Course Name: Canning Technology and Value Addition in Seafood
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Lecture:2

A warm greeting to all and welcome to the course on Seafood Canning Technology. Myself, Dr. Abhilash Sasidharan. I am an Assistant Professor at the Department of Fish Processing Technology, Kerala University of Fisheries and Ocean Studies, KUFOS, Kochi. And this course will be dealing with food preservation technology called Canning Technology. As you know, Canning Technology has a wide application in seafood preservation scenario. Since it is applicable to a wide variety of foods, especially seafood, and it has a very huge export potential and wide application regarding the shelf-life stability of the product that we finally get after processing using this technology. The main feature of the products processed using this technology is basically they could be stored at room temperature and the shelf life is almost 1 year.

Welcome to the first session of Seafood Canning Technology. In this session, we will be dealing with the general introduction of the process and the basic concept of the Canning Technology. If you are trying to define this technology, what do you mean by canning? If you take a general definition: canning is a method of food preservation in which food is packed in metal, glass, or plastic containers, sealed airtight, and heated significantly or sufficiently to destroy spoilage, pathogenic, and food poisoning organisms, making the food safe for consumption. This could be considered as a theoretical or textbook definition of the canning process.Each terminology in this definition is very important. So, if you take the terminology canning itself: what do you mean by canning? The term canning itself derived from the concept that a particular metal container or tin canister in the initial days; the container that we used for canning was made of tin-coated steel. So, that particular type of containers was called as canisters or cans. So, putting food inside such cans and processing it was generally called as canning. That is how the entire process of canning got that particular terminology called canning. So, canning is nothing but the process of putting food inside a metal container. But it is also, if you closely watch the definition, another important terminology in that definition is it is a method of food preservation.

Canning is such a technology in which both packaging as well as food preservation technologies emerge. So, not only a packaging technology, it is also a kind of food preservation technique. So, we are preserving food for a longer period of time. So, that is one of the important terminologies, as we previously discussed. It is also packed in a

metal or glass container. So, different kinds of containers are used for enclosing the food in this particular technology.

The different kinds of containers such as metal, glass, or plastic containers are mentioned here. And also, another part of the definition or another keyword in the definition you will see is that it is sealed airtight. This airtight sealing or technologically called hermetic sealing is also very important or integral part of this process. That is another important terminology and another key terminology that we come across in this definition. So, that is also very significant. It is not just heated; it is heated sufficiently.

So, what do you mean by sufficient heating? That is also a very important terminology. In the coming sessions, we will be discussing in detail this particular aspect of sufficient heating. And also, another terminology is to destroying the microorganisms like as the definition also talks about destroying different kinds of spoilage, pathogenic, and food poisoning organisms. So, generally if you call it as microorganisms, the process also destroys such kind of microorganisms. And the last terminology or the most important terminology of this definition is safe for human consumption or safe for consumption.

So, safer consumption means who is using this product, he should not be affected in a negative way by consuming this product. So, the technology should make sure that the final product is safe for human consumption. So, these are the different aspects or different key words that need to be emphasized in this particular definition. So, in this course, we will be approaching this technology in a concept like in a CCP mode. So, what is CCP? It is basically the concept, the container, and the process. So, if you consider the canning technology as a food processing technology, these three aspects are going to be very significant. If you are going to understand or learn this technology, we have to approach this technology by understanding these CCPs, these three terminologies: the concept, the container, and the process. So, let us discuss in this first session, so the container and the process will be dealt with in the following sessions. In this session as an introductory session, we will be dealing with the concept or the first C.

So, what is the concept? The basic concept is that there is going to be a container. The container can be a metal container as we already discussed; it could be glass; it could be flexible containers like plastic containers. Different kinds of containers are there; any container can be used. The important factor is that the container should have the property to withstand high temperatures; that is the main property of the container which is to be used as a canning tool. So, there will be a container and inside the container basically will be enclosing food. Since we are discussing seafood in this session, so we will be dealing mostly with seafood aspects. It could be any food like, as I mentioned earlier, this technology can be used for processing different varieties of foods including vegetables, fruits, other kinds of meat, solid, semi-solid liquid. So, any kind of a wide variety or wide

range of foods could be processed using this canning technology. So, basically there is going to be a container and food will be enclosed in that container.

