Chapter 1

Overview of HACCP in Fish Processing Establishments

Dr.Femeena Hassan
Quality Assurance and Management Division
ICAR-Central Institute of Fisheries Technology

Hazard Analysis and Critical Control Point (HACCP) is an internationally recognized system for reducing the risk of safety hazards in food. Hazard Analysis Critical Control Point (HACCP) is a type of food safety management system. HACCP created the foundation for modern food safety standard.HACCP was developed by the Pillsbury Company while working on producing foods for NASA for use in space missions in early 1959. NASA had concerns of food, particularly crumbs, in the space capsule in zero gravity and also food that was free of pathogens and biological toxins that Pillsbury addressed by the use of HACCP. Principles that were mandated as part of NASAs engineering practices were applied to food production for the first time. It was an end-to-end control system that managed risks throughout the entire lifecycle of the space food, from ingredient procurement to transportation, to packaging and storage.The concept of HACCP was first presented to the public in the 1971 National Conference on Food Protection. At that time, it was based on three principles. In 1985, interest in HACCP was renewed when a subcommittee of the Food Protection Committee of NASA issued a report on microbiological criteria. A National Advisory Committee on Microbiological Criteria for Foods was formed and that committee published a report in 1992 that provided the framework for HACCP as we know it today.

Today's fish industry is facing new challenges, with more complex products and processes that require intensive controls during their processing, storage and distribution. The HACCP concept can guarantee the safety of fish products, enhancing consumer confidence in the fish industry, while at the same time can motivate exporting developing countries to build a solid food-safety control system. Here potential biological, chemical or physical hazards are identified and controlled at specific points in the process. Any company involved in the manufacturing, processing or handling of food products can use HACCP to improve food safety

Safe food is one which is free of contaminants and will not cause harm, injury or illness. Food gets contaminated at different stages, may be in the procurement of raw materials or during production but the extent of contamination or abuse determines the hazard potential by the Food-borne diseases, i.e. illnesses due to consumption of contaminated food are one of the most prevalent health problems in India as well as in other parts of the world. (WHO, 1984). In spite of the efforts taken, the incidence of food-borne diseases is increasing in number frequency all over. This problem is likely to continue to grow, unless new methods and strategies are adopted to counter them (WHO, 1991). This feature can be attributed to the insufficiency of the traditional approaches of quality control in controlling and preventing food-borne diseases. Hence, it is imperative that a concerted approach to food safety be developed. This could be achieved by combining two types of information. The information on the socio-cultural and economic situation and (ii) the technical information related to food manufacture and

food habits obtained through the application of the Hazard Analysis and Critical Control Point or HACCP (WHO, 1993).

HACCP is a science-based method, increasingly adopted by food manufacturers throughout the world for the prevention of food-borne diseases (WHO, 1993). It works through a step wise process to identify hazards, put in preventative measures to eliminate or reduce particular hazards in their food products. It is proactive not reactive and is based on risk. It does not rely on product testing as most Quality control programs have done in the past. Final product testing does not identify or remove all hazards as the hazards may not be evenly distributed and can be missed in sampling. A large number of products would need to be tested in order to get statistically accurate results and most testing of food is destructive.

It is a system of controls in a food processing industry, which helps them to identify and prevent problems even before they occur. This system is systematic and scientifically based and is consi9dered as a tool for ensuring food safety throughout the world (Brian, 1992). Even though HACCP was introduced in food system as early as 1960's, it found its way in India little late. Interestingly among the various food processing activities, this system was initially introduced in the fish processing sector. This changeover is rather forced upon the seafood processors because of the emergence of the European Union Market, which contributes to more than 40% of the total export market of marine products from India.

HACCP is a 'Systematic approach to the identification and assessment of the hazards and risks associated with a food operation and defining of the means of their control' (WHO, 1993). Anything which has a potential to cause harm to consumer safety should be considered a hazard. World Health Organization and international Commission of Microbiological specification of Foods recommended HACCP for food safety in developing countries (WHO/ICMSF, 1980). European Commission (European Commission 1991 and 1994) has made HACCP based quality management system mandatory in fisheries to export shrimp/fish products to European Markets. The Codex Alimentarius Commission is currently encouraging practical implementation of HACCP systems in food industries (Codex, 1991). HACCP based quality management systems are also advocated in the USFDA/NOAA Voluntary Seafood Inspection Programme for countries exporting seafood to the USA.

HACCP is a management tool that provides a more structured approach to the control of identified hazards that are identified by traditional inspection and quality control procedure. When applying the HACCP concept in food processing, control is transferred solely form end product testing (i.e., testing for failure). There will, however, always be a need for some end product testing particularly for verification purposes and in product development.

