Cooling Technology: Why and How utilized in Food Processing and allied Industries

Prof. Tridib Kumar Goswami
Department of Agriculture Engineering
Indian Institute of Technology, Kharagpur

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Lecture 03
Definitions

Good morning. So, in the previous class we also said about temperature quotient and its importance. Now, to, as well of course, we covered a little on preservation techniques, right, why we need preservation? Now, to go forward, we need to know some definitions, like there are many things which we have to define. For example, perishable food materials. We say that these materials are perishable, we say that these materials are not perishable. Now, the word perishable means that the moment you are harvesting or slaughtering or catching slaughtering fish meat, catching fish, harvesting fruits and vegetables from that moment if the material is destroyed or it starts deteriorating, if it is deteriorating then it can be said that the material is perishable, right.

So, those which deteriorates quickly, after harvest for example, fruits and vegetables or soon after slaughter or catch slaughter of meat poultry or catch of fish. So, if they become gradually deteriorating and at the end it becomes spoiled then they are called perishable food materials. Now, most of the food materials are perishable in nature, most of the food materials, but there are some other materials also which may or may not be perishable for which we need to know the definition of certain terminologies, as we said, food, perishable food material. Then, we also say that there are some materials which are semi perishable.

Now, semi perishable food, what we mean, that means, it will perish, but not so early, right it will perish, but not so early it will take some time to perish. That means, if perishable food materials after catching or slaughtering or harvesting if they stay for 1 or 2 days then the semi perishable food materials is supposed to stay for 2 days some weeks or months depending on what you are talking about. Then, one such example is egg which is semi perishable. Now, you have seen your parents buying eggs or you are buying eggs and you are not keeping it inside the freeze. If you keep it outside also, if it is not very very hot days, then that egg does not perish or it does not get spoiled easily.

This is called nature has given a protection, a protective mechanism has been given.

Now, egg you see, the nature, the most create, I mean as far as creation is concerned is most scientific or most, what should I say, nature is so powerful that egg, as we gave the example, from the egg by hatching, we get the animal, whatever it be, those which are produced through eggs. Yeah, mammalian do not produce eggs. So, for them it is not directly you get the newborn, but for many animals like chicken or duck or many many others they do lay egg and then hatch and then the annual comes out. Now you see nature is so beautiful that the egg during hatching, it is not that hatching is done in half a day or a day and the egg comes out, no, or animal comes out, no, it is taking some days.

So, till that time, the egg has to be intact, otherwise animal will not be produced. So, such a greatness of nature that it has given a coating. So, that coating is given on the nature on the egg and this coating prevents the spoilage of egg right. This is an unique example of semi perishable food because the protecting is done by the nature, itself protection of the egg is done by the nature itself. So, it inhibits the spoilage and after hatching the newborn comes out.

This is one example which is, as I said, the result of the creation of nature. Similarly, we do, we human being also do certain treatments, for preservation, where the environmental conditions are accordingly changed and the material is made stable a little. For example, if we do pasteurize, I hope, you get everyday, milk, from the market, through pouch, and those pouches are called pasteurized milk. See, there are many others, like smoked food material, or pickled these are simple technique by which they are used in extension of the storage life. Now, in pasteurization since it I told that whenever new things will come I will try to give some idea otherwise it becomes Greek to others.

Pasteurization is a technique of course, by heat treatment that at 63 degree centigrade for 30 minutes or 72 degree centigrade for 15 seconds milk is heated that heating can be done by any means, milk, is heated and we get pasteurized milk where the pathogenic organisms are killed by the heat treatment of pasteurization. Not the entire gamut of microorganisms because, in earlier class, I said, now all microorganisms are not enemy there are many microorganisms, which are helpful there are many microorganisms which are detrimental. So, obviously, you want to keep the helpful ones not the detrimental ones and in this case, pathogens are, pathogen means those organisms, by which the disease is caused, any disease is caused is known as pathogen. So, these pathogens are killed by pasteurization that is heat treatment. Similarly, smoking also one such and pickling also one such method by which human being, unlike nature, has created extension of the life, and because of that extension of life or shelf life, I should say extension of shelf life and now the shelf life, a new word has come up what is that shelf life normally is said to be.

The period, from the point of either harvesting or slaughtering or catching to the point of consumption this duration of time is known as shelf life, perhaps, it will come also in the definition part, but since it has come here, I also explain that right. So, the not required or unwanted organisms are removed and the shelf life of the product is extended and this is called semi perishable food material, right. Now, another definition is shelf stable food material. Now shelf stable means it does not require anything, shelf sufficient, means I do not need any help. So, shelf stable is such, it does not need any help, it does not require any treatment.

It is automatically or by it shelf, in the way of shelf health, it has been able to extend the storage life. So, these are called shelf stable food materials, these are nonperishable at room temperature for example, cereals grains, nuts etc. I do not know how many of you have seen that your parents or elders they have bought when the price is low, rice and many others, particularly, rice, I am talking about and kept for maybe half of the year or whole of the year the quantum of rice required when the price of the rice is low, but they did not do anything with the rice just kept like that and it stayed for several weeks to months to maybe years without any help of anything, right. This you might have noticed or you might have heard because it is shelf stable. Now, in this regard another thing which comes up, which is not written here is called water activity, by scientific definition it is called partial pressure of or vapour pressure of water in the food material, over, it is a ratio, rather, it is a ratio of vapour pressure of water in the food material to that in the pure water at the same temperature.