And the next important aspect is that whatever air which is trapped inside the container will be removed by different methods obviously that we will be discussing in detail; you can make sure that basically a vacuum has to be maintained inside the container. So, if the air is completely removed and we need to maintain vacuum inside the container, the next important point is that the container has to be sealed airtight as we discussed in the definition.

Once we remove the air, the container is sealed airtight. So, nothing could to basically enter again inside the container. So, again if it is like anything else getting inside means air should not penetrate back into the container as well as any kinds of microbes, moisture. So, any kind of media is prevented from re-entering the container. And then what is happening is that this particular container is heated or subjected to temperatures of high elevations.

So, high temperatures are going to be applied. So, there is a reference temperature for this process. So, the reference temperature for this process is around 121.1 degrees Celsius. So, there is a reference temperature. So, like that we will discuss more but any kind of preservation technology is going to have a reference temperature. For example; you may have studied freezing and chilling technology. So, for chilling, the reference temperature is 4 degrees Celsius; for freezing, the reference temperature is around minus 35 degrees Celsius, and storage temperatures are their reference storage temperatures are going to also be there depending upon the type of the technology that we are going to use.

So, in frozen technology, the frozen storage temperatures are going to be minus 80 to minus 20 degree Celsius. And also, as you see that the temperature that we are mentioning that which is the 121.1 degree Celsius is pointed out at the core of the product. So, there is also another significant concept called core temperature. The core point or core is the nothing but the geometrical center of that foot that we are going to process inside a container. So, whatever be our reference temperature, this reference temperature has to reach this core point. Then only we can consider that the process is complete or the process is successful like in many other techniques.

So, the product is basically enclosed within a container and it is heated up to 121.1 degrees Celsius and also at a high pressure of 15 to 20 psi is applied for this process. So, this is basically the entire scenario that is going to happen in Canning Technology. So, a food is enclosed in a container, the air is removed, the container sealed airtight and containers subjected to high temperature and pressure. High temperature means up to 121.1 degrees Celsius to the core and the pressure is up to 15 to 20 psi.

So, why these kinds of applications are done on this particular technology; what is the significance of this high temperature, high pressure, sealing, removal of air etc. So basically, what we are doing is we are making sure proper vacuum is generated inside the container so that there is another aspect called Post Process Spoilage or PPS. So, why we are maintaining this kind of steps in these processes, only purpose is that we need to prevent the post-process spoilage. So, why preserving, why this preservation is important.

So, as you know like seafood is a delicacy and seafood are preferred by millions of people especially in India coastal area seafood is highly sought after. So, seafood is highly nutritious you know. So, as human beings many organisms require this nutrition, nutrition means basic nutritional composition. So, any food material which is rich in protein, rich in carbohydrates, rich in minerals, vitamins etc. This high amount of nutrition in seafood is preferred by a different variety of microorganisms as well as many macroorganisms also like a human being, other microorganisms like birds, animals and also microorganisms such as bacteria and other different kinds of organisms.

So, why we are doing preservation is that we need to make sure that the particular nutritional food source is available only for human consumption. So, any other macroorganisms we can prevent them from accessing the food by creating physical or mechanical barriers, where you can store it in a safe place, you can cover it or you can pack it properly. So, that other kind of macroorganisms cannot approach the food or cannot access the food, only humans are given the access. But in the case of microorganisms this kind of mechanical barriers or physical barriers will not perform. So, as human beings require nutrition, bacteria also require nutrition.

