Dairy and Food Process & Products Technology
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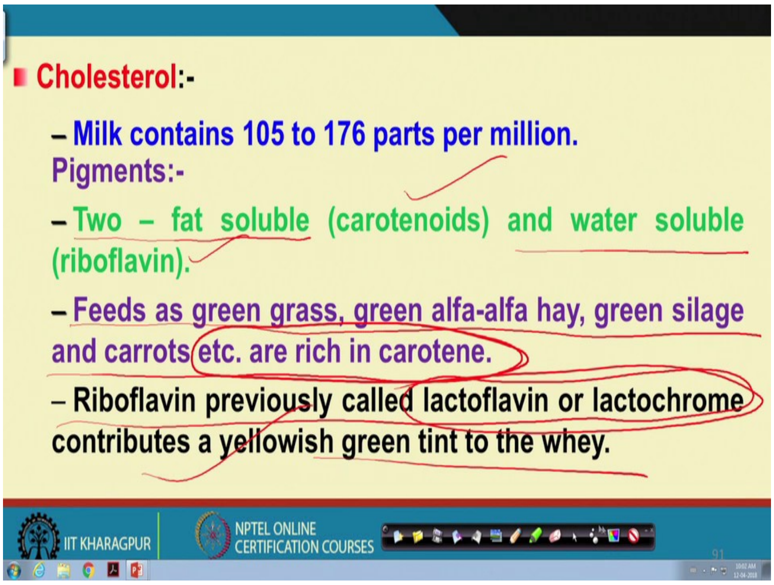
Lecture - 35
Small Constituents of Milk

Ready. So, we were discussing about the small constituents, the major constituents I have already been discussed, earlier the smaller constituents out of which cholesterol this is our lecture number 35 in Dairy and Food Process and Products Technology, this course. So, we will discuss small constituents of milk whatever is still remaining, right.



So, out of which we said cholesterol which we finished in the last class and we also said that cholesterol is nowadays is not considered as bad as it was in the earlier years. It was imposed, that yes don't take foods which have high cholesterol etcetera etcetera your level will go up etcetera. But sciences like that today it is something is very good tomorrow it may may not be so things like that this is this is a changing process it is not a constant that, but other than there are few which normally do not, but those things like this are variable.

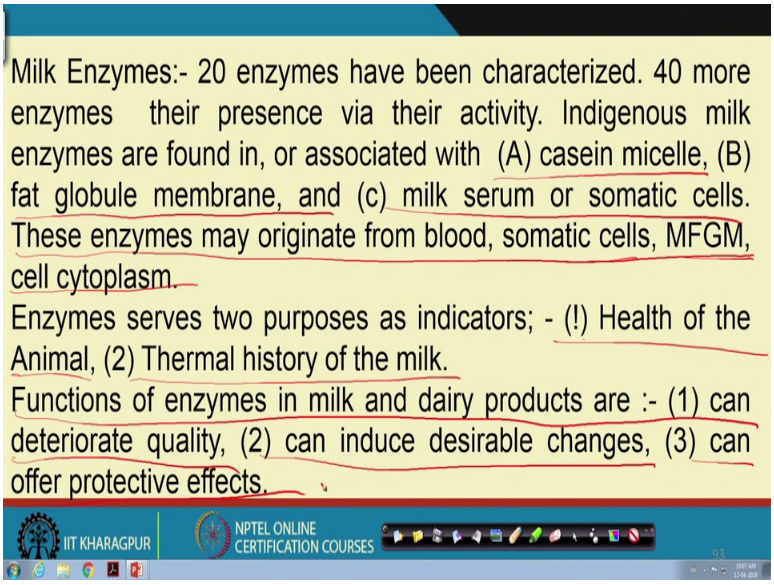
Today it is good, tomorrow it is bad or tomorrow it is good, today it is bad things like that, ok. So, milk contents around 105 to 176 parts per million your cholesterol, right. And I here specifically we have not send out of which how much is low density lipid or high cholesterol is an part of lipid it is in the lipid family. So, it is that we had said when we are said in the lipid, right. And this whether it is low density or high density lipid that that they distribution I have not said, right. So, it is the total cholesterol present in milk.

Other things which are present in small are pigments out of which some are water soluble and some are fat soluble, right. Because pigments they are also water soluble, they are also fat soluble, so depending on whether they are water soluble or fat soluble pigments we can distribute into two; two we can divide into two parts one is fat soluble and other is water soluble. Fat soluble is carotenoids and water soluble is riboflavin, right.

