Thermal Operations in Food Process Engineering: Theory and Applications

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Lecture - 01
Fundamentals of Food Processing and Preservation

As we said in the preamble that we need to know some fundamental things of food materials because unless we know that we will not be able to decide which one to do and which one not to do, where to apply where not to apply. So, some because this is this class being a cosmopolitan, so, others also should also know a little about. So, that is why I have decided I have created that you if you see the course content.

And one more thing it should be also clear that though the course content is said it may not be absolutely possible to follow week wise all the topics in the way it has been given in the course outline, 'right', because that was done long back and when the proposal was given. Now, when you are processing, when you are proceeding with the courses it may not be that and each class as you know is of 30 minutes. So, it may not be possible that the one which you have given can be adhered too something may be which is of very importants could have been can be given more emphasis and for which others may be shifted. So, but we will try to cover all the topics which we have laid down in our course curriculum, 'right'.

So, now let us go to the basic fundamental of Fundamentals of Food Processing and Preservation, 'right'. So, this one we shall start with that fundamentals of food processing and preservation, ok.

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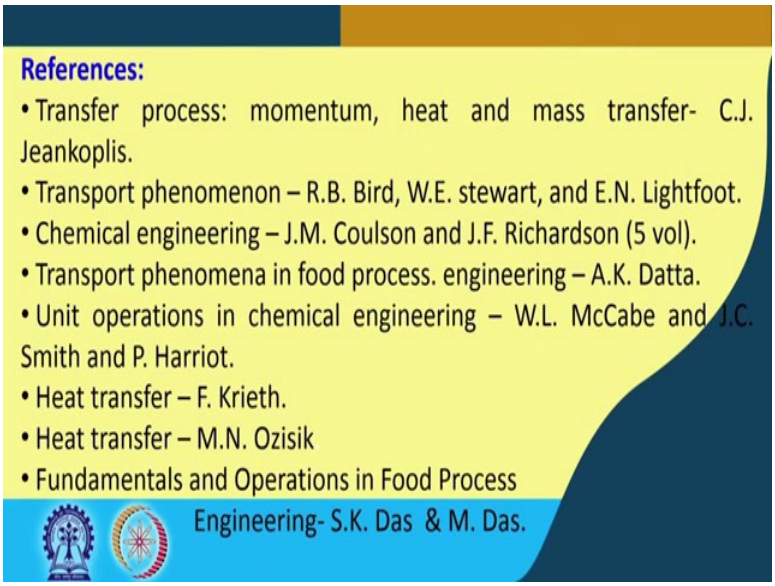

Then let us also look into for this course what are the books you can consult, 'right'. The basic course is Transfer Process: Momentum, Heat and Mass Transfer. This is a very-very good book most of the students they follow this book. This is of Jeankoplis, the pronunciation could be Jeankoplis or Jeankoplis, 'right'.

Then, Transport Phenomena by R. B. Bird, W. E. Stewart and E. N. Lightfoot; now, this is also a very good book because Bird, Stewart and Lightfoot and normally you will see that most of this people or students or even teachers they do say Bird, Stewart because by this name it is so much popular and they are also and these books are edited time and again. So, new and new things are also introduced into them, 'right'. So, this is on total transport process. So, our thing is on one part that is heat transfer or thermal operations, 'right'.

Then third book is Chemical Engineering by Coulson and Richardson. So, this Coulson and Richardson has 5 volumes, 'right'; volume 1, volume 2, volume 3, volume 4 and volume 5. So, you can consult that those books also, these are all books which are normally available in any standard library, college library any standard college library this book should be available. Then, Transport Phenomena in Food Processes or Food Process Engineering or Food Processing Engineering perhaps it is in food process engineering. It is also written by A K Datta one of our colleague, 'right', professor A. K.

Datta a small which here deals with mostly on the theoretical part and some of the problem solutions are also there.

Then Unit Operations in Chemical Engineering; this is again read by the name you can understand that it is also multi disciplinary and this is written by W.L. McCabe and Smith and Harriot. So, that is why again I tell you that this book is also popular in the name McCabe Smith and Harriot is normally silent McCabe Smith anybody will tell McCabe Smith and earlier it was in FPS systems, but the recent additions they have also introduced both FPS as well as SI because now all engineering units are in SI. So, they have also converted that into SI.

