

Course Name: Canning Technology and Value Addition in Seafood

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Week: 1

Lecture:3

History of canning technology - Part 1

Welcome to the second session of Seafood Canning Technology. In this session, we will be dealing with the history of canning, particularly how this technology evolved over the years. Canning Technology has around more than 100 years of evolutionary history. We will be discussing different kinds of interventions, inventions, and developments that happened during each stage of historical significance. To understand the history of a particular technology, we need to have an idea regarding what was actually happening before the invention of this technology. Before that, we had fewer options even though the surplus production of seafood was there.

There were not sufficient technologies available to continue or maintain the freshness of the seafood. Seafood is a very perishable product, and it is very difficult to maintain the quality for a longer period of time. In order to store the surplus production of seafood at those periods of time, the technologies we had were actually adopted from natural scenarios or natural conditions like drying, salting, smoking, and pickling; those kinds of methods. The products subjected to these processes at that particular period of time were not in much consumer demand. If you take the example of drying itself, in dried fish, we remove the moisture content of the fish. When we remove the moisture content of the fish, it brings out an array of changes to the food, particularly the fish muscle: the color of the fish may change, the biochemical composition may be altered, and even the texture and smell of the fish change. So, from a pleasant form of seafood, sometimes if we are not careful enough in hygienically handling the fish during drying, it may lead to an unpleasant product. Such preservation methods, even though they existed during that period, were not finely tuned or hygienically standardized to ensure a more consistent quality and consumer acceptability. It was not there at that particular time.

The dried products were not in much demand, and similarly, in the case of cured products like salting, drying, and smoking, which were also practiced at that time, there were certain unacceptabilities among consumers. Smoking impregnates the food with the phenolic components in the smoke, adding a particular smoky flavor to the fish. This alters the color, taste, and other characteristics of the fish, limiting demand during that period. Another method heavily in practice was pickling processes.

But pickling also alters the food because it contains a high concentration of acid. It is an acidic product, so that also changes the taste, texture, and overall consumption experience

for consumers. All these preservation techniques existing at that time lacked consumer acceptability. So, the industry demanded new preservation techniques to overcome these limitations. The major intervention regarding the invention of canning occurred during the period of Napoleon Bonaparte, who lived between 1761 and 1821.

During his era, it was actually the pre-industrialization era. So, during that period, the world was filled with warlike situations, with many countries at war with each other. War or similar activities were of utmost importance, handling the social scenarios or situations at that time. Such warlike aggressions were common then. The issue with war is that it involves soldiers who are a major integral part at that time, and soldiers were crucial to winning a war.

Soldiers, meaning people who need to travel away from their normal habitat, had to carry food with them because there was a saying that an army marches on its stomach. What it means is that if you do not feed your army with healthy and nutritious food, it will affect the performance of the cavalry. During that time, the food the army could take was either in the form of dry, dehydrated form, smoked, cured, or pickled. There were not many options available, and freezing technology evolved much later. However, freezing required costly machinery and considerable infrastructure to maintain the quality of the frozen product. But even then, it was mainly in war situations or for soldiers.

Frozen products are still not preferred. In that particular period of time, Napoleon encountered such problems because scurvy was a common nutritional disease, especially among navy personnel who fought at sea. Naval soldiers faced many issues because they were far from land and at sea for days. The particular amount of food they could carry would spoil within weeks, and the problem with consuming dehydrated, pickled, or smoked food is that they are high in salt content. Consuming them in large quantities could lead to health conditions. Napoleon addressed this issue when he found out that the performance of his soldiers was significantly affected by the non-availability of fresh food. He announced in 1795, '12,000 francs and fame,' offering a reward to anyone who could develop a technology to enable his soldiers to carry fresh or nutritious food without it spoiling in the battlefields.

This was Napoleon Bonaparte's announcement in 1795. Napoleon triggered a series of invention efforts by many scientists and individuals at that time. The 12,000 francs was a significant amount then. Many people started working on that challenge, and the person who first responded to that challenge with a significant solution was Nicolas Appert. He lived between 1749-1841. Nicolas Appert is still considered the father of Canning Technology because he came up with a technique. But the history of that technique is also significant because the concept of heating to preserve food for a longer period of time was already known during the 14th and 15th centuries, especially in China and

Japan. Even at that time, there was knowledge in society that the process of heating could extend the shelf life of a product, though the understanding of the actual process was limited.

