Course Name: Canning Technology and Value Addition in Seafood
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SOP for seafood canning P3

Welcome back to the NPTEL course Canning Technology and Value Addition of Seafood. In today's session we will be continuing with the standard operating procedures for seafood canning and we will be discussing about different national standards and international standards. In the previous class, we had discussed about GMPs, SOPs and SSOPs and we had started with the HACCP. We had seen different terms and their definitions and how these are important in the HACCP plan and in today's class we will be starting with the different HACCP steps and different principles. So, all together we have 12 steps and 7 principles and let's see one by one in detail.

First, we have to conduct a hazard analysis. Understand the different hazards - biological, physical, or chemical. Determine the CCPs, identify critical points, set a critical control point, and establish a critical limit. Once the critical limit is set, monitor it regularly to ensure it does not deviate. If deviation occurs, take corrective actions, find solutions, and verify the effectiveness of the corrective actions. Record and document all activities in the plant.

These seven principles are crucial, and before implementing HACCP, assemble a team to oversee it. The HACCP team should consist of members from various departments such as quality, production, and laboratory. Consider the product, like canned sardines in oil, describe its details, intended use, and construct a flow chart.

Specify the exact steps for canning the product, including byproducts and additional ingredients at each step. Clearly define and detail these aspects. Verify the flow chart on-site, as it may be prepared in an office but needs validation at the production site. The team must visit the production site to ensure that the steps outlined in the flow chart are precisely followed.

So, everything has to follow the same HACCP principles. If this (Fig.1) is the flow chart for canned sardine in oil, and let's say the critical point is sterilization, we need to develop a decision tree - a critical control point decision tree. Ask questions at each step. The first question is, do preventive measures exist for the hazard? If yes, proceed to the next step. Prepare a CCP accordingly.