This is the primary at the same temperature. If the temperatures are different then of course, it will also be different, but if it is at the same temperature then the ratio of vapour pressure of water in the food material to that of the pure water is known as water activity. Now, water activity varies between say 0 to 1, right and it has been seen that microbes do grow in, what different water activity level. For example, if the water activity is 0.9 and above then bacteria can grow, mold can grow, yeast can grow.

So, everything can grow beyond 0.9 water activity. Similarly, if the water activity is 0.8, as we said, 0.9 above all 3 are growing, that is micro microbes, yeast, mold, generally we handle with these 3 types of organisms, microorganisms yeast, mold.

So, in this case water activity if it is around 0.8 and above, but less than say 0.9 then bacteria will not grow, but yeast and mold will grow, right. Now, if it is further brought down to 0.

7 then between 0.7 and above means 0.8 the bacteria, yeast will not grow, only mold can

grow because for bacteria we need 0.9 for yeast we need 0.8 and for mold if it is between 0.9 and above, then mold will grow, but this is in general it does not mean that it will not be changing, right.

It will obviously be changing. When it will obviously be changing, when the water activity levels are also changed. So, that is why we can roughly say, if the water activity level is maintained at 0.6 or below then chances of microbial contamination or activity is very very low.

If it is less than 0.6, microorganisms, I rather, 0.6, or less than 0.6 water activity. So, this tells that the rice, which, I referred to which your parents have bought from the market and kept for several months or years, that has an water activity less than 0.6 for which none of the organisms or yeast or mold are able to grow at that temperature whatever it be, this is called shelf stable food material.

Another way of human intervention of it is that if it is canned, canned means you have seen canned and those canned are called retorted. Retorting means it is under high pressure and so high temperature. Now, anywhere, whenever you are handling with temperature, we will see that it is not the temperature only, it is a time temperature combination. It is a time temperature combination which plays the role of it whether it is good or bad whatever it be depending on the use, this may be time temperature relationship. I could have said this in the case of pasteurization, when I said 63 degree centigrade and 30 minutes 72 degree centigrade and 15 minutes, you see how the time as well as temperature are changing and also that could be around say 145 degree centigrade with no with no time or it is just hold at that temperature.

So, it is a combination of time temperature which is acting on it. This you have to keep in mind that it is a time and temperature both together is acting on the product and giving the result out of that. For example, if a canned food material is opened then you have seen that the canned material has to be consumed within that moment rather or you cannot hold it or keep it for long period or some period. It is advised that the moment you are opening or destroying the seal of the can that moment you have to consume, you should consume rather for better safety. Now, how this canning is done, any idea, I told that any new thing, normally that will come, I will try to figure them out easily.

So that it becomes easy for you to decide further. So, canning is done that at 121 degree centigrade for 15 minute. If it is heated, you see time temperature combination 121 degree centigrade for 15 minutes then it is expected that all the organisms will die or be killed and you have organism free material and that is called canned materials. In earlier days this can was not so popular, but nowadays you see that everything is coming in

terms of can why because it is retorded because it is not able to be spoiled so easily if it is even at room temperature. So, you can keep the canned materials in room temperature for which it is a very good as far as preservation or keeping it for long time is concerned.

Now, how the cans are prepared you have any idea perhaps not the can sheets are like this, right, thus, if this be a sheet of can then if this also be another sheet of can then this sheet is made one side a little fold like this the other can, other sheet also, or required quantity is also made like this, folding and these two has now 2 and 2, 4 surfaces now they are brought together. So, now we have 4 layers, one this, another this, third one is this, fourth one is this. So, 4 layers are there and they are tightened, they are tightened nicely and this is called a seamless joint, and there is no leak no real gas, nothing goes in and this way the cans are formed and your food material is kept in the can and then heated and can be kept at room temperature. So they comprise of the shelf stable foods. Some other definitions like dry storage if the storage at 20 degree centigrade and 50 percent RH is done, it is called dry storage.

So, 20 degree centigrade 50 percent relative humidity. We will come in detail about relative humidity when we will go to some other class, like what I was saying that this 20 degree centigrade and 50 percent RH that is RH will be talking in detail when we are in some other class in the sense, may be afterwards, where we will be covering psychrometry. Now cool storage, another definition, this is storage below 12 degree centigrade then refrigerated storage, there are two types of refrigerated storages, one is above 0 and another is sub 0. Above 0 means beyond 0 to 10, 9, 8 whatever for which you have developed. So, that is called storage above 0 degree.

Now, if it is to be stored below 0 then it is normally by minus 18 degree centigrade and minus 18 degree centigrade, why it is perhaps, our time is not there. So, we will let you know afterwards. So, this way the storage is, our storage time is increased. Now, some more are there like shelf stable or the shelf life which we have already said that is the time duration between processing and consumption, light protected some, like, medicines also some materials are required to be kept in light, right. And it is protected from visible for rather visible light or wrapped with aluminum foil that prevents high reactions, right.

So, with this let us stop today's class and wait for the next class. Thank you.