So, that the colour of milk if you remember, the colour of milk when we were talking about we were saying that if the fat content is high then the colour may be yellowish. Do you remember? But it is not always that if the carotene content is high or carotenoids are present in high concentration then that may influence on the colour of the milk, right.

So, they the bad people, the bad intentioned business mind business people they do take this into consideration, right. So, this comes under feed, carotenoids that will come under feed. So, if the feed is accordingly controlled so that also we will give some yellowish colour to the milk which is deceiving, right. And also that way which sometimes it is on the colour which we see or the bluish tint which comes from the milk that is because that is because of the riboflavin present in milk. Riboflavin is water soluble carotenoide or carotenes are or carotenoids are fat soluble, right. So, feeds as green grass green alfa-alfa hay, these are green silage and carrots etcetera they are rich in carotene. So, if they are fed like that so they will automatically give the milk which will be yellowish in colour not desirable because we want the yellow colour from the fat not from pigments, right.

Similarly, riboflavin which is previously known as lactoflavin or lactochrome these contributes yellowish green tint to the whey, right, yellowish green tint to the whey. So, the whey which comes out that is again greenish in colour you will see you will you can ask your mummy who do or who does all these or seniors that when they make the chhena that the leftover that is whey the colour of it, and you will see in most of the cases they will say why it is greenish in colour, right. Yellowish greenish tint is there and that is primarily due to the presence of riboflavin. They are they are they are concentration is very very small, but good enough to show their presence, right. So, from there let us move to others, this we have already said.



Others like milk enzymes this is another umbrella where lot of enzymes are present in milk and lot of activities they do, right. Around 20 enzymes have been characterized, whereas 40 more enzymes, they are presence via they are 40 more enzymes also show their presence through there activities. So, 20 enzymes have been characterized from milk, right. Characterized means they are identified and they are they have been seen the observed, presence in milk and they are separated identified like that. So, there is a 20. Whereas, 40 more enzymes show their presence through their activity may not be that those enzymes could be isolated and then identified through a through experimentations, but their presence is felt with the activity they show, right.

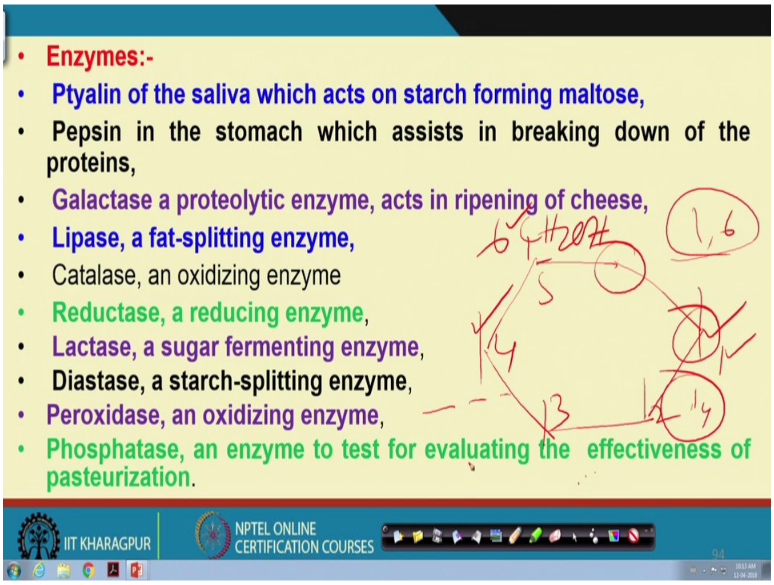
So, indigenous milk enzymes are found in or associated with associated with casein in casein micelle or fat globule membrane and milk serum or somatic cells. So, in this case another new term is come up that is called somatic cells rest of the things we have discussed in many because fat global membrane FGM, we have discussed earlier casein micelle we have discussed earlier.

Somatic cell, somatic cell is a cell which is presence in all parts of the body except the reproductive parts or cells, except the reproductive cells all ells are called somatic cells, right. This is another information. So, these enzymes may originate from blood, right, somatic cells or fat globule membrane or cell cytoplasm, so from any where these enzymes may come up.

Enzymes serves two purposes as indicators that is health of the animal and thermal history of the milk, right. So, these presence of enzymes or the identification of the enzymes, identification of the enzymes do play that this serves two purposes two how one is the more the enzymes presents that will tell the health of the health of the animal from where you are drawing the milk and the status of the milk that is thermal stability or thermal history of the milk, right. Because it is not likely that in today's scenario if you are in urban areas may not be in rural to so much, so much so much so much things are affecting, but in urban areas obviously, you will not get milk drawn now and in an hour it is served to your house. Normally they are processed and then it is then it is circulated through some mechanisms of chain distributions.

