INFOFISH

MANUAL ON PROCESSING

Processing, Packaging and Presentation of Value-added Fishery Products

INFOFISH
CFC/IFAD/INFOFISH PROJECT ON
EXPORT PROMOTION OF VALUE-ADDED FISHERY PRODUCT AND THEIR SUSTAINABLE DEVELOPMENT

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AND THEIR SUSTAINABLE DEVELOPMENT

This document is partly based on production trials/demonstrations and training programs conducted under the CFC/IFAD/INFOFISH Project on "Export Promotion of Value-added Fishery Products and their Sustainable Development". Any reference to machinery and equipment in the document should not be considered as an endorsement of products or such equipment for the process/processes discussed.

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INTRODUCTION

This handbook aims at providing fundamental guidelines on production, packaging and presentation of fifteen selected value-added fishery products with potential economic importance in the seafood industry. Needless to say, the demand for value added fishery products continues to rise alongside the evolving needs and consumers' lifestyle. The publication will be able to equip upcoming entrepreneurs with the technical know-hows and expertise on the processing steps related to the products.

Almost all the products can be prepared in a medium-scale plant which are equipped with basic processing facilities. The technology involved is simple and can be modified to suit varying degrees of automation. However, the product should satisfy the quality criteria and product specifications of the buyer.

Needless to say, processing and presentation of value-added products to major markets have to be carried out under specific guidelines which ensure product quality and safety. These guidelines are market specific, but they are all based on the application of Good Manufacturing Practices (GMP) and Hazard Analysis Critical Control Points (HACCP) based production and process controls. Discussion of these quality criteria is beyond the scope of this publication. However, for the convenience of the user of the manual, some basic guidelines on GMP (Appendix 1), Critical Control Points as applied to raw shrimp processing (Appendix II) and buyer specifications for one of the commonly traded conventional products – raw headless shrimp (Appendix III) are appended in the manual.

CONTENTS

PRODUCT – 1

EZ –PEEL SHRIMP

PRODUCT : EZ – PEEL SHRIMP

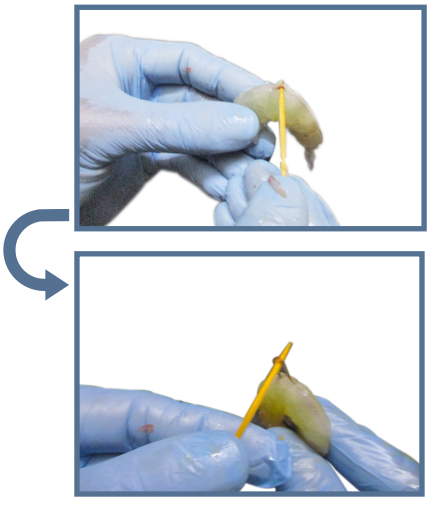
Product description : Headless Shell-on (HLSO) shrimp, with the cuticle dorsally or laterally cut up to the last segment facilitating easy peeling. However, the cuticle remains attached to the flesh. When shrimp is cooked, with the expansion of the flesh, the cuticle opens up from the cut ends, making the cooked shrimp easy to peel and hence the name "Easy peel".

Raw material : Black tiger *(Penaeus monodon)*, White *(Penaeus indicus),* White leg shrimp *(Litopenaeus vannamei)*, Brown (*Metapenaeus dobsoni* and *M monoceros)* or Pink shrimp *(Penaeus duorarum)*.

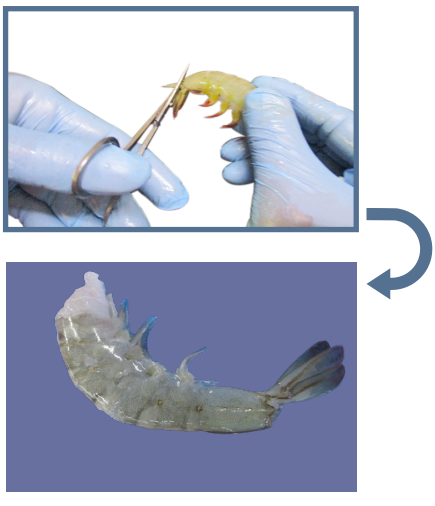
Commercial pack sizes : 1 kg, 1.8 kg or 2 kg blocks; 500 gm or 1 kg bag or 250/350 gm tray pack

