Course Manual on

Shrimp Processing and Quality Assurance for Export

AU-Avanti Aquaculture Skill Development Centre

(AU-Avanti ASDC)

Established by Avanti Foundation

New Building, MLR Department, Andhra University
Visakhapatnam, Andhra Pradesh

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Credits

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Contents

1 Infrastructure and Amenities for Quality Assurance in Shrimp Processing Plant

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Introduction: Shrimp procured from the aquaculture farmers is processed in a shrimp processing unit. Processing of shrimp is essential to extend its shelf life, maintain its nutritive and sensory properties, increase convenience, ensure safety and most importantly increase economic value of shrimp. The commonly used shrimp processing technologies in shrimp processing units of Andhra Pradesh are plate freezing and individually quick freezing techniques. The shrimp are frozen either as raw-frozen products or cooked-frozen products. Plate freezing is employed to produce block frozen shrimp products (Fig 1a) and IQF freezers are employed to produce individual frozen shrimp products (Fig 1b).

It is necessary to preserve the harvested shrimp under chilled condition (core temperature of less than +4 °C) till they are processed in a shrimp processing unit. Chilling inhibits the growth of bacteria. The use of ice is recommended to keep the shrimp in a cool condition before freezing. Freezing is performed at temperatures between -35 to -45 °C in freezers so that the shrimp attain a core temperature of -18 °C which completely stops the growth of bacteria from growing. However, both enzymatic and non-enzymatic changes continue in frozen products but at a much slower rate.

A general material-process flow chart in a shrimp processing unit is given in Fig 2. The main sections in a shrimp processing unit are activities are raw material receiving section, pre-processing section, processing section and frozen storage section

In the raw material (RM) receiving section, the shrimp that was harvested from approved shrimp farms are received. Activities in the RM section include temperature checking of the raw material, noting the traceability details, collecting the supplier's declaration regarding non-usage of antibiotics, organoleptic assessment of the raw material, sulphite testing, bubble washing to remove dirt and weighing of the shrimp. From RM section the shrimp is sent to the pre-processing section.

In the pre-processing section the edible parts of the shrimp are separated from the inedible parts. Activities in the pre-processing section include de-heading of shrimp, grading of shrimp, deveining, peeling, making different market styles (easy peel, butterfly, PD, PUD etc) of shrimp, washing and icing

