

Course Name: Canning Technology and Value Addition in Seafood

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Week:5

Lecture:15

Process of seafood canning- P1

In today's session, we will be discussing about canning procedure for various seafood products. Under this session we will be discussing about step-by-step process, variations that can be seen in item wise canning of different seafoods. We will also see what are the different types of seafoods that can be used for canning and the pre-processing methods that are generally employed before processing the products, what are the different pre-processing methods that can be adopted and what are the different additives that are added to the seafoods during canning process.

Coming to the first step of the process, this is a general step and it is same for almost all the products whether it is fruits or vegetables or fish or meat. So, the first step includes raw material reception. After receiving the product, it is prepared for canning. The raw material is prepared either it can be if it is fruits or vegetables it needs to be cleaned, the unwanted parts, dirt, everything need to be removed. If it is fish again the de-gutting or de-heading need to be done. It's again cleaning process and also in the same way the meat also the cleaning process. That's the preparation part where the raw material is prepared for the further steps and it includes all the basic steps. Then after preparation of the raw material, the product or the raw material will be canned or it will be filled in the can or in the bottle if it is juice or beverage it is filled in the bottle and after adding the product samples in the can, it is covered with a liquid that can be brine or oil or it can also be sauces. We find sardines with tomato sauce. So, we can use tomato sauce also. After adding the liquid, the enclosed air or the trapped air inside the can is removed by exhausting and after that, the cans are sealed and the walls or anything which is sticking to the wall or adhering to the wall is removed by washing and wiping out and drying it and then it is subjected to sterilization or pasteurization and then it is cooled. This step is very important because mainly we are concentrating on killing the bacteria during sterilization or pasteurization. So, cooling helps in giving a cold shock and thereby the

microbes does not grow and after cooling it is dried again and then labeled and it is palleting or it is stacked and then stored for a period of time during which it is checked that no microbes are growing and only after that it is marketed. So, these are the general steps and also cans need to be received and we need to get a certification from the suppliers that cans are proper and they meet the requirements and these cans need to be washed and it need to be prepared for the process so that also has to be done simultaneously.

The major types of fish that used for canning are tuna, sardine, salmon, mackerel, cod, anchovies and herrings. In the case of tuna, we find albacore, skipjack, yellowfin and big guy you will find their scientific names along with the common names.

In case of tuna, the raw materials are received; generally, the fish are caught in bulk. So, they cannot be kept as such and they need to be frozen. The frozen material reaches the plant for the processing of a canning process. So, when it reaches to the plant, it has to be thawed out and thawing need to be done properly and there should not be any direct contact between the water and the food product. So, after thawing it is de-headed and the gut content is removed so that further microbial contaminations can be prevented after de-heading and de-gutting, it is washed and it is bled so that any traces of blood is there it can be removed and then it is cooked or baked and only after baking the skin and other parts are removed because the skin is bit thicker for the tuna. It can be removed easily after baking followed by removal of the fins and other parts of the skins. After that, it is sectioned or it is cut into small pieces and as per the requirement it can be converted to different forms. You can also make it into flakes and then it is filled in the can and it is pressed and then the can is filled and it can be brined or it can be oiled and after that it is subjected to exhausting, sterilization and after sterilization the cans need to be cooled and labeled and it needs to be stored before it is being marketed.

After thawing and butchering process, tuna is cooked using atmospheric steam and it is generally done at 100 to 102 °C. This is the baking condition and this helps in removing the skin easily and also the cooking conditions or cooking temperatures vary along the length of the or backbone of the fish. So, it is like 50 to 70°C variations can be seen this along the length of the fish and also it takes time for the temperature to reach to the hardest or the thickest portion. So, that also need to be taken care of while canning the

tuna. There are various styles in which it can be packed; one is a solid pack and it consists of usually cutting the tuna either by sides i.e., it is cut into loins just like the higher animals; it is also labeled as loins and here in the solid pack the loins are cut into transverse segments and it is placed in the can and you don't place any segment parallel to this thing. So, it is just filling the can. The solid contents are packed in the vertical position and there are no parallel segments are kept and in the chunks tile 50% is the chunk at half inch size smaller flakes can be added along the chunk but the major part will be chunk that is 50% will be the chunk portion and in the grated tile the sizes are much smaller. It is like half inch or less than half inch and these are packed but we need to be careful that it doesn't become paste when we do the sterilization so that can it to be taken again the next style is flakes and flakes again it is smaller chunks which are obtained during grating and usually the filling media is oil vegetable oil or brine and the most common defect that can be observed in the tuna is green meat formation that is because we are using the low quality products for the canning. If you are going for a fresh sample of fresh fish, we can avoid green coloring.