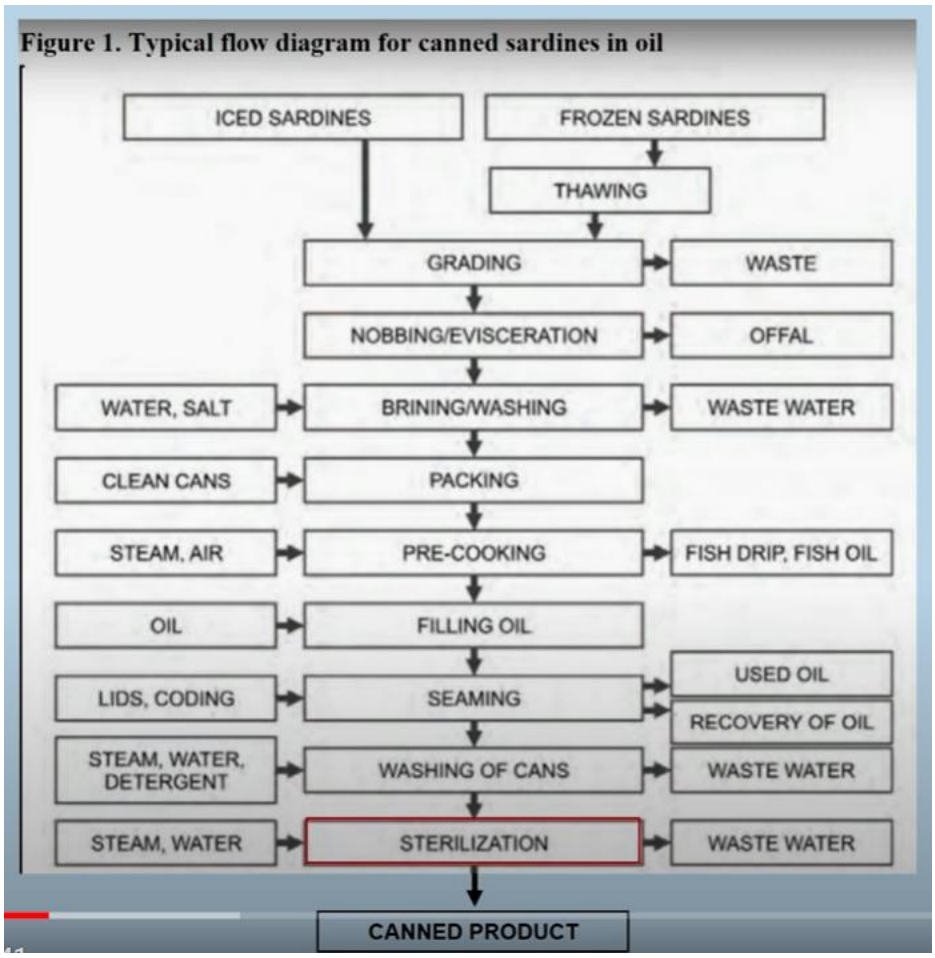

Fig.1

If the answer is no, determine if control is necessary. If yes, modify processes accordingly. If no, it is not a CCP. Ask questions at each step, and if the answer is yes, it needs to be addressed. This way, prepare a decision tree and identify CCPs. For example, in a sterilization process, if preventive measures exist, and they eliminate or reduce the hazard, determine the preventive measure. This becomes the critical control point. Modify temperature and time, and it becomes a CCP.

Fig.2 is an example for canned tuna. Reception can be a CCP, with metal detection, heat processing, cooling, and drying are other CCPs in tuna canning. Tuna, being a scombroid fish, may have high histamine levels, causing scombroid poisoning. Raw material should have histamine levels below 50 ppm and no heavy metals for mercury poisoning below 0.8 ppm. Histamine levels can be brought down if you prevent the microbial growth by reducing temperatures - frozen fish below -18 degrees Celsius and fresh fish at 0 degrees Celsius. At reception, ensure these parameters are maintained.

CCP	Critical Limits & Tolerances	Monitoring	Corrective Actions
1.Reception	Frozen fish < -18°C -Fresh fish 0°C -Histamine < 50ppm -Mercury < 0.8ppm -Cans must meet container specification for safety.	-Measure temperature upon receipt and request temperature history of tuna -Visual inspection -Sample for histamine and mercury -Letter of guarantee from supplier. Visual examination of all lots of empty cans	-Inform/change supplier -If histamine<50ppm, increase surveillance at gutting and filleting - Reject defective cans, contact supplier
2.Metal Detection	-Absence of metal pieces	-Regular checks and cleaning of metal detector	-Stop production, fix and recalibrate the detector before continuing production
3.Heat Processing	-Critical limit is the botulinum cook or 12-D process	-Periodic checks on heat distribution in retort and temperature recording equipment -Records on all actions and measurements must be kept and reviewed daily.	If time/temperature requirements are violated products must be put on hold for reprocessing and the cause must be identified. -Review of all operations and monitoring procedures and calibration of thermometers and automatic recorders
4.Cooling/Drying	-There must be measurable residual chlorine in the water(critical limit – 0.5mg/l)	-Cooling water should be tested (microbial quality and chlorine residue) at least two times per day by a designated person	-Production must be stopped if water is contaminated or critical limit exceeded, water treatment must be adjusted and the source of contamination investigated.

Fig.2

Chemical tests are needed for histamine levels, and temperatures of the received material should be recorded. For canned products, the cans must meet consumer specifications. The supplier must guarantee compliance. Set critical limits - histamine at reception below 50 ppm. Once the limit has been set, at this critical control point, it has to be monitored. Monitor temperature, visually inspect, and check histamine and mercury levels through chemical methods. Get a guarantee from the supplier that the cans comply with requirements.

Again, we can do visual examination. If it does not meet the set limits, there is a failure; corrective action must be taken. If the problem is with the can, inform the supplier or change the can. If histamine levels are above 50 ppm, adopt preventive measures to lower it; if too high, reject the product. Defective cans should be rejected, and defects must be communicated to the suppliers.

At metal detection, any metal impurities are a physical threat and should be absent in the food. The absence of metal pieces is the critical limit and should be monitored. Clean and check the metal detector regularly, ensuring it provides accurate details. Repair, calibrate, and fix any defects observed while monitoring, allowing the machine to continue working during production.

Heat processing, or heat sterilization, is crucial. During canning, focus on the Clostridium botulinum bacteria, with a temperature of 121 degrees Celsius for 15 seconds. Ensure these critical limits are maintained during heat processing for killing the organism. Periodically check the retort temperature, record it correctly, and adhere to the proper duration. Take corrective actions if anything deviates from the critical limits. We gave to maintain time-temperature requirements, monitor and calibrate thermometers, and use automatic recorders. These are crucial corrective actions in the heat processing step of the canning industry.