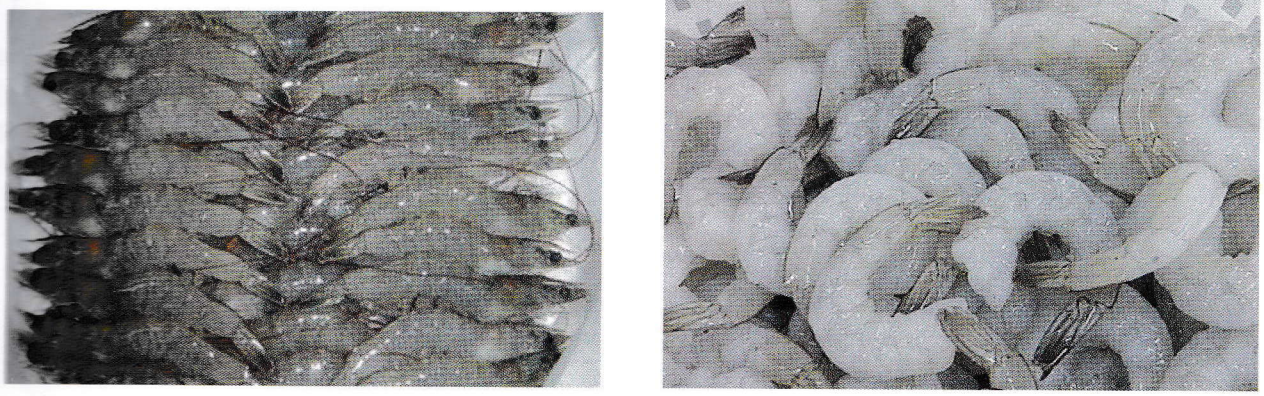

Fig. 1. Frozen Shrimp products

a) Block frozen shrimp b) IQF shrimp

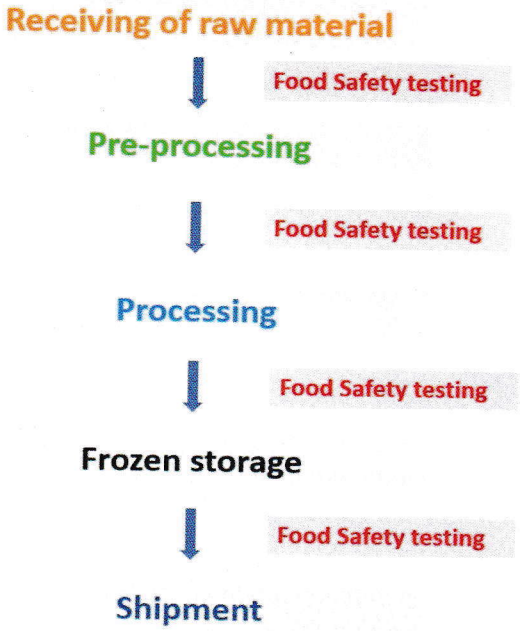

Fig 2. Material-Process flow chart in a shrimp processing unit

of shrimp. The pre-processed shrimp is sent to the processing section through a chute. Shell waste is disposed off from the pre-processing section through a waste disposal chute in to the waste disposal room.

In the processing section, the shrimp received from the pre-processing section are converted to frozen shrimp products. Activities in the processing section include soaking of shrimp, cooking, glazing, plate freezing, IQF, packaging, labelling, metal detection. In some processing units cook-peeled shrimp, marinated shrimp, battering and breaded shrimp are also prepared. In processing units where cooking is performed, there should be separate high-risk area with male and female change rooms. Only cooked material enters the high-risk area. The frozen shrimp products are stored in cold storages at a temperature of -18 °C. Continuous temperature recording is done using a data logger to ensure that -18 °C temperature is maintained without any interruption. The food safety testing is continuously performed in all the sections. The shrimp products that are certified as fit for human consumption (Health Certificate) are shipped to the export destination.

The layout of a shrimp processing unit should ensure unidirectional flow of material so that the quality of the finished products in not compromised. The raw material (whole shrimp) should enter from one end of the processing unit and the finished products should leave from the other end of the processing unit. A general layout of a shrimp processing unit is depicted (Fig 3). The layout must ensure a seamless flow of material i.e., raw material receiving, pre-processing, processing, storage and transport (Fig. 4).

