Dairy and Food Process & Products Technology
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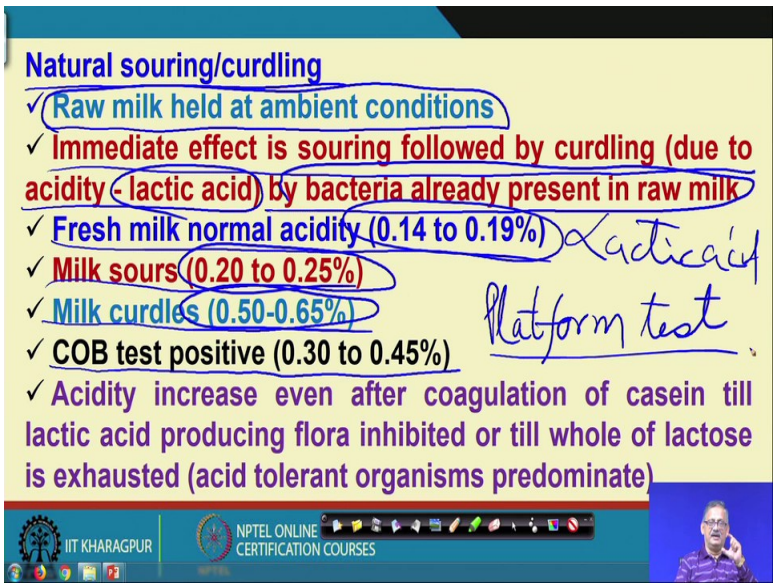
Lecture - 39
Natural or Other Type of Spoilage

We are discussing milk spoilage right. Primarily, we have discussed on the different aspects of how microbes are. Now we will look into this in lecture number 39 in this Dairy and Food Processing Products Technology, lecture number 39, natural or other type of spoilages right.



So, if we look at first the natural or souring curdling, souring of curdling, this is the most natural light. Why you call it to be natural or souring of cuddling? This we call natural because, example we have given n number of times that you keep some milk just like that for couple of hours or several hours, then without doing anything, you see that that milk has curdled.

This is called natural curdling or natural souring right where the organisms have invaded from the ambient or surrounding to milk causing the utilization of the lactose by the lactic acid bacteria or any other bacteria which might have invaded into milk and cause the acid production that is why it is the lactic acid right. And this is true for any natural disturbance or any natural changes or due to the nature which has cause the changes in the milk called natural souring or curdling right.

So, that example we are giving, raw milk held at ambient conditions if that is there, then it happens. Immediate effect is souring followed by curdling due to the acidity that is lactic acid by bacteria already present in milk or invaded from the outside. Fresh milk normally do have the acidity around 0.1 to 0.19 percent acidity in terms of lactic acid right. So, this acidity is in expressed in terms of lactic acid because the acid produced by this is the lactic acid that is why it is expressed in terms of lactic acids right. Milk sours between 0.2 to 0.25 percent acidity, 0.2 to 0.25 percent acidity, the milk souring takes place; curdling has not taken place right.

Normal milk is 0.14 to 0.19 percent of lactic acid. Souring of milk is between 0.2 to 0.25 percent of lactic acid where you taste sour feeling is there sour taste is there but it is not curdled. For curdling, milk curdles at 0.5 to 0.65 percent of lactic acid right and COB, that is Clot On Boiling test, I said some day I will tell about the platform test like, platform test, someday will tell, may not be today, some other day platform test. In there, COB is one test right. COB is called Clot On Boiling. If you take a milk in a test tube and heat it under Bunsen burner or any heating medium, nowadays, I those things are going away even in schools and colleges that Bunsen and burner and other things this concept is going off. Nowadays, people are doing it with gaseous, that is normal gaseous right.