The process variables that are used to control the operation are identified by a HACCP review. Much of the effectiveness of HACCP is achieved through the relevant area, e.g., microbiology, food chemistry, production, quality assurance, that identifies specific hazards and measures for their control to ensure the safety prevention rather than relying mainly on end-product testing and inspection. It is capable of accommodating change, such as advances in equipment design, processing procedures or technological developments.

The benefits from the use of HACCP are many and can be summarized as follows (Anon, 1996):

- HACCP is a systematic approach covering all aspects of food safety from raw materials, growth, harvesting and purchase to final product use.
- Use of HACCP will move a company from sole retrospective end product testing approach towards a preventive quality assurance approach.
- Provides for a cost-effective control of food borne hazards
- Focuses technical resources into critical parts of seafood processing
- The use of preventive approaches such as HACCP leads to reduced product losses.
- Demonstrating that a HACCP quality management system in place in processing plant will assist in meeting standards in importing countries and contribute to customer satisfaction.

The HACCP system requires food proprietors to identify potential food hazards, decide which of these hazards need to be controlled to ensure food safety, and put into place effective control and monitoring procedures to prevent the hazard causing harm to consumer.

Twelve steps are necessary to develop a solid HACCP plan .It includes seven principles also.

Step1. Assemble the HACCP Team

The first step is assembling a team of individuals who have specific knowledge and expertise about the product and process. The multidisciplinary team should include individuals from departments such as:

- Engineering
- Production
- Sanitation
- Quality assurance

Don't forget to include local personnel who are involved in the operation. The team may benefit from outside experts to weigh in on potential biological, chemical and/or physical hazards, bit these experts should serve as consultants not as a replacement for your HACCP team.

Step 2. Describe the Product

First, the HACCP team provides a general description of the food, ingredients and processing methods. Then the method of distribution should be described along with information on whether the food is to be distributed frozen, refrigerated or at ambient temperature.

Step 3. Identify the Intended Use and Consumers

Describe the normal expected use of the food. The intended consumers may be the general public or a particular segment of the population (e.g., infants, immunocompromised individuals, the elderly, etc.)

Step 4. Construct Flow Diagram to Describe the Process

The flow diagram should provide a clear, simple outline of all the steps involved in the process that are directly under the control of the establishment. (The flow diagram can also include steps in the food chain which come before and after the processing that occurs in the establishment.)

The diagram can be a block-type design — it should does not need to be as complex as engineering drawings. Also, including a simple schematic of the facility can be useful for understanding product and process flow.

Step 5. On-Site Confirmation of Flow Diagram

The HACCP team should perform an on-site review of the operation to verify the accuracy and completeness of the flow diagram, and modifications should be made to the diagram as needed. After these first five preliminary tasks have been completed, the following seven principles of HACCP are applied.

Step 6. - Conduct a Hazard Analysis (Principle 1)

The application of this principle involves listing the steps in the process and identifying where significant hazards are likely to Occur. The HACCP team will focus on hazards that can be prevented, eliminated or controlled by the HACCP plan. A justification for including or excluding the hazard is reported and possible control measures are identified.

Step 7. Identify the Critical Control Points (Principle 2)

A critical control point (CCP) is a point, step or procedure at which control can be applied and a food safety hazard can be prevented, eliminated or reduced to acceptable levels. The HACCP team will use a CCP decision tree to help identify the critical control points in the process. A critical control point may control more than one food safety hazard or in some cases more than one CCP is needed to control a single hazard. The number of CCP's needed depends on the processing steps and the control needed to assure food safety.

Step8. Establish Critical Limits viz., target levels and tolerances which must be net to ensure each CCP is under control.(**Principle 3**)

A critical limit (CL) is the maximum and/or minimum value to which a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level the occurrence of a food safety hazard. The critical limit is usually a measure such as time, temperature, water activity (Aw), pH, weight, or some other measure that is based on scientific literature and/or regulatory standards.

Step 9. Establish a monitoring system to ensure control of the CCP by schedule testing or observations. (Principle 4)

The HACCP team will describe monitoring procedures for the measurement of the critical limit at each critical control point. Monitoring procedures should describe how the measurement will be taken, when the measurement is taken, who is responsible for the measurement and how frequently the measurement is taken during production.

Step 10. - Establish the corrective action or preventive measures to be taken when monitoring indicates that a particular CCP is moving out of control. (Principle 5)

Corrective actions are the procedures that are followed when a deviation in a critical limit occurs. The HACCP team will identify the steps that will be taken to prevent potentially hazardous food from entering the food chain and the steps that are needed to correct the process. This usually includes identification of the problems and the steps taken to assure that the problem will not occur again.