But the presence of enzymes or identification of these enzymes in that milk will tell you how good or how bad your thermal processing was there, and how good or how bad your original source of the animal that is health of the animal how good or bad it was. So, these two are the indicators of the presence of enzymes.

Functions of enzymes are like it can deteriorate quality, it can induce desirable changes, it can offer protective effects. So, 3 primary functions we can identify. That obviously, it enzymes can do good or bad, if you remember I gave the examples of knife. So, knife is also similar thing which you can used for good purpose you can use for bad purpose. So, enzymes in milk are also like that it can be you it uses for some good purposes it is also it can cause some bad output or bad things in the milk, right. So, apart from that it can also act as a protective agent or it can give the protection of the milk if there be, right. So, these 3 purposes enzymes do function, right.



So, the enzymes which are normally an at a at a glance we can say the ptyalin, now the other day you are saying that in our this mouth cavity or this organo organo this what we call this olfactory region in this mouth cavity and nasal cavity, particularly in mouth cavity we in the saliva lot of enzymes are there lot of enzymes are secreted. Is not at any movement you take it and you get all all of them that's why I give the example that parents and other seniors they do ask you to chew and then swallow or engulf the food material, other than just taking it and swallowing it this at.

So, chew it, the moment you are chewing that secretion of the enzymes starts through alive saliva, right. So, that is why chewing is a very very important step for digestion. So, in those things so many enzymes are there in our body system in our saliva. Similarly so many enzymes are there in milk also one such ptyalin which is present in our saliva is one which acts on this starch forming maltose. Starch is degraded by this ptyalin enzyme and this degrades starch because starch we know that is the polymer of glucose that is the polymer of glucose. So, n number of glucose they are depending on the source of this starch, this n can be many, right. It varies widely from source to source, right. But really very large number very very high numbers of glucose monomers are polymerized in starch, right.

And in the also you have if we don't know then let us also tell here, that there are two types of starch, one is amylose and other is amylopectin, right. This is true for any food amylose and amylopectin, and out of which amylose is a straight chain where the glucose poly monomers are attached by straight chain and in the amylopectin there are some branching may be after every 20 30 40 units of this glucose polymers there could a branching from where another 20 30 may be attached and further branching could be from there or from this straight chain.

So, amylopectin is branched, amaylose is straight chain that is why in amylose the linking is alpha 1 4 linkage, right. Alpha 1 4 linkage since it has come. So, I will just tell that that this is the glucose, right, this is the oxygen this is CH 2 OH, right. Whether it is alpha beta I am going into that these are hydrogen and hydroxyl groups, right. Normally this is called 1 position, right, this is 1 2 3 4 5 and this is 6, right. So, when 1 4 are there another similar this is 1, another glucose at 4 is clubbed together farming the chain, right, that is the straight chain.

Whereas, in the branching these one position is coupled with this exposition of another, right. So, there it is 1 6, this glycosidic linkage and this is 1 4 glycosidic linkage, right. So, that is what happens in amylase. However, starch when this is degraded that time you get this maltose which is an intermediate from the starch big molecule to a smaller molecule maltose that is available the degradation of this from the starch is done by the enzyme called ptyalin.

Some others like pepsin in the stomach which assists in breaking down of the protein, right. the earlier also I get this example pepsin, are which acts on the proteins to break it down, because ultimately whatever you take whether it is whether it is carbohydrate fat or protein they are big big molecules depending on the particular one you are taking. So, those are ultimately degraded to the by the body system to either produce some proteins which are helping your body or may be some energy, or may be respiration, or things like that, right. So, it is not the bigger molecules which are directly utilized. So, they are also broken in our stomach that is the reactor, and in that reactor lot many enzymes are there. This is one such pepsin which is degrading protein to a smaller units, right. You have seen proteins are so big, so they are also broken into smaller units, right.

Then galactase, galactase is a proteolytic enzyme that acts on the ripening of cheese. If we come across sometime afterwards preparation of cheese when will go there that time we will see the cheese while making it galactase helps a lot in proteolyt that is the proteolytic enzyme galactase which acts on the protein and during the ripening of cheese. This ripening is not the ripening of our fruits like guava from green to yellow, mango from green to yellow that we call ripening. This is another ripening, right. Though the word is similar ripening, but the meaning is different. So, there in cheese forming this break down of the protein is also done by the enzyme called galactase, right.