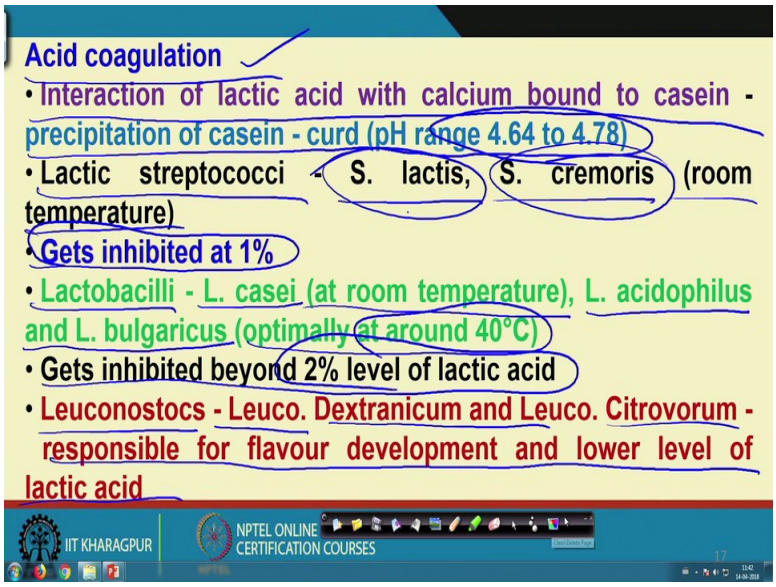
However, still scientifically we call ok it is Bunsen burner, you keep that test tube, heat it and when you are heating if there is some clot formation in the in the in the milk, then we call it to be COB positive, that is clot on boiling is positive. This clot and boiling tells that your milk is highly acidic and that acidity is to the tune of 0.3 to 0.45 percent of lactic acid right. Curdling is taking place between 0.5 and 0.65 percent.

But COB is positive, that it is acidic. So, if you put it as I gave some other day when you are receiving in dairy producing or some milk products producing, dairy industry if you are, if you are working or if you are employed then, you may have to tell out of lot many some whether I will not many rather milk sources, we have to tell which one is good, which one is bad, which one is to be thrown out or given back to the supplier and which one we will take back for further treatment. Now, if you find some of them are COB positive then obviously, there is a chance that by the time it is further process that acidity may go up and it may ultimately curdled the milk or it miss boil the milk total. So, from may be 50 liter some, thousands of lakhs of liters milk might be spoiled.

So, you are not allowing. So, this COB is one such platform test that is called clot on boiling whose acidity is somewhere between 0.3 to 0.45 percent of lactic acid. Acidity increases even after coagulation of casein till lactic acid producing flora inhibited or till whole of lactose is exhausted that this acid tolerant organisms predominate right. Should some acids tolerant organisms are there. So, it is a good information that by souring your pH has come down to 0.5 or 0.65 level. So, that level your curdling of milk has occurred but scientifically, if you look at that it has it has curdled the protein.

So, we will there be further acidity producing? It is yes. Further it will go on till some sufficient quantity of lactic acid is produced. So, that none of the organisms can grow or survive or that acid tolerant organisms are no longer surviving or multiplying or doing action or all the lactose which is present is exhausted by the organisms.

So, till that condition the acid production will continue right.



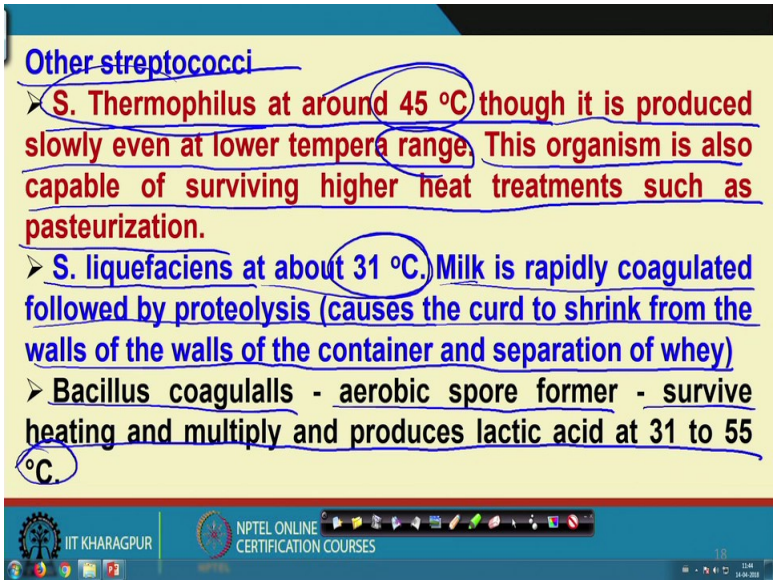
Then acid coagulation, this is the case where we come every day or some most of the time at home; acid coagulation, when the earlier case it was done by the nature, that time you are not confident whether this was explicitly done by some known organisms, some known product have been done or not. So, that time, that curdled milk normally you don't consume, you throw it because that was done by the natural sources could be originally from milk or could be invaded from the outside right. So, that is why even if you boil milk for first time and then keep it for long period in hot condition, then you will see that still it is curdling right. So, that means, during boiling, you have killed all