Then I like these two books very much I also follow personally that is maybe it is that liking the book is personal absolutely because the way the book is covered, the way the topics that covered, the way the language is used all these have influence on the liking. So, that is why I do not say that beyond these books other books are also not appreciable not like that, 'right'. I cannot give you list of 100 books because that itself will take long time and there is no end to that, 'right'.

And nowadays the whole world being in your hand because you have this, what we call Smartphone and others. So, these gadgets electronic gadgets they have brought the entire world perhaps in your palm or in your hand. So, like that you can as any time consult any other book if you like there is no; there is no such demarcation that you cannot do this or you cannot do that. Wherever you feel that this language and this topic is suiting me and I should follow that you can obviously.

But, personally for heat transfer these two books I follow very much number one is Heat Transfer by Frank Krieth, the treatment and language I like very much and the other one by Heat Transfer by M.N. Ozisik 'right' this is also a very good book on heat transfer I also like this book very much 'right'. But, again as I said this is my liking does not mean you have also to follow the same, you choose your book.

The other one recently has come up very recently maybe a month or around one of our colleagues he has published or not one, two of my colleagues who have retired and given full devotion on this very good book written by Professor S.K. Das and Professor M. Das the name of the book is Fundamentals and Operations in Food Process Engineering, 'right'. This book is also very good well written. I have seen it little I do not say that I

have gone through thoroughly, but yes this is also a good book where the fundamentals are well covered. But, I do not know whether the heat transfer was given so much emphasis or not, but yes part of that is also there, 'right'.

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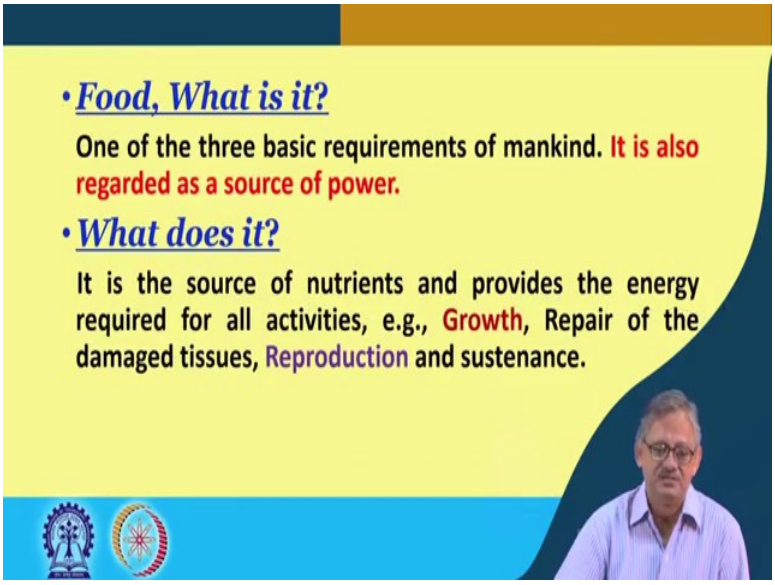

So, after the references let us go to the subject, 'right' what we call is a food, what is it? 'right'. So, normally we call one of the three basic requirements of mankind is the food; three basic requirements means; one is food, another is you should have clothing and another you should have the something over your head that is some room or house, 'right'. These are the three basic needs of human being.

So, the fundamental one is the food, other two if you get fine, if you do not get you are not going to die. But, this one if you do not get for a longer period definitely you are going to either deteriorate or at the end die. So, this is the most fundamental basic requirement of mankind, 'right' it is also regarded as the source of power. So, whatever that I am talking to you, you are listening to me all these required some power. So, who is supplying? This food is supplying all this power. You are working, I am working, I am coming from a place to this place and we will be going out after the classes are over; where from the energy will come? This will come from the food.

So, by and large food we call that who one which normally we take through our mouth, 'right'. Obviously, all the things which we take through our mouth are not food like medicines normally they are not considered at as food though nowadays doctor show that

the patient does not have any impact on that particularly any psychological effect that medicine is being taken. Doctors do say that you take it as your food, do not consider it to be a medicine. So, you see so, food is so I mean required that even medicines are also being said to be the food, ‘right’.