Major markets : Japan, USA, Europe and Middle East

PROCESSING AND PACKING



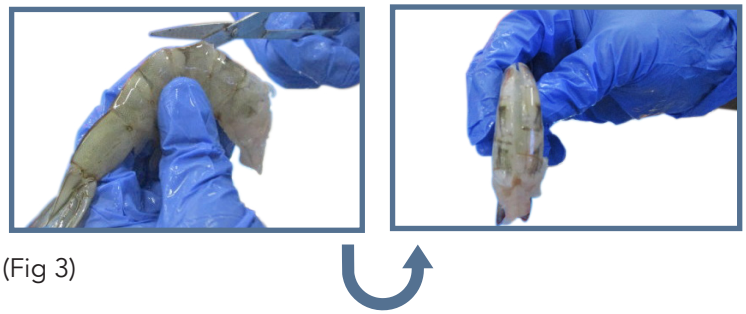
(Fig 1)



(Fig 2)

Remove the head to make the shrimp Headless Shell-on, devein the shrimp by inserting a pin or needle or pointed bamboo stick between the segments dorsally and lifting the vein (Fig 1).

Remove the telson by gently raising it upwards, away from the tail fans, towards the dorsal surface of the last segment, till it severs from the body (Fig 2).



(Fig 3)

The cuticle may be opened dorsally or laterally depending on the buyer's requirements. A pair of scissors with sharp pointed arms may be used for this purpose. Damage to the flesh should be minimized by holding the pointed cutting edges of the scissors away from the flesh. The cuticle is cut, up to the end of the last segment dorsally or laterally, while leaving it intact on the body (Fig 3).

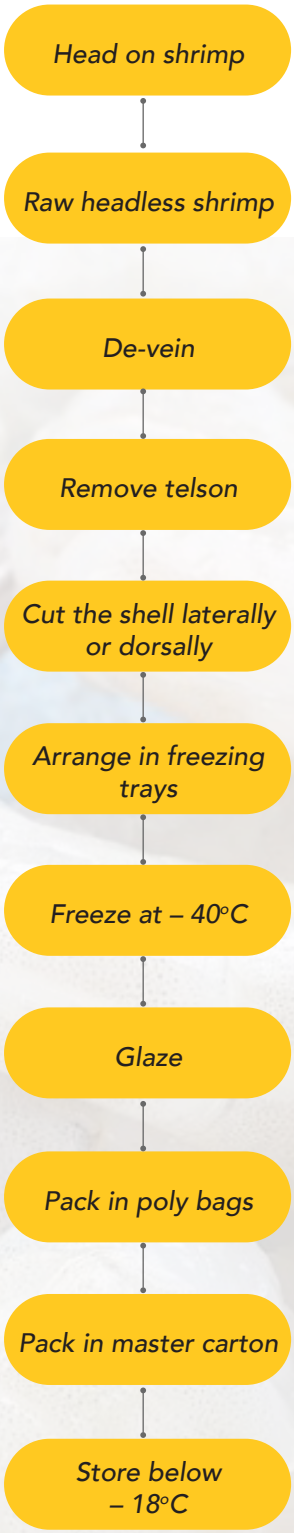
Arrange in freezer trays and freeze the product using a contact /blast freezer, or feed into the inlet belt of the IQF freezer and freeze as appropriate. Pack in 1- 2 kg poly bags (Fig 5). For consumer packs arrange in PVC/polystyrene trays and shrink wrap or pack in laminated pouches and vacuum/blast or IQF freeze (Fig 6). Pack in boxes/master cartons as per buyer specifications. Store below -18°C.