the organism present in milk but subsequently, you have kept it outside from nature it has invaded into the milk and it has grown up at ultimately brought the level of pH to that where curdling takes place.

Now, it is not only the pH but also the other fermentation products are respond may or may not be responsible which you do not know that is why it is not known to you and you throw it. You don't take any, any, any, any risk of consuming; whereas, now what you are saying acid coagulation; so, at home, when you are doing, when mummy is doing for you may be some chhena, maybe some whey for you for doctors do tell when you are weak, you are to be given more protein. So, chhena is one of the source or if somebody's stomach is not good upset, so he may not be given chhena protein but he may be given whey only. So, that type mummy or seniors, they are making knowingly some acid is given or some acids also are given like calcium lactate or things like that or may be some nimbu pani, that is some citric acid through the completion of the this nimbu that is the lemon, you are creating acidity and that is causing your curdling of the protein right.

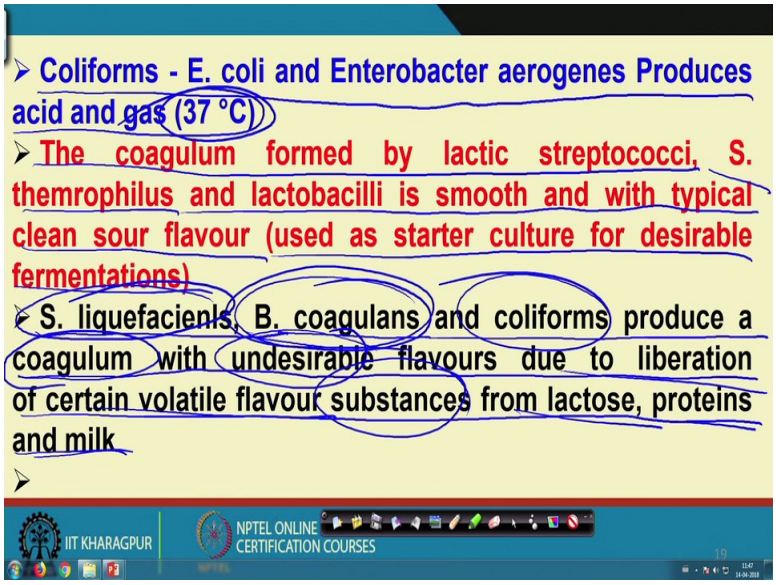
So, that is interaction of lactic acid with calcium bound to casein, precipitation of casein occurs and that is curd where the pH range is around 4.64 to 4.78. Some lactic streptococci or like streptococcus lactis, streptococcus cremoris, they do act at room temperature and form the acid coagulation but here you know and there gets the it inhibited at 1 percent. These organisms are getting inhibited for further growth or activity at around 1 percent level of lactic acid. Lactobacilli species, where lactobacillus casei at room temperature to be towards and produces acidity. Lactobacillus acidophilus and Lactobacillus bulgaricus, they optimally at around 40 degree centigrade, they get inhibited by around 2 percent lactic acid level right. Leuconostocs species like Leuconostoc Dextranicum and Leuconostoc Citrovorum responsible for flavour development and lower level of lactic acid.

So, these are some acid coagulation or some acid forming organisms which you can do knowingly.