Here, we can see the CCPs in case of canning. Four CCPs are there. The first one is at the reception. We have to check whether it is meeting the critical limits like if we are bringing the frozen fish, then the temperature should be below 18 °C and if you are going to use fresh fish then it should be in the chilled conditions and also the histamine content should be below 50 ppm and mercury should be within the limits it should be below 0.8 ppm. Also, can is another requirement which is received. Can specifications also need to be assured and we need to get certifications from the supplier if any of these things these requirements or critical limits are not met, then immediately the supplier needs to be informed and we have to reject the sample or the material. This can be done by monitoring the thing and corrective actions may be taken wherever it is required and similarly we have to check the presence of metals and that also need to be removed and occasionally metal detectors need to be cleaned so that any defect is there in the machinery that can be averted or can be removed.

Heat processing is most critical here and because this is a heat processed cooked product which can be consumed as such; it is not necessary that we have to recook it. So, when we do heat processing targeting the botulinum bacteria and the critical limits for

botulinum should be checked and we should see that it is meeting the requirements and all the time temperature relationship or it has to be maintained thoroughly and then next or the last CCP here is cooling and drying. This is because we are using water. So, water can transmit microbes to the container and or to the surface of the container so that can be prevented by using portable water or by checking the chlorine content so the critical limit here being set for chlorine is 0.5 milligram per liter so regular intervals these things need to be checked by the technologist or the designated person and is not meeting the limit then actions need to be taken accordingly. So, these are the four CCPs in the tuna canning process and these are the international standard for tuna canned in oil and it was published in 1967. Accordingly, heavy metals like arsenic, lead and copper; the limits were set for this and that is 11 ppm for arsenic and lead it is 10 ppm, copper 100 ppm and zinc and tin it is 50 and 250 ppm respectively. Mercury should be 0.5 ppm and microbiological activity should meet the requirements and histamine content should be below or around 20 ppm. Preferably it should be below 20 ppm because tuna belongs to scombroid a family and histamine poisoning is very significant. Also, very important thing that need to be considered and it comes generally from the scombroid fishes histamine content is more. Once, histamine formation has happened, it indicates the spoilage of the product. So, this also has to be checked and is not within limits then immediately the material has to be returned.

Coming to the next fish sardine or mackerel, here we can see in sardine category, we have Atlantic herring then Peruvian anchovy and we also have Indian oil sardine. Indian oil sardine it is rich in oil that's why it is called oil sardine. In the case of mackerel, we find chub or Pacific mackerel, Spanish mackerel, Atlantic mackerel and Indian mackerel. So, these are the different types of sardine and mackerel that are used for canning. The protocol for canning of sardine at the raw material again it can be in the frozen form. If it is in the frozen form then it needs to be thawed. If it is in the fresh form, we can go directly to the washing and cleaning and we do the weighing to know the yield after cleaning and other processes. Since, sardine contains scales, it needs to be removed and that is the descaling process and after descaling, we go for nobbing. It's the process where to remove the head and the gut region together. So, after nobbing, the size cutting and it is reduced to the required size. So, after nobbing, the fish is cut into small pieces

followed by filling into can. In the can, when you are filling the can we give a headspace and headspace is given to maintain the vacuum during canning. When we cut the pieces, it should not cover the entire height of the can. So, it should be slightly below the can and the liquid should cover the contents because if it is not covering then it will cause retort burn in the later stages also, we need to give the headspace. So, considering these two things, the size of the product needs to be adjusted accordingly. After cutting to the required length, it is washed again and then weighed and brining is done. During the brining process, it is immersed into the saturated salt solution for 8 to 10 minutes because it removes the unwanted slime or blood stains that are attached to it and that will be washed off during brining and it will also improve the textural properties of the product. After brining, it is again washed to remove if adhering any extra salt on the surface and that will be removed during washing and then it is pre-cooked at 100 degrees centigrade in steam for 30 minutes and then it is filled in the can. We do the hot filling into the oil in hot state is filled into the can. Brine can also be used for filling the can. Once we have completed the filling, it is seamed and then we go for exhausting, retorting and then it is cooled. When we bring the temperature down, it should not be slow cooling and it should immediately be brought down to 37 to 38 degrees centigrade. So, immediately after retorting, cooling should be done immediately and once the cooling has completed the can surface should be dried thoroughly and it should be labeled and stored. The drying is important because any droplets of water on the surface of can it will cause rusting or spoilages on the surface of the scan. That's why we go for drying and labeling is also done to understand what has been packed and when it has been done. To know all these things, the labels are put and then we are storing it in the storage room.