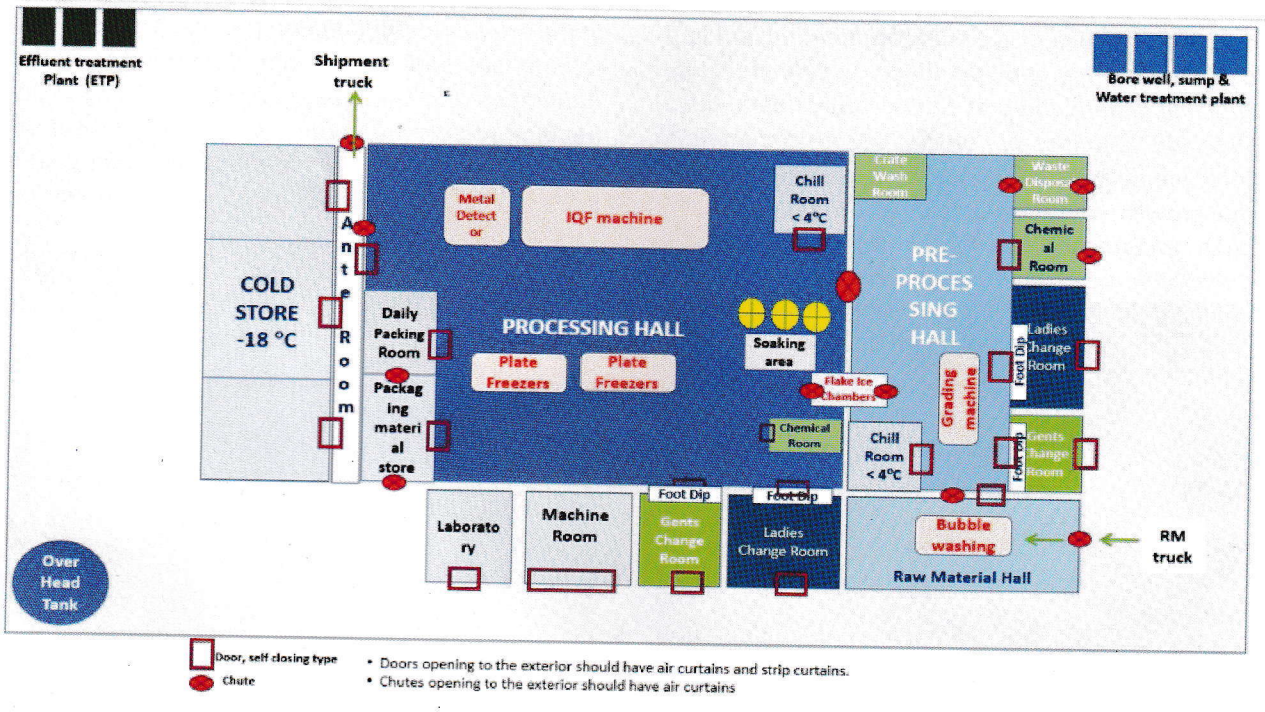

Fig. 3. General Layout of a Shrimp Processing Unit

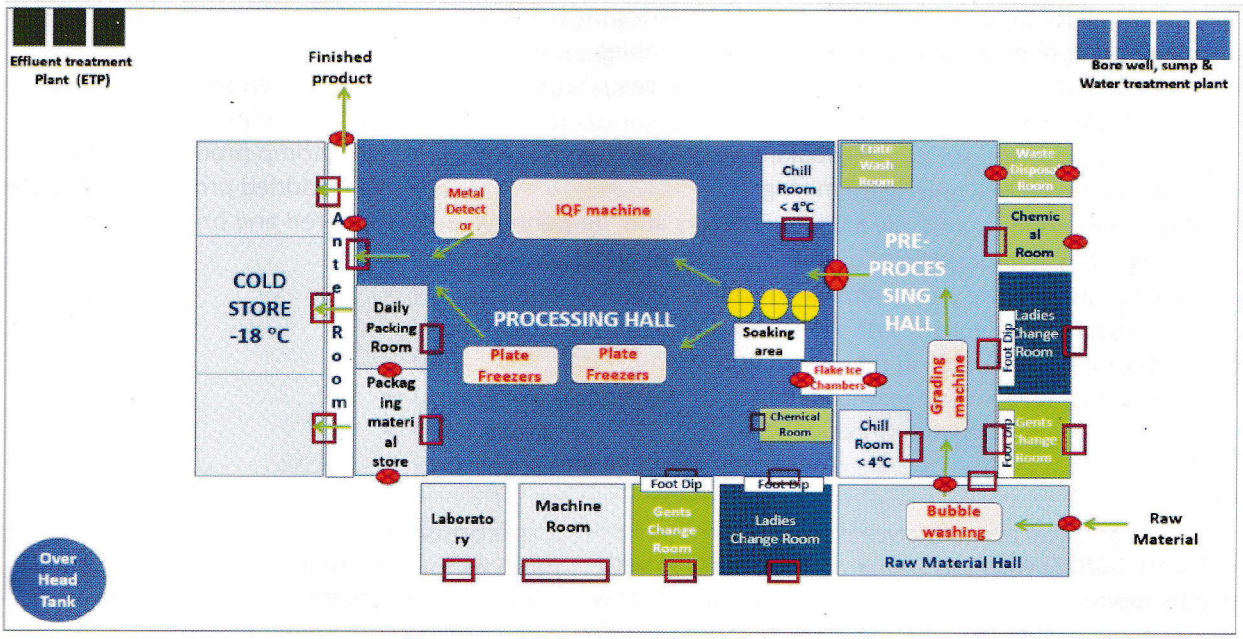

Fig. 4. Unidirectional movement of shrimp in processing unit

The layout houses the following facilities for proper functioning of shrimp processing facility as detailed in Table 1.