After heat processing, the spore-forming bacteria Clostridium enters the spore stage. When provided with the right temperature and environment, it begins growing. Hence, the temperature cannot be brought down slowly after retorting, as this could allow the bacteria to emerge and multiply. A cold shock is induced through the cooling and drying process, which is crucial.

In cooling, water comes in contact with the container and the food contact surface. The chlorine level must be correct, with a specified and measurable limit and the critical limit set at 0.5 mg per liter. Regularly monitor this level and have designated individuals conduct testing at intervals. If the chlorine level is below the limit, corrective actions must be taken, and chlorine added as needed.

HACCP is an accepted management system for food processing companies to ensure food safety. It is a practical requirement for all food canaries and needs inspection and approval from the local competent authority. This has been established in EU Regulation 852/2004, highlighting the importance of implementing and maintaining HACCP. CODEX also defines CCP as a process step where control is essential to prevent, eliminate, or reduce a food safety hazard to an acceptable level. CCP holds significant importance, as CODEX recognizes it as a crucial process step where contamination can be eliminated or prevented, the safety of food products can be ensured or reduced to an acceptable limit. If contamination cannot be eliminated, the hazard level will be brought down. To be identified as a CCP, there must be real-time, operative control applied at the process step, not an imaginary control point. Regular monitoring at intervals, especially for critical points like sterilization temperature, is crucial.

Certain CCPs are generic to production, such as double seaming for cans, ensuring no leakage and intactness, and sterilization also is a CCP. Sanitization of cooling water; it should be potable, well chlorinated, should not pass any contaminants to the food. And again, metal detection. These are some four generic steps and are also CCPs for canned fish.

Now the standards for canned fish, these are mentioned in CODEX and the number is also given here. There are some only few products. We have pacific salmon, shrimps, tuna in water or oil, then we have canned crab meat, sardine and sardine like products and mackerel and CODEX and their specifications are given and US federal again code of federal standards are there. Federal regulations they also give standards for certain food products, certain canned products like pacific salmon, tuna and here the 21, Title 21 it stands for food and drugs and CFO stands for code for federal regulations. 161 stands for part. Under this we get only fish and shellfish and 190 is the subpart. If you look here it is mentioned here. So, it is ECFR, Title 21 is food and drugs and under this we have part 161 that is fish and shellfish.

So, the code will be written like this and here we have in the CFR, we have standards for pacific salmon, tuna and wet pack shrimp and transparent and non-transparent containers. And again, there are UK codes for canned food products and here these are the different products which are described there in the standards. So, we have mackerel fillets in tomato sauce, mackerel fillets in oil and brine and we also have their specifications. So, if you refer these things, you will get the details of these products and their standards.

And apart from this, the companies can also have their own brand for domestic sales and they should not be clubbed with domestic market and international market or the export market it should not be mixed.

The label should be clear, containing all specifications and be retailer and trader-specific. It should include details like product name, species, can size, net weight, grain weight, recipe information, and allergen ingredients. If GMO products are used, a GMO statement is required. If it is GMO, for example, if you are using rice or you are using BT cotton or you are using any GMO products brinjal then you have to give the GMO statements. In fish it is not there so you don't have to go for this but then again flowchart for manufacturing operations, CCPs, it need not be mentioned in the label but when we prepare the standards all these things need to be given and we also need assurances from the suppliers also that they are not providing GMO products. The chemical parameters, the nutritional information, physical and sensory characteristics, all these parameters need to be recorded and given in detail in the standards or the records.

The product's health benefits can be mentioned on the label, sometimes using logos. Ingredient suppliers must follow HACCP or a quality management system, recognized by global food safety initiatives. These standards, at national and international levels, are generally followed for canning or any food product at the plant, personal, or manufacturing level. Each process should adhere to the standards with complete dedication to ensure food safety.

Concluding SOPs, previous classes discussed GMPs, criteria for adoption, and actions required. SOPs, SSOPs, HACCP, and ISO 9000 play roles in maintaining food safety and quality. SOPs are adopted to ensure food quality and safety, avoiding risks to humans as the end consumers.