So, that is where, this is of course, medicine is a supplementing your body system, but food is also which is supplementing everything to your body required by the body, ‘right’. So, anything we take through our mouth normally we call it to be food. Of course, that should be that should be in the positive sense means that should be utilized by the body for its betterment, for its maintenance, for its energy requirement, then we call it to be food, ‘right’.

Do not say that somebody is taking some alcohol or some even cigarette smoking, they are not definitely because that is also being consumed through the mouth. But, in the beginning I said that which are helpful for the body, which is required by the body, when we take it through our mouth that is called to be food. I do not say that this is the legal definition. Legal definition can be some on other thing, but this is not the subject where we will highlight on that, ‘right’ we want to give the students some background on the why we should read it. So, that is what we are trying.

So, ‘right’ what does it do? What the food does? It is the source of nutrients and provide the energy required for all activities. For example, growth, then repair of the damaged tissues, reproduction, and sustenance everything. So, everything is being supplied by the food. So, it has multifaceted activities, ‘right’. So, for your growth you remember when you were child or when newborn baby is coming up maybe of this size, ‘right’ and that baby has now become a boy like you or a girl like you, ‘right’. So, that growth of the body is done by the supply of the food.

So, body is supplied this food as required and these foods are and also like a man like me old man like me who is required food why because not only for growth, but also for its maintenance and repair, ‘right’. So, with aging definitely the requirements are also different and that aging process to combat that this food is the basic thing by which it is to be done, ‘right’.

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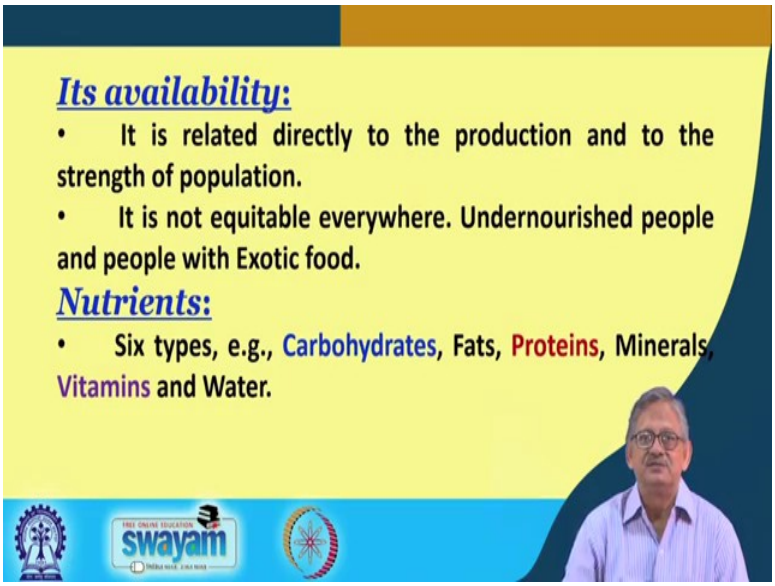

So, we what it does we know then it is availability, where it is available, 'right'. It is related directly to the production and to the strength of the population. Obviously, that says at one part of any the world if a commodity is produced and if the population at that part is very low; that means, consumption is very low then the surplus where it will go? So, that is being supplied throughout the world, 'right'.

So, that is; that means, it is both coming as production and to the strength of the population whereas, a part where a commodity is being produced their food material is being produced whereas, the strength of the population is very high. So, consumption is very high so, it may not be that the production which has been made is sufficient to cater the population there. So, there it may be required that from external sources that food maybe imported or maybe brought for the people, 'right'. So, that is what we said that it is directly related to the production as well as the strength of the population.

It is not equitable everywhere under undernourished people and people with exotic food are also there. Obviously, if you know the world scenario world situation that there are many people who are not able to take two times basic food that you know they are call malnourished or undernourished people, 'right'. Also this is one extreme, the other extreme is also true that people are not able to spend their money. So, lot of exotic foods is being consumed by them and they do also waste many of them. So, these are the two excrements.

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Yes in between are also there. So, all is that it is equitable it is not equitably distributed all over the world. Had it been then the people or mankind would not have any problem, 'right'. So, unless and until and that is why all these politics or all these incidents are happening because of the mal distribution or unequal distribution or non equitable distribution of the food throughout the world to all the mankind, 'right'.