Step 11. - Establish verification procedures which include appropriate supplementary tests, together with a review which confirms that HACCP is working effectively. **(Principle 6)**

Those activities, other than monitoring, that determine the validity of the HACCP plan and that the system is operating according to the plan. The HACCP team may identify activities such as auditing of CCP's, record review, prior shipment review, instrument calibration and product testing as part of the verification activities.

Step 12- Establish verification procedures which include appropriate supplementary tests, together with a review which confirms that HACCP is working effectively. (Principle 7)

A key component of the HACCP plan is recording information that can be used to prove that a food was produced safely. The records also need to include information about the HACCP plan. Record should include information on the HACCP Team, product description, flow diagrams, the hazard analysis, the CCP's identified, Critical Limits, Monitoring System, Corrective Actions, Recordkeeping Procedures, and Verification Procedures.

The HACCP is implemented in 12 steps which includes five preliminary steps followed by seven principles. The five preliminary steps include Assembly of HACCP team, description of the products, identifying its indented use, construct a flow diagram and on-site verification of process steps.

Before starting any study, senior management of the company must be committed to providing the necessary resources for the exercise to be completed and to implementing the finding of the exercise, including reviews and updates. Without such commitment there is little point in beginning the study. When conducting a HACCP study, the seven principles are applied in the following stages (Anon, 1996).

The success of HACCP depends on educating and training management and employees in importance of producing safe food which includes information of control of foodborne hazards related to all stages of food chain, making sure employees understand what HACCP is and providing specific

training on instructions and procedures that outline employee tasks in monitoring each Critical Control Point.

Definitions of some of the important terms associated with HACCP are given below for better understanding.

HACCP	:	A systematic approach to the identification, evaluation and control of food-safety hazards.
HACCP System	:	The result of the implementation of the HACCP plan
HACCP Plan	:	The written document that is based upon principles of HACCP and that delineates the procedures to be followed
HACCP Team	:	The group of people who are responsible for developing, implementing and maintaining the HACCP system
Flow Diagram	:	A systematic representation of the sequence of steps or operations used in the production or manufacture of a particular food item
Hazard	:	A biological, chemical or physical agent that is reasonably likely to cause illness or injury in the absence of its control
Severity	:	The seriousness of a hazard (if not properly controlled).
Control	:	(a)(Verb) To manage the conditions of an operation to maintain compliance with established criteria. (b) (Noun) The state in which correct procedures are being followed and criteria are being met.
Control Measure	:	Any action or activity that can be used to prevent, eliminate or reduce a significant hazard
Control Point	:	Any point, step or procedure at which biological, physical or chemical factors can be controlled

Critical Control Point (CCP)	:	A step at which control can be applied and is essential to prevent or eliminate a food-safety hazard or reduce it to an acceptable level.
CCP Decision Tree	:	A sequence of questions asked to determine whether a control point is a CCP.
Critical Limit	:	A criterion which separates acceptability from unacceptability.
	:	-A maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food-safety hazard.
Operating limits	:	Criteria that are more stringent than critical limits and that are used by an operator to reduce the risk of a deviation
Monitor	:	To conduct a planned sequence of observations or measurements to assess whether a CCP is under control and to produce an accurate record for future use in verification.
Continuous Monitoring	:	Uninterrupted collect ion and recording of data such as temperature on a strip chart.
Corrective Action	:	Any action to be taken when the results of monitoring at the CCP indicate a loss of control
Deviation	:	Failure to meet a critical limit.
Validation	:	Obtaining evidence that the elements of the HACCP plan are effective.
Verification	:	The element of verification focused on collecting and evaluating scientific and technical information to determine if the HACCP plan, when properly implemented, will effectively control the hazards.

HACCP Does not Stand Alone

The application of HACCP does not stand alone in a food processing facility. The plan must be built on other food safety programs. Good Manufacturing Practices (GMP) that are practiced by the processing facility will support HACCP plan and will address food safety and food quality issues that are not critical for the reduction of food safety hazards. Sanitation Standard Operating Procedures (SSOP's) are required and address procedures for clean facilities, equipment and personnel that are necessary for all products produced in a facility.

Food provides nutrition for human being and quality of food is of at most importance in this health-conscious world. The quality is defined as the Degree to which a set of inherent characteristics fulfils requirements. Therefore, the aim of any food industry is to fulfil the requirements of the customer by adopting strategies in order to improve and stabilize production (and associated processes) to avoid, or at least minimize, issues which led to the defect(S) in the first place.