Next is the protocol for mackerel canning. Here, we get the fresh fish as it is whole and if it is in the frozen form it needs to be thawed and if it is in the fresh form then it needs to be washed. This is done to remove the adhering dirt or unwanted slime or any material which is attached to the surface so that need to be removed again since mackerel does not contain scales, we don't have to do descaling. We can directly go for dressing where we remove the fins and other things, we can also remove the head and belly region or the gut contents and then wash it thoroughly to remove the bloodstains. Again, cut into two small pieces according to the requirement of the can then wash it again and then we do subject

it to brining again it just like the brining process in the sardine. Here also, mackerel pieces are soaked into the saturated brine for 8 to 10 minutes and this helps in removing the curdling formation because mackerel it contains soluble proteins and they aggregate when they are reacting with the brining. So, if you are not doing this brining process, instead of this directly going for canning this curd formation it will stick the internal surface of the container and which will cause spoilage or rusting of the can in the later stage. Therefore, we need to remove the soluble proteins before we go for canning then it is again dipping after finishing the brining it has to be dipped in fresh water to remove the excess salt and it has to be packed in the can again, we add dry salt or we can add other filling materials like oil or we can also go for brine and then seam it just like other protocols, we can also go for retorting, cooling drying, labeling and storage. So, its related part is almost similar to the other protocols.

Canning of sardine or sardine like fish it is either done by Mediterranean method that is raw pack method or Norwegian method that is hot smoking method. So, these two methods can be done. In the Mediterranean method, the fish is washed first in the brine and next is the procedure is nobbing where we remove the head and the gut content. So, usually in the Mediterranean method, it is achieved mechanically. After nobbing, again it is brined; it is put in the brine and then it is packed in the can and cooked at 100 degrees centigrade at normal atmospheric pressure using steam and a pre-cooking is done usually for 15 to 30 minutes and then it is cut into small pieces. After pre-cooking, the cans are inverted to drain the liquor that comprises of fat and water. The liquid part is removed. In the Norwegian method, after nobbing and brining, both methods are similar to the Mediterranean method, it is hot smoked and dried. Smoking is done at 80 degrees centigrade for 2 hours. This gives additional flavor to the product. The smoke flavor also depends upon the kind of wood being used for smoking purpose. The smoke gets deposited on the surface of the fish and it improves the flavor of the product. After smoking, it is packed into the can and filling media like brine or vegetable oil are added and then we go for the retorting. So, in this case the CCPs are receiving of raw material then container closure, sterilization, cooling of the sterile cans and storage. So, these are the five CCPs and again in the raw material part we need to be careful regarding what kind of material we are collecting. Also, we need to see that the histamine is within limits

like how we discussed it in the tuna. If it is not within limits it needs to be returned for the fresh fish. The chilling and the temperature should be below 6 degrees centigrade and also the histamine content should be below 50 ppm again in the container closure we have to be careful we have to get guarantee from the supplier the containers are good and also, we have to check whether it is leak proof, the seams are perfect or not that need to be checked. Again, the sterilization temperatures; what is the temperature for every container based on the kind of container, the sterilization conditions will change. So, we have to follow the standardized methods and that need to be checked and monitored regularly also the cooling conditions. The potable water needs to be used, also the chlorine content needs to be checked; it should be 1 ppm and then stacking of the cans; it should be done at 40 degrees centigrade. So, all these things need to be checked monitored it need to be verified regularly and if any error is there it need to be corrected. The corrective actions need to be recorded and this is the international standard for sardine and again you can see for sardine and mackerel the international standards are same the limits are being same and for mercury it is 0.5 ppm zinc 50 ppm, copper 10 ppm, arsenic 1 ppm and lead 1 ppm. So, these are the heavy metals. Then the microbiological requirement, it should be commercially sterile and these are the international standards laid in 2001 for sardine and mackerel. So, these are the standards for mackerel and the standards are same for sardine this is an international standard you can see on the top the numbers the code is given and this standard was laid in 2001 for both sardine and mackerel.