So, what it supplies? It supplies the basic nutrients. There are six basic nutrients we know; one is carbohydrate, then fat, then protein, then mineral, then vitamins and water, 'right' though water as of now is available mostly freely. I do not say all over the world because in many parts where water is not so easily available. So, there it is costly or people have to buy, but places like ours like here the water is freely available, but do not put it aside because this is one of the very basic nutrient required by the body, 'right' you may not be taking food even that are food if you may not be taking a day, but you need to take at least water for the day otherwise; obviously, body will be asking for water more and more. So, that time you will be in trouble.

So, these are the six basic nutrients carbohydrates, fats, proteins, minerals, vitamins and water, 'right'. So, water we cannot keep it absolutely aside.

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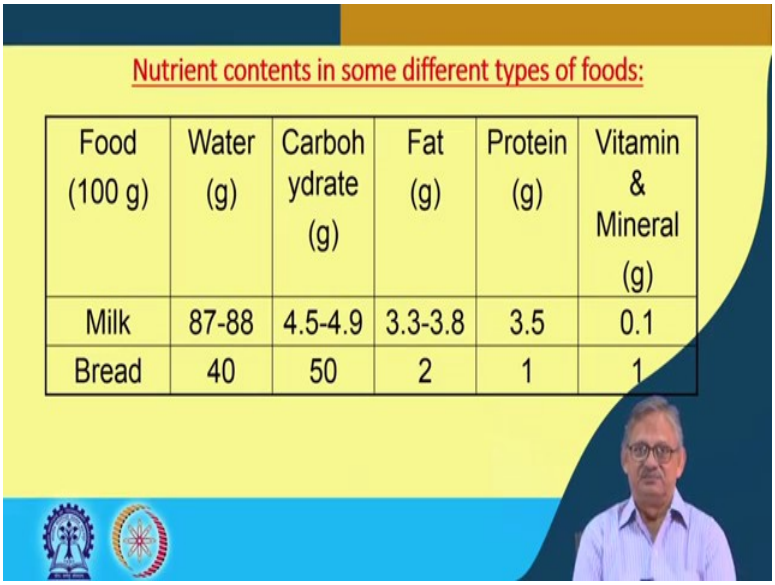

Then what are the nutrients we are about getting. So, from this table we can say that nutrient contents in some different types of foods are like this. For example, if you take hundred gram of edible portion, 'right' milk or bread. These are the two which commonly we use as food if we take them, it the composition is like this. The water content of milk is around 87 to 88 grams per 100 gram whereas, sorry whereas, bread has around 40 grams.

Carbohydrates in milk has around 4.5 to 4.9 on an average whereas, bread has around 50 grams, fat in milk is around 3.3 to 3.8 again on an average depending on different sources of milk etcetera. Different you if you go into the dairy chemistry or dairy section dairy science and technology there you will see it is not; it is not on consolidated to only 3.3 to 3.8, it is it varies very widely. However, so, it is in milk 3.3 to 3.8 whereas, in bread it is very low it is 2 grams per 100 gram and protein is 3.5 grams in milk whereas, in bread it is only 1 gram vitamin and mineral in milk it is roughly 0.1 gram whereas, in bread it is 1 gram.

So, you see depending on the purpose of showing this table is that you have an idea, 'right' overview of what are the nutrients, how much are available from what type of food material. We have given two examples milk and bread and you see that widely varying in all the constituents or nutrients as we have described, 'right'. So, this is an example.

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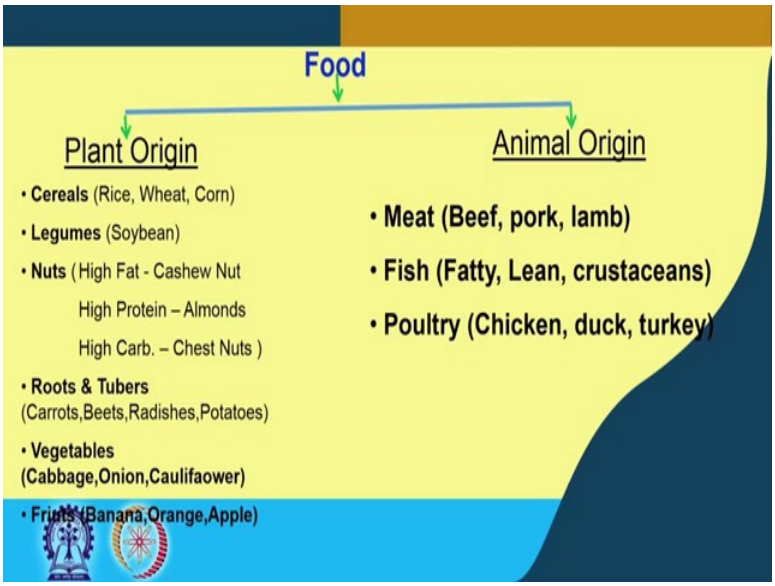