Table 1. Area in the shrimp processing unit and activities performed

Area	Equipment housed	Activities
Raw material receiving area	• Bubble washing Machines • Weighing scales • Stainless steel tables • Hose pipes with non-return valves • Crate washer	• Initial checking of temperature of raw material, • Checking traceability • Collecting supplier's declaration • Organoleptic inspection of raw material • Washing of raw material • Weighing of shrimp, • Sulphite test
Pre-processing hall (with separate ladies and gents change rooms and Chill room, waste disposal room)	• Flake Ice Machines • Grading Machines • Stainless steel tables • Pre-processing conveyors • Chill room • Hose pipes with non-return valves • Jet washers • Weighing balances • Hand dips	• Ice production • Deheading • Grading • Peeling • Deveining • Cutting • Washing • Head waste and shell waste disposal • Storing excess material in chill room

Processing hall (with separate ladies and gents change rooms, chill rooms)	• Flake Ice Machines • Stainless steel tables • Weighing balances • Hand dips • Soaking vessels with motor for mixing • Plate Freezers and de-panning unit • IQF machine assembly with hardners • Metal detectors • Sealers • Cookers • Automatic weighing and packing machines	• Soaking with phosphate or non-phosphate • Block frozen shrimp product • IQF shrimp product (raw) • IQF shrimp product (Cooked) • Value added products (marinated, battered and breaded etc)
Cold store (-18°C) with an ante-room	• Panelled stores with temperature display • Temperature recorder • Fork lifts / vehicles • Humidity meter • Conveyor in ante-room for shipment	• Storing of finished products • Continuous temperature recording. • Shipment of finished product
Waste disposal room	Containers / bags for storing waste	• Head and shell waste from pre-processing area
Chemical stores	Separate areas for dry chemicals and wet chemicals	• Shell waste from cook-peel zone of high risk area
Packaging material store	• Steel racks • Automatic label printer	• Storing liquid soap and Chlorine solution • Storing salt, phosphate and non-phosphate chemicals
Over head water tank	Cement tank with inside lined with tiles	• Storage of primary packing covers • Storage of master cartons • Labels, bar-code printing on packaging material • Storing treated water
Water treatment plant (WTP)	• Bore well • Sump • Sand filters • Activated Carbon filters • Water Softener • Chlorine dozers • Ultraviolet light assembly • Reverse osmosis membranes	• Purifying and disinfection of ground water to meet the water standard requirements IS: 4251 for non-EU processing units and EU Directive 98/83/EC (2020/2184) for EU processing units.
Effluent treatment plant (ETP)	• Collection tank • Primary Settling tank • Anaerobic tank • Aerobic tank • Sludge beds	• Treat the solid and liquid effluents from the shrimp processing unit to meet the pollution control board (PCB) requirements.

Change rooms	• Lockers for storing valuables • Hangers for hanging street cloth • Street chappal stand • Cupboard for storing uniforms, masks, head caps, hair nets, gloves • Gum boot stand • Foot operated dust bins • Fly catchers • Wash basins with foot operated taps • Liquid soap dispensers • Hand driers • Foot dips	• Separate change rooms for women at entry to pre-processing, processing and high-risk area • Separate change rooms for men at entry to pre-processing, processing and high-risk area • All workers, supervisors, quality control personnel, managers, machinery staff, visitors, must enter through the change rooms with proper uniform into the processing unit for avoiding contamination
Laboratory	• Autoclaves • Hot air Oven • Incubators • Water baths • Laminar air flow chamber • Stomacher blender • pH meter • Weighing balance • Microscope • Refrigerator • Freezer • ELISA reader • Vortex mixer • Centrifuge • Nitrogen cylinder • Micropipettes • Gas stove • Glassware • Plastic ware	• Microbiological and Chemical analysis of raw material, processed shrimp product, water and ice.
Machine room	• Compressors • Data loggers • Generators • Power supply control	Running of freezers, cold stores, chill rooms, flake ice machines, other machinery used in shrimp processing unit
Vehicle wash area	• Jet washers • Vehicle ramp	Washing the insulated vehicles involved in procuring raw material from shrimp farms
Laundry room	• Washing Machines • Driers	Washing uniforms used in the shrimp processing unit
Canteen	• Dining tables • Drinking water facility	Workers and staff to eat food and drink water