During the 17th century, many Italian scientists and confectioners worked on heating food in a container and sealing it. The concept of heating and sealing food in a container was already present. Nicolas Appert took that hypothesis and developed it into a practically applicable method. He used glass jars to heat and seal whatever food needed to be preserved. He found that if you heat something in a container and seal it properly, the food can be stored for a longer period of time.

That was his invention. What Nicolas Appert did was that the technique was perfected in his laboratory and he experimented with a number of foods by using the same process like he was heating it in a container and sealing it and he developed heating methods of around 50 different kinds of food products and he published a book actually in 1811 after getting the reward the technology was presented to Napoleon Bonaparte and he won the reward and after that in 1810 he accomplished this and in 1811 he brought out a book actually called as the art of preserving animal and vegetable substances that was the French meaning of the title of the book and in that particular book he mentioned around 50 how you should be doing this process, how heating and sealing of this containers need to be practiced and this book was very popular and later, it was translated into English and it was popular in US also. The US version of this book was titled as 'The book for all households'. This book contained elaborate techniques or processes which needs to be followed while producing a product using his technology and the actual container that is used by Nicolas Apert is a wide mouth glass jar for his process and he used normal cork for closing the container. Significance of his work if you read the book, you will understand that he already knew many of the basic principles that we still practice regarding the Canning Technology.

But he didn't know the mechanism behind those processes but all the concepts or all the basic principles he understood. For example, he mentioned that the fire has the peculiar property. The terminology that he uses that fire has the peculiar property not only for changing the combination of the constituent parts of vegetable and animal productions but also of retarding for many years at least if not of destroying the natural tendency of those same productions to decomposition. So, these were the observations made by him. But the significant part is, from this statement, we need to understand is that fire has the peculiar property.

He understood that the material that we are going to heat and the way we are going to heat or the fire that we are using it has a peculiar property for imparting certain characteristics to the food. He understood the importance of heating; that is one of the

important points still we practice when we are sanitizing canned products. Another statement is that application of fire in a manner. He knew the significance of application of heat but he also understood the way the heat needs to be applied. Any kind of heating will not give you the desired results; that is also understood in canning.

What kind of heating medium you should be using and what kind of heating; whether it should be a direct flame or indirect flame; a direct heating indirect heating; these concepts are now widely discussed when we are sanitizing a product. But the interesting part is that during the intervention of this technology; Nikolas Appert understood the fact about how the fire needs to be applied. He is also mentioning that before I state the details of my process, I have to observe that it's going to consist principally. What are the principles he required? He wanted the people who follow his technology to observe when applying these techniques So, he also mentions about enclosing in bottles; the substances to be preserved. So, the heating is one important part and enclosing it in a bottle is also.

The packaging part of the technologies also was well understood by Nikolas Appert and also, he talks about corking the bottles with the utmost care and chiefly on the corking that the success of the process depends. He is stating that the success of the Canning Technology or success of the canning process depends on properly closing the container. Closing the container lid at particular appropriate point of time and in an appropriate manner was very significant for the success of this process. So, this is still followed. The can closing process or the closing of the container process; now we use sophisticated techniques to close it successfully so that we will get an air tight seal.

But at that period of time, the only option available was for applying a cork in the opening of the container. But still he understood the fact that it was highly significant to close the container properly and also another significant method he observed is that the use of water bath. He did not use the direct heating or direct flame. He heated water and the heat of the water was in turn used to heat the bottle. So, he basically used a water bath.

Greater or less length of time so that is another observation he made. He understood that for different food products, we need either a more heating time or lesser heating time. Basically, the concept of time- temperature combination that we follow when we are applying Canning Technology in these times was understood by Nikolas Appert, hundreds of years before when he invented the technique. All the basic principles which are still relevant to this technology was completely understood by Nikolas Appert but and he specifically mentions it in his book so that is also a very interesting point and also finally he makes sure withdrawing the bottles from the water bath at the periods prescribed. That also is mentioned by Nikolas Appert.

Why this withdrawing of the bottles because, he understood that we need to remove the heat source from the bottle after it has been sufficiently cooked for a particular period of time because if you don't remove the bottle, you will basically overcook the product. So, he understood that withdrawing he used the terminology like withdrawing the bottles from the water bath at the period prescribed. For each product there was a time period prescribed by him in which you need to remove the bottle from the heat source. So, all the heating and cooling cycles the time-temperature combinations, the process, the importance of can closing or the bottle container closing was well understood by him and he specifically explains significance of all these processes in his book. When we proceed from Nikolas Appert, the next significant contribution is made by Peter Durand during his lifetime.

