So, milk man business has come down drastically. So, there Pasteurization is used. Now, this word perhaps the other day I also said that this word Pasteurization has come up from the renowned scientist Louis Pasteur. From there we this has been established, this has been implemented commercially to destroy the pathogenic organism present in milk.

So, in that Pasteurization there are many ways of doing pasteurization like either hot water or steam or dry heat or electrical currents, all can be used and this can be coupled

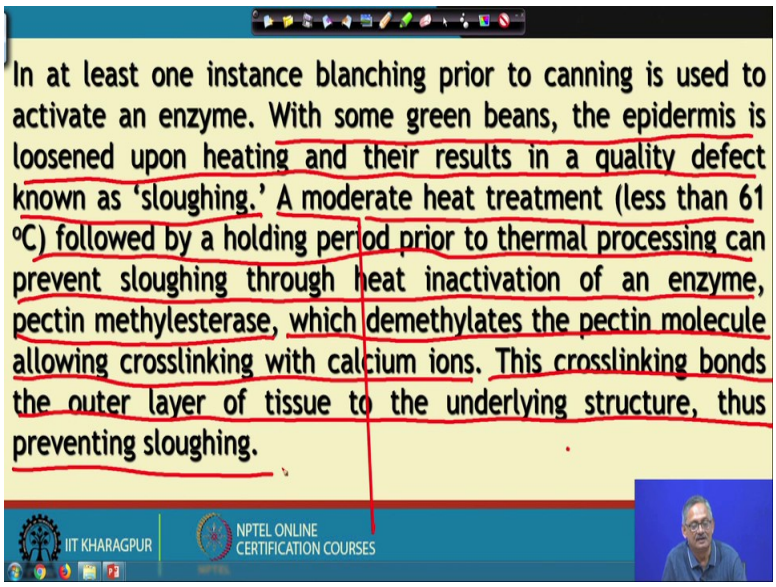
with the cooling promptly right. So, by definition we can call low temperature long time that is at lower temperature, I said that we will come to another parameter called temperature quotient after sometime may be some class.

So, there in detail, there you will see that the higher the temperature higher is the rates of reaction. So, to minimize there here LTLT that is Low temperature long time pasteurization is used and this low temperature long time come time temperature combination used is 63 °C for 30 min right; 60°C , 63 °C e for 30 min.

Another that is called High temperature short time or HTST. This HTST is 72 °C for 15 sec right and all are cooled to 10°C immediately. So, we have one-two types of pasteurization one LTLT that is Lower temperature long time and another HTST or High temperature short time. But keep in mind, keep in mind this time temperature combination is there that is whether you are heating at 63 °C time is the 30 min; whereas, 72°C time is only 15 sec right.

There is some other that is called Ultra high temperature.

(Refer Slide Time: 26:50)



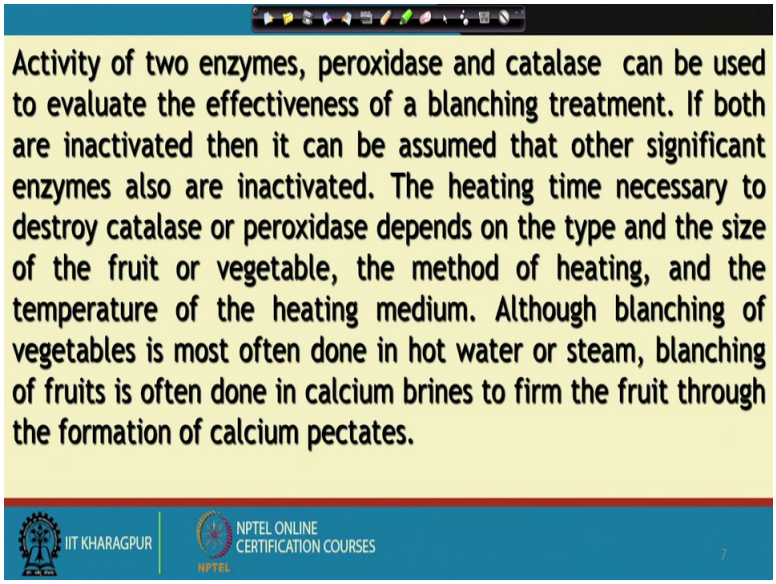
So, I think we have shifted ok. So, in at least one instant blanching prior to canning is used to activate an enzyme. With some green beans, with some green beans, the epidermis is loosened upon heating and their results in a quality defect known as 'sloughing' right.

So, a moderate heat treatment; a moderate heat treatment which is less than 61°C followed by a holding period prior to thermal processing, this can prevent sloughing through heat inactivation of an enzyme and this helps pectin methylesterase, which demathy demethylates; the pectin molecule allowing crosslinking with calcium ions; And this cross linking bonds, the outer layer of the tissue underlying structure preventing the sloughing.

So, normally earlier we have said that blanching inactivates enzymes right and we also give some example like cut piece of potato or cut piece of apple when we are doing that. So, their balancing helps that inactivation of this is possible, but in some cases activation is also done. For example, this where sloughing is appearing and the tissues are been preserved by the structural tissues are preserved so that sloughing is not there right. So, this helps a lot when we are.

So, accordingly as and when you require blanching may be helpful in destroying enzymes, blanching may be helpful in retaining the enzyme right. So, again the time and temperature combination that this is in a typical case where we are doing for the betterment of the product we right.

(Refer Slide Time: 29:49)



So, if you look at the other thing that that these two enzymes at this, peroxidase and catalase, this can be used to evaluate the effectiveness of blanching treatment if both are

in activated; then, it can be assumed that the other significant enzymes also are inactivated right.

The heating time necessary to destroy catalase or peroxidase that depends on the type and size of the fruit material, fruit or vegetables or food, method of heating and the temperature of the heating medium. Although blanching of vegetables is in most is often is a often done in hot water or steam.

So, blanching of fruit is often done in calcium brine. There calcium helps in forming the fruit right through the formation of some say pectates rather than through the formation of some pectates these are formed that calcium forms the material right, in that case it helps in ok.

So this, here stop for this class because our time is over. So, next class we will proceed further.