So, these bacteria will also be interested in accessing this nutritious and rich seafood varieties. So, how we will prevent bacteria from accessing this seafood? So, generally like most of the preservation techniques, it's just by creating a hurdle, so that most of the bacteria cannot reach seafood. So, most of the preservation techniques what we do is we are presenting the bacteria with a hurdle, which most of the bacteria cannot jump or cannot cross to reach the food.

So, only a selected bacteria will be able to cross that kind of preservation or processing conditions and those bacteria will be considered as our reference bacteria. So, only those kinds of bacteria we need to deal with which will be able to overcome this hurdle. So, that is the main basic principle behind any preservation technique like drying for example, drying if you are taking drying, what is the hurdle we are presenting to the bacteria or another spoilage conditions are basically the availability of water is restricted. So, water activity is brought down.

So, most of the bacteria as we know the most of the microorganisms require a particular level of water activity. So, that is restricted in drying and for example, freezing the low temperature is basically the hurdle that we are applying. So, many bacteria cannot tolerate this kind of low temperatures, they cannot jump over this hurdle, only a few selected psychrophilic microorganisms can only overcome that particular hurdle. So, temperature as is a very key or very important hurdle that we use in different kinds of preservation techniques.

So, there is a concept of how we are going to preserve, the importance of preservation is that we need to restrict the access of this nutrition or seafood nutrition or seafood to human beings. So, that we can store it for a longer period of time, only human beings are given access to this nutrition. So, all the macroorganisms we can prevent by using proper packaging and storage technique, but in the case of microorganisms, we need to present a particular kind of barriers called hurdles. Hurdles can be different like it can be temperature could be a hurdle, a high temperature can be a hurdle, a low temperature can be a hurdle, a pH; particular pH range can be a hurdle.

Also, the availability of water activity, redox potential and different kinds of hurdles are there, which could be used for different preservation techniques. But in the case of Canning Technology, the hurdle that we use is high temperature. So, as we know, temperature is a very important hurdle that we use in different preservation techniques. Two methods of temperature applications can be used, it could be used generally for food preservation purposes. So, the two varieties or two ways or methods of using this temperature is either you can reduce the temperature or which is called cold temperature or you can increase the temperature which is called hot temperature.

So, cold temperature basically it is called chilled and frozen storage techniques. As you know that in freezing technology, you can study that chilled storage is there for it is around 4 degrees Celsius, frozen technologies around minus 35 degrees Celsius and storage of this chilled and frozen products has to be from 4 to minus 18 degrees Celsius. So, that is about the cold temperature. So, if you are using hot temperature, high temperature in the case of canning, so, the temperature grid is going to be very important.

So, different types of temperatures, what do you mean by temperature actually? Temperature is basically a representation of high temperature, high heat, heat as you know is a form of energy, which could be represented using temperature. So, the temperature is nothing but a unit of heat energy. So, there is going to be high temperature and low temperature. So, if you consider the application of temperature in the case of food processing, if you see the various temperatures that we are going to apply, it could be divided between a zone, the zone temperature is between 5 degrees Celsius and 60 degrees Celsius. These 5 degrees Celsius and 60 degrees Celsius are generally called as danger zones.

Why it is called a danger zone means, this is the temperature range in which most of the microorganisms survives and thrives very well, because this is the ideal temperature range in which microorganisms can feed, multiply and grow. So, this temperature is considered as a danger zone as the food preservation is concerned. So, our basic idea when we are approaching it with any kind of food preservation technique is that, you need to apply or move the food from this danger zone as soon as possible or you need to maintain the food above or below this danger zone, then only it could be prevented from microbial spoiling. So, this danger zone is for high temperature it is above 60 and for shield or forcing technology it is below 5 degrees Celsius. So, why this significance of 60 degrees Celsius?

So, from the range of temperature that is used from 60 degree and above is generally called as thermal processing. So, thermal processing is basically an umbrella terminology that is used to represent different kinds of food preservation techniques that uses high temperatures or elevated temperatures. For example, basic pasteurization techniques are there. Pasteurization what we use is that, generally we use a temperature range below 100 degree Celsius and also normal cooking as you know it is around 100 degree Celsius and normal cooking and blanching is around 100 to 90 degrees Celsius, pasteurization is around below 100 degrees Celsius.