Other organisms like streptococcus; so, our streptococci other organisms like streptococci. So, in that streptococcus Thermophilus at around 45 degree celsius towards though it is produced slowly even at lower temperature range, that streptococcus though it is given 45 degree centigrade but it can work at lower temperature range also. This organism is also capable of surviving higher heat treatments such as pasteurization that is the danger, that this some of the streptococcus, they are highly heat sensitive heat resistant and they can even with stand the pasteurization temperature.

So, that is why you have to do after pasteurization, the pasteurization test if it is negative then by all possibility it is taken that all the pathogenic organisms are destroyed right. Streptococcus liquefaciens at about 31 degree centigrade works on milk and milk is rapidly coagulated followed by proteolysis, it is the curd to shrink from the walls of the container and separation of whey right. Bacillus coagulalls, it is aerobic spore former. It is survive heating and multiply and produce lactic acid at around 31 to 35 degree centigrade.

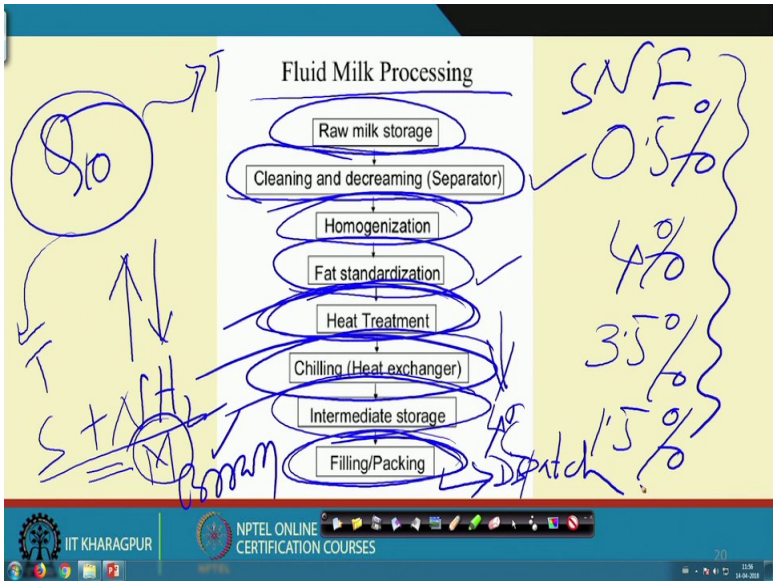


Then coliforms; some coliforms of course, coli means like e coli and others, they are very very dangerous pathogen right, very very dangerous pathogen normally they are not allowed to be in any food material. But even if it is invaded, that is what you should also know that coliforms, that is e coli and Enterobacter aerogenes produces acid and gas around 37 degree centigrade. 37 degree centigrade means our body temperature is also 37 point something. So, that 37 degree is the body temperature. So, that the body temperature is also this coliform can grow and multiply.

The coagulum formed by lactic streptococci or streptococcus thermophilus and lactobacilli is smooth and with typical clean sour flavour used as starter culture for desirable fermentation. In some of the cases like informing while you are preparing, while you are preparing say some acid knowingly right knowingly you are producing like in cheese where you are producing some acid or may be developing some flavor, I said the other day ripening. So, that ripening process, you are developing some flavour knowingly. So, this kind of organisms may help to do those flavour forming in the product and that is desirable.

Now Streptococcus liquefacien is the liquefacienis the, this or beta coagulans, that is bacillus B coagulans that is bacillus coagulans and coliforms produce a coagulum with undesirable flavours due to the liberation of certain volatile flavour substances from lactose, proteins and milk. So, Streptococcus liquefacienl, that liquefacienis or Bacillus coagulans, they or coliforms, they produce some coagulum with undesirable flavour

which liberates from certain with liberates certain volatile flavour substance from lactose or proteins or milk which are not desirable right undesirable.



Then, then we come to the flow chart of how this is also a part of that our mandate which we are given that how the liquid milk is is processed right. So, that processing of course that involves lot of things like pasteurization, homogenization or what is your end product depending on that your things are different right.