The period he lived was 1766 to 1822, Peter Durand is a very significant name when we consider about the Canning Technology as such. When we consider Nikolas Appert as the father of the Canning Technology; we should consider Peter Durand as the father of Industrial Canning because, he revolutionized the industrial process of canning. Why means he got the first patent for the idea of preserving the food using a tin can. He introduced the concept of applying the metal containers or tin coated steel containers which could be used for canning. As you know, Nikola Appert did all his experiments in glass bottles.

At this particular period of time, the manufacture of glass bottles was very costly and still the glass containers are a premium kind of packaging products. That time also it was very costly and it was very difficult to handle, difficult to transport, it was brittle. So, a lot of issues were there with glass containers. So as Peter Durant introduced the metal containers for this canning. He got the patent granted to him in 1810 itself by King George III of the England.

He was granted the first UK patent for using metal containers for canning. That was a very significant intervention. Later what Peter Durant did for popularizing his technology or popularizing his patent was that he sold patent to two gentlemen; one was Robert Ayars in USA during 1812 and another one was Bryan Donkin of UK during 1812. These two gentlemen, what they did was the patent was purchased from Peter Durand and they went to UK and USA and established their first industrial canning factories in those places.

That was a very significant step. The first industrial facility in UK and USA was created by Mr. Bryan Donkin and Robert Ayars. That is a very significant achievement when we consider the history of the canning. But the issue with the canning at that particular period of time is that metal container can be used but the issue with the tin coated steel containers was that it was all handmade at that particular period of time. The ironsmiths have to be working on making of the container and only a few containers could be made

in an hour to one container one or two containers per hour or something like that.

When it was tediously constructed by ironsmiths. They need to cut the metal containers; they need to bend the sheets and make it into can shapes. That was a very tedious process. A significant intervention happened in 1846 when Henry Evans who developed prefabricated dice to increase the production speeds tenfold because he invented prefabricated dice to cut the different parts of the container. So, the issue before the measurement was it should be hand cut, we need to draw certain specific measurements over the metal sheet and that needs to be specifically cut by hand by the ironsmith. The Henry Evans, what he did was specific cutting dice he developed.

So, at a go they can immediately cut the required measured metal plates easily so that actually accelerated the speed of the production of metal containers and also in 1847 Allan Taylor patents a machine for stamping cylindrical can. Henry Evans actually developed prefabricated metal dice for cutting the sheets. Allan Taylor what he did was that he patents a machine or he invents a machine for standing cylindrical can ends. The ends of the can need to be stamped so that the lids need to be fitted perfectly that was also a very tedious process so he improved that process also in 1849, Henry Evans is granted the patent for the pendulum press. Another significant is pendulum press which combined with a die device makes a can and in a single operation.

He developed a pendulum press because the cans could be easily stamped from metal sheets. This invention by Henry Evans and Allan Taylor and further by Henry Evans in 1849 all this accelerated the container making process that significantly affected the industrial way because of the stamping machine or pendulum press actually the production rate of canning was around five to six cans per hour. During that period of time, by the invention of Henry Evans, the production increased up to 50 to 60 per hour. For information, now the can making process is around 2000 cans per minute. So just imagine that up to that level now the technology is developed.

Now the production capacity is around 2000 cans per minute but at that particular period of time it was only five to six cans per hour so then it increased to 50 to 60 per hour and then further as the technology improved the number of cans produced during a particular period of time increased. Another significant issue the containers at that particular point of time was the difficulty to open that container since the metal containers were used at that particular point of time, we need to use different kinds of tools for opening the container like a hammer or a chisel or something like that. So, it was a very laborious process at that particular point. So, the major invention in this direction was made by Ezra J Warner in 1858 in US.

What he did was he patents the first can opener. So, he invented the first can opener which could be easily used by the consumer to open the metal container. This was

heavily used by the US military during the civil war at that particular period during the 1850s and also other than can openers there was a significant intervention in 1858 which was done by John L. Mason he patents the Mason's jar. The Mason's jar is a significant intervention because during that period of time the glass containers as I said that the only way to close the glass container was using by cork the corking process. So, it was very unhygienic and it was a very difficult process and difficult to open after corking John L.

Mason did was that how to fit a screw cap on a glass container. He made specific grooves to the opening of the glass container and to which a metal or any other form of lid can be rotated and fitted into that place. So, the screw cap was introduced into the glass container by John L. Mason that actually revolutionized the home canning industry or home canning process. So, the normal consumers could buy this kind of Mason jars further use it for home canning purposes so that was a very significant intervention.

Thank you