And next one if you go above 100 degrees Celsius, generally the terminology that we use is sterilization process. So, canning or retort post-processing comes under the sterilization process, where the temperature that we use is around 121.1 degree Celsius. And there are also higher temperature applications are there like ultra-high temperature short time processing is there, where we use a temperature range of 135 to 150 degree Celsius. And further going up there are thermal processing techniques like frying and grilling, where the grill temperature is going to be 180 to 200 degrees Celsius. And also, baking processes are there which in we use the temperatures of around 350 degrees Celsius. So, these are the different kinds of elevated temperatures or high temperatures that we apply to make sure that the food is free from microorganisms. And also, especially in the case of thermal processing, our aim is not only preserving the food or making sure that the food is free from microorganisms.

Also, this application of heat to different food renders the food most ideal for the palatability of the human beings. It alters the basic natures of the nutritional components like it denatures the protein, it improves the texture of the food, it improves the flavor of the food, it improves the digestibility of the food. So, these are all the other aspects that is very important while you are selecting a thermal processing technique.

So, what do you mean by application of heat? So, what is the exposure to temperature by food during thermal processing? What are the main changes a particular food is experiencing when is subjected to high temperatures? So, for example, if you are

subjecting a particular food for a basic cooking process, so you are just going to boil some potatoes or you are going to make a fish curry or just boiling fish. So, what happens is; as you know the reference temperature in a normal cooking, which we are going to do in room temperature and normal atmospheric pressure and pressure conditions.

The maximum temperature that we can approach is around 100 degrees Celsius in the case of atmospheric pressure conditions. If you want to move upwards increase the temperature, obviously either you need to change the medium of heating or you need to increase the pressure. So, once we have selected the reference temperature, for example, if you are going to normally cook a particular food, the maximum temperature that the food is going to experience is around 100 degrees Celsius. But as the temperature of the food increases, basically the food is exposed to a series of temperatures until it reaches the reference temperature. What do you mean by food getting exposed to different temperature? For example, there is a temperature range called 60-60, 60 degrees Celsius.

So, these 60 degrees Celsius is going to be very important in the case of thermal processing. Why this 60? Because 60 degree is the temperature at which the denaturation of protein takes place. So, why the protein denaturation is very important means by denaturation of the protein, we get improved digestibility because protein are complex molecules, which are broken down to simpler molecules, so that it could be easily absorbed by the digestive system. And it also improves the palatability by modifying the texture. Texture means by denaturing the protein, basic nature of the protein is changed.

So, some proteins, especially the myofibrillar proteins will show certain textural properties, improved textural properties. So, that is going to be very preferable in the case of different kinds of foods. Improved digestibility, improved palatability, improved color and improved texture, these are the advantages of this kind of protein denaturation that is going to happen when we are subjecting to temperature above 60. So, temperatures above 60 degrees Celsius not only denatures the protein, it also inactivates enzymes and microbes.

There is another advantage of this protein denaturation. There is also another advantage of these 60 degrees Celsius. Because if you increase the temperature above 60 degrees Celsius, all the proteins are denatured or inactivated. So, all the proteins mean also the enzymes that are going to create the enzymatic spoilage and also the microorganisms, the basic DNA, DNA is based on protein. So, the temperature also denatures the basic DNA of the microorganism and it results in the microbial destruction in that particular food.

So, that is the significance of the 60 degrees Celsius. But when you are heating a food, the food does not reach the reference temperature or the 100 degrees Celsius all of a sudden. So, this food has to experience all the temperatures above 60 degrees Celsius, then only the temperature, the core temperature of the food reaches 100 degrees Celsius

from 60 to 100, all the temperature units it has to experience. So, basically what is happening is each temperature point is having a lethal effect on microorganisms.