Then lipase, lipase is an enzyme which acts on lipid which we have already said. So, lipid is degraded by lipase and milk contents lot of lipase and this lipase can break down or the if when for example, when you are doing since it has come when you are doing homogenization that you are you are breaking down the bigger fat molecule into smaller fat molecule, right. So, when you are making this and we have said that there is a fat globule membrane. So, that membrane if it is broken then the fat becomes exposed. So, this enzyme that is the lipase acts readily on that and thereby it destroys or it deteriorates that fat producing maybe of or some undesirable thing, right. So, this lipase act is also there and it acts on that.

Then catalase, catalase is an oxidizing enzyme or oxidizing enzyme. So, any oxidizing deterioration of the fat can be initiated by catalyst. Then reductase this is a reducing enzyme. So, any reduction process can be in a enhanced or initiated by the enzyme called reductase then lactase, lactase is a sugar fermenting enzyme, right. This we have been telling repeatedly that when you are doing lactase if lactase is there then that acts on acts on the on the substrate called lactose which is the milk sugar, right. So, on the milk sugar this lactose is acting and then forming your lactic acid. So, this lactic acid is not in this case desirable, right. In this case it is not desirable because ultimately we know if the isoelectric part or if the pH comes to the level of 4.6 then it is not desirable then casein comes out casein precipitates. So, this lactase is acting on the lactose and that lactose is producing lactic acid which is not desirable.

So, you see some are desirable, some are not desirable depending on the usage depending on the requirement depending on how they are acting on at what condition so that could be beneficial or that could be detrimental, right. Then diastase, in many of the, in many of the digestive medicines you will see that this diastase is written, right. So, this diastase is a starch splitting enzyme again it can act on this starch diastase and starch whether it is alpha amylase or beta oh sorry amylase or amylopectin does not matter, diastase act on both of them. So, starch is being splitted by the enzyme diastase. So, diastase you can in this case if you are taking it to be for digestion then you can say that for digestion diastase is a very good enzyme, right, helpful enzyme. So, you can utilize it in a good way diastase is also present in milk.

Then peroxidase, peroxidase again is an oxidizing enzyme peroxidase is again an oxidizing enzyme. So, the enzymes which oxidizes now, that can oxidize fat, that can oxidize protein depending on wherever or carbohydrate. So, depending on wherever how the reactions are happening what is the substrate how the substrate is available. So, all these are there so oxidation can be initiated by the peroxidase, right.

The name and you will see all the enzymes whatever till now we have mentioned or named some many others also there will come and these enzymes are ending with a s e, right. Peroxidase, then galactase, then lipase, then catalase except ptyalin, right. Ptyalin of the saliva which acts on starch for being maltose this ptyalin except that all are some exceptions could be they are all are ending with the ase, a s e. So, enzymes are always with the ending with a s e ase, right, lactase, then lipase, then reductase, peroxidase etcetera.

So, another enzyme which is very very important in milk is called phosphatase. This is an enzyme to test for evaluating, effectiveness of pasteurization, right. This is already present in milk all these which till now we have discussed are present in milk and pasteurization though we have not separately said, but at this referred many many times that this is the process by which the inactivation of the pathogenic organisms are done and the name came up from the name of Louis Pasteur, right. So, the scientist Louis Pasteur from his name it came up as pasteur process as pasteurization.

So, this we are heating, right. So, that and we also said earlier that heating is not a single parameter that is temperature, it is always a combination of time and temperature that is affecting. The time and temperature that what temperature for how long you are heating according to that the affect will be found or effect will be understood. So, depending on how much you are heating. So, you are destroying the may be all these enzymes, may be some organisms etcetera and for pasteurization it is the organisms which are diseased causing diseased producing organisms they are destroyed. And this disease producing organisms are many, and they are called normally the they are called your disease producing organisms and they are what they are said to be this of course, it is there producing disease and harmful of course, they are harmful organisms and this organisms are killed by the heat treatment.

Now, whether pathogenic, yes. Now term was not coming in when often. So, pathogenic organism they are disease causing organism and this pathogens are killed by the heat treatment. Now, where that the heat treatment was correct or not to the extent it was good or not this sufficient to kill all the disease producing or pathogenic organisms are not is checked by these in presence of these enzyme phosphatase, because phosphatase is such an enzyme which is resistant compare to other compare to other your enzymes.

So, today we are we have come to the end. So, again enzymes will discuss in the next class.

Thank you.