So, what is your end product that will dictate how you will be following the process? But by and large to have one general process, so this milk fluid processing flow chart we are giving. This is what that raw fluid processing raw milk is coming in the storage, storage tank lot of lot of materials are being stored, lot of milk is stored, then it undergoes cleaning and decreaming if it required that is by a separator vacuum separator is used if it is decreamed or it is cleaning.

So, cleaning and decreaming that step could be there, then it is homogenized, then it is fat standardized right, depending on what is your end product fat contain you want right. That you have already stated that, I want 3.5 percent fat in the milk or I want 4 percent fat in the milk or I want 1.5 percent fat in the milk or could be I want only 0.5 percent in the milk.

So, you know your end product right, liquid milk end product you know and normally, this end product is normally this end product is characterized by the fat content of the milk. Also, the moment fat contains in fixed simultaneously your that Solid Not Fat or

SNF is also automatically fixed right. So, less fat more SNF or more fat less SNF, that is the combination right. So, you know what is your SNF, what is your fat content. The moment you know, so after cleaning, whether you will de-cream or standardize means, either you will take out the fat or you will add some from other source, some more fat so that the required fat content is achieved right, thats' what is your end product that must be known right.

So, once that is known. So, either this stage or this stage or both in combination are followed. Then the heat treatment, so this heat treatment is done for deactivating enzymes deactivating microbes. So, that you can retain it for a longer period; the enzymes putrefying enzyme or those which are spoiling enzymes, they are deactivated and the pathogenic organisms are also deactivated.

So, these two are done and then, you are better off with the product that what you want to make that product you know. So, you have already done either standardization or by de-creaming, you have or both in combination, you have done, you are right fat content SNF content and then you have subjected to heating. Then, after heating chilling is done and chilling also is done by some heat exchangers; obviously, any heat either giving or withdrawing, any heat giving or withdrawing is achieved by heat exchanger right. The thing where heat is getting exchange whether it is hot or cold doesn't matter in either case, it is the heat which is getting exchanged.

So, that is why it is called heat exchanger. So, in that heat exchanger, it is done chilling and this chilling is done normally, quickly. Since, it has come we also tell that this quikness or this after heating the chilling is done quickly the one of the primary reason is that, it is not that organisms associated. It is that your milk it contains high quantity of proteinaceous substances, that is nitrogenous substances as well your sugar or reducing sugar as lactose.

So, this lactose and the amino group of the protein right; so they do react forming Maillard reaction. And from the Q 10, you know that Q 10 was there the higher the temperature, the higher the temperature, higher as the rate of reaction. The lower the temperature, lower is the rate of reaction. This was known right. So, that is why, when you have heated killed organisms at high temperature if that amino group plus your sugar

if that is reacting forming your melanoides right, forming melanoides or melanoidins. So, that is the maillard reaction causing brown colour that is not desirable right.

So, you are chilling it quickly, avoiding this to take place right because your destruction of organisms have already taken place while you have heated it right. So, then you take into intermediate storage where big big containers are there with cooling facility you are storing normally at around 4 degree centigrade, you are storing or keeping it. And from there, it depending on whether you are filling it in a tank big tank or you are filling it in some small packaging units depending on how you are distributing your material, that I will go to that place from there it will go to dispatch right.

So, this is how the fluid milk is being processed right. This is how the fluid milk is being processed. So, let me clean the board. This is like that that, fluid milk we have received raw milk and from the raw milk storage, we have cleaned it or decream depending on as we said the end product what you need. So, decreamed and then it is homogenized so that fat particles becomes uniform at a smaller globular diameter, then you also make the fat standardization, that also depends on what is your end product you have, you get it end product, then it is after standardization you are treating with heat.

So, after heat treatment it is chilled and this is both of course, heating and chilling are done in heat exchangers; so, called heat exchanger because heat exchangers are there or are those where your exchange of heat is occurring. So, in chiller or chilling unit or heater heating unit both are in that way heat exchangers. And then, you are after chilling, you are bringing it to your storage place from where you are distributed either through filling some tanks or filling some containers or doing some packaging depending on what is your requirement right.

So with this, let us because time is also out. So, let us stop today.

Thank you.