So, there is another concept that we are introducing which is the lethality of the temperature, lethal effect or lethality of the process. So, each temperature is having a lethal value, a lethal effect on the microorganisms. For example, 60 degrees Celsius is going to have a particular lethal effect and while the 65 is going to have a higher lethal effect than 60 degrees Celsius. Like, once it reaches the reference temperature, if it is normal cooking, our reference temperature is going to be 100 degrees Celsius. If you are going for canning, our reference temperature is going to be 121.1 degree Celsius. So, once the internal temperature of the food reaches that particular reference temperature, it has to experience or it has to go through all the temperature points.

So, why this is important means each temperature as I mentioned earlier is going to have a lethal effect on microorganisms. So, total lethality of a process is basically the sum of lethality of all temperature the food is going to be exposed during the entire process. So, that is going to be the totality of the process, or total lethality of the process. So, it is basically exposing the food to different lethal effects of the different temperatures, the entire range of temperature is going to have an effect on the basic nature of the food and also on the basic nature of the microorganism that are present in inside the food.

Cooking as you know, you can see that different temperatures bring different changes to the food. If you take meat for an example, as the temperature increases, the color of the meat is going to change because of the protein denaturation, the texture of the meat is going to change, the palatability, the flavor of the meat is going to change. So, lot of both desirable and undesirable changes are going to be brought by the temperature into the food. So, when you are applying temperature as a preservation technique or a thermal processing technique or canning as such, the temperature that we are going to apply is basically you know, let us the reference temperature that we are going to use in canning technologies 121.1 degree Celsius. By applying this temperature what we are going to achieve, what is our aim that we are trying to achieve by applying this kind of high temperature.

So, basically, we can define it as 5 m's, what are the 5 m's? The first one is minimum loss of nutrients that is one of the most important targets that we are trying to achieve in thermal processing. So, what do you mean by minimum loss of nutrients? As you know, many nutritional components like especially the vitamins are heat labile, they are sensitive to heat. If you heat a particular food for example, vegetables we are going to cook for a longer period of time, the vitamins are going to reduce the normal number of vitamins in that particular vegetable is going to reduce when it even going to cook. Because vitamins are the most heat labile or heat sensitive of the nutrient that is why the many recommends like you know, you have to eat the vegetables or foods raw without

cooking because the vitamins will get lost. So, in thermal processing we cannot take a chance because we cannot keep it raw, the temperature needs to be this particular reference temperature has to be maintained.

So, we cannot take risk. But we need to make sure that by this particular thermal processing only minimum loss of nutrients happens. So, that is one of the M and another one is minimum or no chance of post process spoilage. So, there has to be no chance of post process spoilage, it should be minimum or nil. So, that is another important point and another one is minimum or no chance of health risk after consumption. We have to make sure that there is minimum or no chance of health risk after consumption of this particular product after heat processing.

And also, we need to make sure that maximum sensory acceptability, the sensory acceptability of the product should be maximum. So, that is very important because even if you make sure that there is minimum loss of nutrients, minimum chance of post process spoilage or minimum chance of health risk after consumption. If you cannot meet the sensory acceptability of the product, the product is not going to be accepted by the consumers and it is going to fail at the market. So, that is not acceptable. So, we need to also make sure that the sensory quality of the product is maximum and by maintaining or by achieving all these 4 M's we can achieve the 5th M which is the 'maximum shelf life at ideal storage temperature' which is room temperature.

There is a most advantage of this particular technology. Products could be preserved at room temperature, we do not need further infrastructure input like for example, if you are considering the frozen or chilled products, we need chilled or frozen storage for keeping the product. Otherwise, the product will come down to normal room temperature, product will get spoiled. So, while different preservation techniques are there, different preservation techniques require different kinds of storage temperature conditions. So, the most important advantage of Canning Technology is that it only requires room temperature for food preservation. So, by achieving this 5 concepts or 5 M's as we discussed before, what is the ultimate goal of this preservation technique? So, as a food technologist we all are striving to achieve basically a balance between 2 concepts which is consumer safety and consumer acceptability.