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Pre-processing hall (with separate ladies and gents change rooms and Chill room, waste disposal room)	• Flake Ice Machines • Grading Machines • Stainless steel tables • Pre-processing conveyors • Chill room • Hose pipes with non-return valves • Jet washers • Weighing balances • Hand dips	• Ice production • Deheading • Grading • Peeling • Deveining • Cutting • Washing • Head waste and shell waste disposal • Storing excess material in chill room
Processing hall (with separate ladies and gents change rooms, chill rooms)	• Flake Ice Machines • Stainless steel tables • Weighing balances • Hand dips • Soaking vessels with motor for mixing • Plate Freezers and de-panning unit • IQF machine assembly with hardners • Metal detectors • Sealers • Cookers • Automatic weighing and packing machines	• Soaking with phosphate or non-phosphate • Block frozen shrimp product • IQF shrimp product (raw) • IQF shrimp product (Cooked) • Value added products (marinated, battered and breaded etc)
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Laboratory	• Autoclaves • Hot air Oven • Incubators • Water baths • Laminar air flow chamber • Stomacher blender • pH meter • Weighing balance • Microscope • Refrigerator • Freezer	• Microbiological and Chemical analysis of raw material, processed shrimp product, water and ice.

Generally, the floor of the pre-processing and processing halls has to be cemented and covered with tiles for easy cleaning. Gradient of the floor should slope towards one side or towards the centre and all the drains must be covered. The slope of the drain should be opposite to the flow of material. The exit end of the drain must be covered with wire mesh to prevent entry of rodents. The entrance of the change rooms of the pre-processing hall, processing hall and high-risk area should have self-closing doors with strip curtains and air curtains to prevent entry of flies. Exhaust fans should be provided for ventilation and the outlets should be made fly proof by covering with wire mesh. Water line with sufficient number of taps should be provided in raw material receiving, pre-processing and processing halls. All the hose connections should be fitted with non-returnable valves (NRV) and hung on hose holders. A foot dip (as wide as the door) should be provided in front of all the doors opening into the pre-processing and processing halls. The pre-processing and processing halls should have adequate lighting and ventilation. All the doors opening to the exterior should be self-closing type, fitted with strip curtain and an air curtain to prevent the entry of flies. All chutes opening to the exterior should be fitted with stainless steel door and an air curtain.

Shrimp processing units of different sizes varying from few thousand square feet of total floor space to more than one lakh square feet of total floor space are in operation in Andhra Pradesh. The size of the shrimp processing unit directly depends on its total freezing capacity. Freezing capacity is calculated by totalling the daily freezing capacity of all the Plate freezers, IQFs and Blast freezers installed in the processing unit. The size of the processing hall depends on the number of freezers that must be fit into the hall. Additional activities such as cooking and value addition requires more floor space. Similarly, the number of freezers decide the quantity of shrimp required for freezing. The more the number of freezers the more the quantity of shrimp required. Accordingly, the size of pre-processing halls and raw material receiving halls are determined. Whatever, the size of the shrimp processing plant, it's basic aim remains the same i.e., to produce safe shrimp products that are fit for export and earn valuable foreign exchange to the country. Constructing a unit equipped with best processing equipment and ensuring a layout with unidirectional flow of material is vital for the successful operation of any shrimp processing unit.