Next we go into that food there are many types normally we categorize I have given all in one because so that the entire thing is before you in the beginning. Food we can; we can; we can demark it as a plant source or animal source. So, if it is plant source then it can be of many very varieties, many types. For example, it is whether cereals example is rice or wheat or corn. If it is legumes then it is whether soybean or others. Nuts – it could be high fat like cashew nut or high protein like almonds or high carbohydrate like chest nuts. So, depending on you how you are selecting your food, 'right'.

Obviously, by the by the side of it let me also tell this that nowadays people are trying to have a balanced diet. It is not that you take lot of carbohydrate you take lot of protein or you take lot of fat, it is not like that. It is a balanced diet so that the diet becomes very balanced and your body gets the required things as and when it is asking for, 'right'.

So, other plant origin things are like if it is root and tubers varieties roots and tuber varieties are carrots or beet or radishes or potatoes there are so many, 'right'. So, these are some examples which come under the roots and tubers varieties then vegetables lot many if you go to the market you will see. Lot many vegetables are there for example, I have given a few cabbage, onion, cauliflower etcetera-etcetera. They are under the variety of vegetables.

Then fruits this is also another very-very big segment of the food supply that is fruits, 'right'. Lot of fruits are available all over the world; maybe something is not available here at other part of the world and maybe something is not available in some other part of the world, but available here. So, like that innumerable fruits are available alright both in terms of; in terms of variety as well as in terms of the quality, 'right' or your choice. For example, we gave banana, orange, apple which are available throughout the world more or less, 'right'. So, these are all from the plant sources according to that you have to select, 'right'.

And then the other thing which is true is that the other source is from the animal source, 'right'. So, I do not distinguish here that vegetarian and non-vegetarian because that is imposed by us 'right' that has been imposed by us. So, vegetarian or non vegetarian it does not mean anything 'right' that is our, but as per as food is concerned yes, basic source is plant origin and another basic source is now animal origin. So, animal origin

that consist of meat like it could be from beef, could be from pork or lamb or many others goat, this, that that, so, many, ‘right’.

That is one variety; second variety could be fish. We again out of that there are many like some are fatty fishes, some are lean fishes, some are crustaceans. So, lot many fishes are available in the market, ‘right’. So, if you go [FL] by this by the by since it has come and it is a general knowledge at list that fish fatty fish means which has high fat and lean which has very low fat that is why they are demarked as fatty or lean fish, ‘right’. Lean fish around 1 to 2 percent fat and fatty fish as high as around 20 percent fat could be generally more than 20 is not so easily available. So, that is why these two examples I have given as fatty and lean fish.

Then, the last part of the animal source is the poultry, ‘right’ and the under this poultry chicken. Yes, chicken is very much that is nurtured or grown in the poultry, then some duck or may be turkeys. So, all these are under the poultry category and these constitute the animal source, ‘right’. It is true, that both are supplying both animal source as well as plant source are supplying all the basic nutrients you need that is carbohydrate, fat, protein, vitamins, minerals and a part of water, ‘right’. The part of water you will see that the plant sources may have water content, ‘right’ from say around 95, 98 percent to even 60, 70 percent or 50 percent, ‘right’ that depends on the typical commodity.

Similarly, in the plant origin also that generally varies somewhere around 60 to 80 percent in terms of water content, ‘right’ and again in the previous table we have shown you that milk and bread the wideness of the availability that we have already shown the similarly that is true for all whether it is animal sources or whether it is from plant sources, ‘right’.

So, with these because the time is a very limited at least for this first class we would like to give you that will continue it in the second class so that some preamble is given something is given, ‘right’; so.

Thank you all.