So, any product that we are going to preserve using any kind of technology; this principle has to be applied which is there should be a balance between consumer safety and consumer acceptability. So, how we are going to achieve this particular balance between consumer safety and consumer acceptability as well as the Canning Technology is concerned. So, to achieving this there is a concept called time-temperature combination. In any kind of thermal processing technique that we are going to use, there is going to be a time temperature combination of the particular process. So, as the name indicates it is

ideal combination of time and temperature that we use to process a particular product.

So, it is important for achieving consumer safety and consumer acceptability. So, how we are going to achieve consumer safety by following this combination? Consumer safety is achieved by preventing reference microorganisms which is spoilage or pathogenic or there are spores, presence of these microorganisms in the food. So, once we use a particular time temperature combination for example, if we are processing a particular food such as sardines, if we are going to can sardines in a particular container. So, the ideal time-temperature combination that we are going to apply is 45 minutes at 121.1 degrees Celsius. So, this is basically the time-temperature combination for that particular product.

How we have arrived at that particular time-temperature combination is that, we make sure that after that particular time-temperature combination, there is no microbiological evidence of the surviving microorganisms or the surviving spores of our reference microorganism. What do you mean by reference microorganism? Reference microorganisms are those microorganisms which can survive the extreme conditions that we are going to present the food in this particular in any kind of preservation technique. For example, in the case of freezing technology it is the psychrophilic microorganisms because those are important, those are the reference microorganisms. Why means they can survive cold temperatures. So, in the case of canning the microorganisms which can survive high temperature, vacuum- this is absence of oxygen.

So, the condition that is going to prevail in that particular process is very important when we are going to identify the reference microorganisms. So, the conditions it is present in canning or canned food product is basically high temperature that as we told the reference temperature is around 121.1 degrees Celsius and there is going to be high pressures of around 15 to 20 PSI and also vacuum is going to be there inside the container. So, since there is vacuum means the microorganism if you take all these parameters one by one. So, we can find out that which is the kind of reference microorganism or which kind of microorganism is going to survive these conditions.

For example, if you take high temperature itself. So, in the canning technology the temperature that we are going to use is 121.1 degrees Celsius. So, it is a high temperature. So, what kind of microorganisms can survive those temperatures. So, as you know only mesophilic or thermophilic microorganisms can survive such temperature conditions.

So, you can make sure that only mesophilic or thermophilic microorganisms will be present after the processing. So, even after canning, those microorganisms have a chance of surviving this condition. So, those are the microorganisms that we need to zero in on. And what is another condition? Another condition is the presence of vacuum or absence

of oxygen or absence of air. So, we can make sure that only anaerobic or facultatively anaerobic microorganisms can survive.

So, the microorganism needs to be not only mesophilic or thermophilic, it also needs to be anaerobic or facultatively anaerobic. So, like this way we can zero in on different microorganisms. So, in the case of Canning Technology, there are two microorganisms. Another two classifications are that either it could be a reference spoilage microorganism or it could be a reference pathogenic or toxin-producing microorganism. Why this classification is important means, so spoilage microorganisms create only a basic spoilage in the particular food because the spoilage microorganism will not render the food unsafe to the consumer.

That is one point. It will definitely spoil the food and it will become less popular among the consumer. The consumer acceptability is going to fall, but it will not cause any harm even if the consumer consumes that particular product if a spoilage microorganism is present in that food. But in the case of pathogenic or toxin-producing microorganisms, if such microorganisms survive in a particular food, if a consumer consumes such food, there is a huge health risk attached to it.

So, consumer even fatality can happen. So, that is a different scenario. That is why there are two classifications in the case of reference microorganisms. One is reference spoilage microorganism and another one is reference pathogenic microorganism. So, basically assuring consumer safety means we need to make sure that both spoilage as well as pathogenic or toxin-producing reference microorganism or their spores are not present in the final product. That is one way of making sure that it is consumer safe.

And how we will make sure that consumer acceptability is there. So, consumer acceptability we are making sure by finding out that only minimal nutritional loss is happening and maximum sensory properties are there. This nutritional loss can be found by nutritional analysis and the sensory characteristics can be found by sensory evaluation. So, using these technologies we can make sure that a particular time-temperature combination at the same time it is safe for the consumer and also it is acceptable for the consumer. So, following this parameter, so following this particular time-temperature combination protocol, we can make sure that a particular product is balanced between consumer safety and consumer acceptability.

So, if you see the entire process of canning, the first process is basically the container. The container is going to be the first point in the case of the process. So, there is going to be a container and inside the container the food is going to be enclosed, and the container has to be sealed. After sealing, the container is subjected to thermal processing. And then after the container has been subjected to thermal processing, it has to be cooled. Why this cooled means we cannot indefinitely maintain the temperature that is why the time-

temperature combination becomes important at this particular point. So, there is a particular time-temperature combination for a particular product. For only that particular time-temperature combination, the product is going to be held at that particular reference temperature.

Then after that time-temperature combination is over, we need to cool the temperature to room temperature. So, there is the entire process of canning. During the entire process of canning, the temperature is going to increase and decrease as we have discussed before. The food is going to experience a range of temperature from 60 to 60. So, there is going to be an increase in temperature and decrease in temperature, and over the period of time, the rate of chemical reactions will decrease and the rate of the inactivation of microorganisms will increase. These are the different changes that are going to happen to the food when we are subjecting it to canning.

So, what are basically the advantages of canning Technology? We have discussed the concept of canning, then what are the advantages? So, the main advantages are that canned products are safe and will not cause any ill health or allergy to the consumer, etc. So, it is completely safe. As we mentioned before, by maintaining or by following the time-temperature combination protocol, we are making sure that the canned product is safe for human consumption. So, canned products are safe and will not cause any ill health or allergy to the consumer. Another advantage is that canned products are ready-to-serve products and hence are instantly available for consumption with little or no further preparation for the table.

That means it is ready-to-eat products. So, Canning Technology is used to produce food products which are Ready To Eat, generally we call it RTE products or MRE products - Meals Ready to Eat. So, by opening the container, the consumer can consume directly either directly from the container or it can be transferred to another container and they can consume from that container. So, no or minimum type of cooking is required. It is like a meal on the go; you can grab a container and while you are traveling you can eat it directly from the container.

So, it is a ready-to-eat product. Another important property of the canned product is that canned products could be made available at any place at any time. As the shelf life of the canned products is room temperature, it can be easily stored and transported by different transportation media to different places. This significantly affects the transportation and storage cost of the food products because only room temperature shelving is required for this particular product. So, it could be made available at any places because in a particular area, particular seasonal food is available in a particular country and that particular canned product can be transported to another place where the particular product is not available.

It can also be stored for many years. So, there is also a particular advantage of the canned product. Another important property of the canned product is that canned products do not require special storage facilities such as cold storage facility, ordinary room temperature storage is sufficient that we have already discussed. And another property is that as inedible portions of the foodstuffs are removed it represents concentrated form of food because in canned products there is no wastage. So, 100% of whatever you are going to can is edible because all the unwanted or non-edible parts are removed and this basically canned products are basically a kind of concentrated food product. So, there is no wastage.

Another advantage is that canned food has a long shelf life measured in years not in weeks or months. Even though technically we determine the shelf life of canned products as one year, it could be stored for many years basically because there have been particular containers which have been recovered after hundreds of years and still whatever contents inside the containers are in edible condition. And another most important property of the canned products is that a wide range of food products can be preserved. Not only seafood, different varieties of food products can be preserved using this particular technology. These are the basic advantages of Canning Technology. Thank you.