(Fig 5)

(Fig 6)

PRODUCT: EZ – PEEL SHRIMP

FLOW DIAGRAM



GRADING EQUIPMENT

Automatic Weight Grading System for Fish, Shrimp, Seafood Processing
(Shanghai Bofeng Electronics Co., Ltd., Shanghai, China)

Roller Type Shrimp Grader
(Shrimp Machine, Zhanjiang City, Guangdong Province, China)

Shrimp Peeling System
(Gregor Jonsson, Inc, USA)

Precision Roller Grader
(Laithram Machinery, USA)

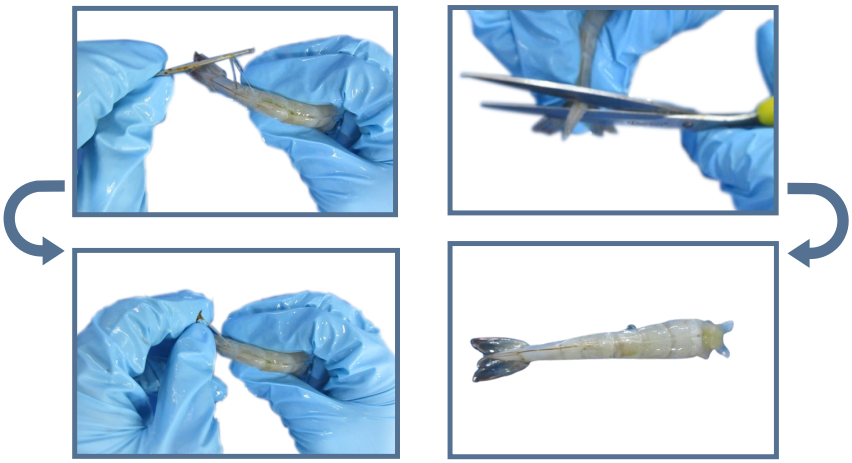
PRODUCT – 2

COOKED EASY PEEL SHRIMP

PRODUCT : COOKED "EASY-PEEL" SHRIMP

Product description	:	Cooked headless, shell on shrimp with the cuticle dorsally or laterally cut up to the last segment. Since the cooking is done with the shell intact, the cuticle remains firmly adhered to the flesh. The cooked shrimp is cut up laterally or dorsally. When the shrimp is further processed/cooked, with the expansion of the flesh, the cuticle opens up from the cut ends, making the shrimp easy to peel.
Raw material	:	Black tiger *(Penaeus monodon)*, White *(Penaeus indicus)*, Whiteleg shrimp *(Litopenaeus vannamei)*, Brown *(Metapenaeus dobsoni* and *M monoceros)* or Pink *(Penaeus duorarum)* shrimp.
Size/grades	:	21/25, 26/30, 31/40 counts
Commercial pack sizes	:	1 kg, 2 kg blocks; 250/500 gm IQF tray pack or 1 kg ploy bag
Major markets	:	Japan, USA, Europe and Middle East

PROCESSING AND PACKAGING



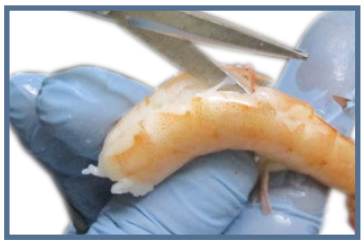
(Fig 1)

(Fig 2)

De-vein the shrimp by inserting a pointed pin/needle or pointed bamboo stick between the dorsally and lifting the vein off (Fig 1).

Remove the telson by gently raising it upwards, away from the tail fans, and towards the dorsal surface of the last segment, till it severs from the body (Fig 2).

(Fig 3)



(Fig 4)

Wash the shrimp in potable, chilled water. Cook the shrimp in boiling water containing 1% salt, for 2-3 minutes (Fig 3). The cooking time varies with the of the shrimp, bigger shrimp needing more time and vice versa.

The cuticle may be opened dorsally or laterally depending on buyer specifications. A pair of scissors with sharp, pointed arms may be used for this purpose. Damage to the flesh should be minimized by holding the pointed cutting edges of the scissors away from the flesh. The cuticle is cut, up to the end of the last segment dorsally or laterally, while leaving it intact on the body (Fig 4).

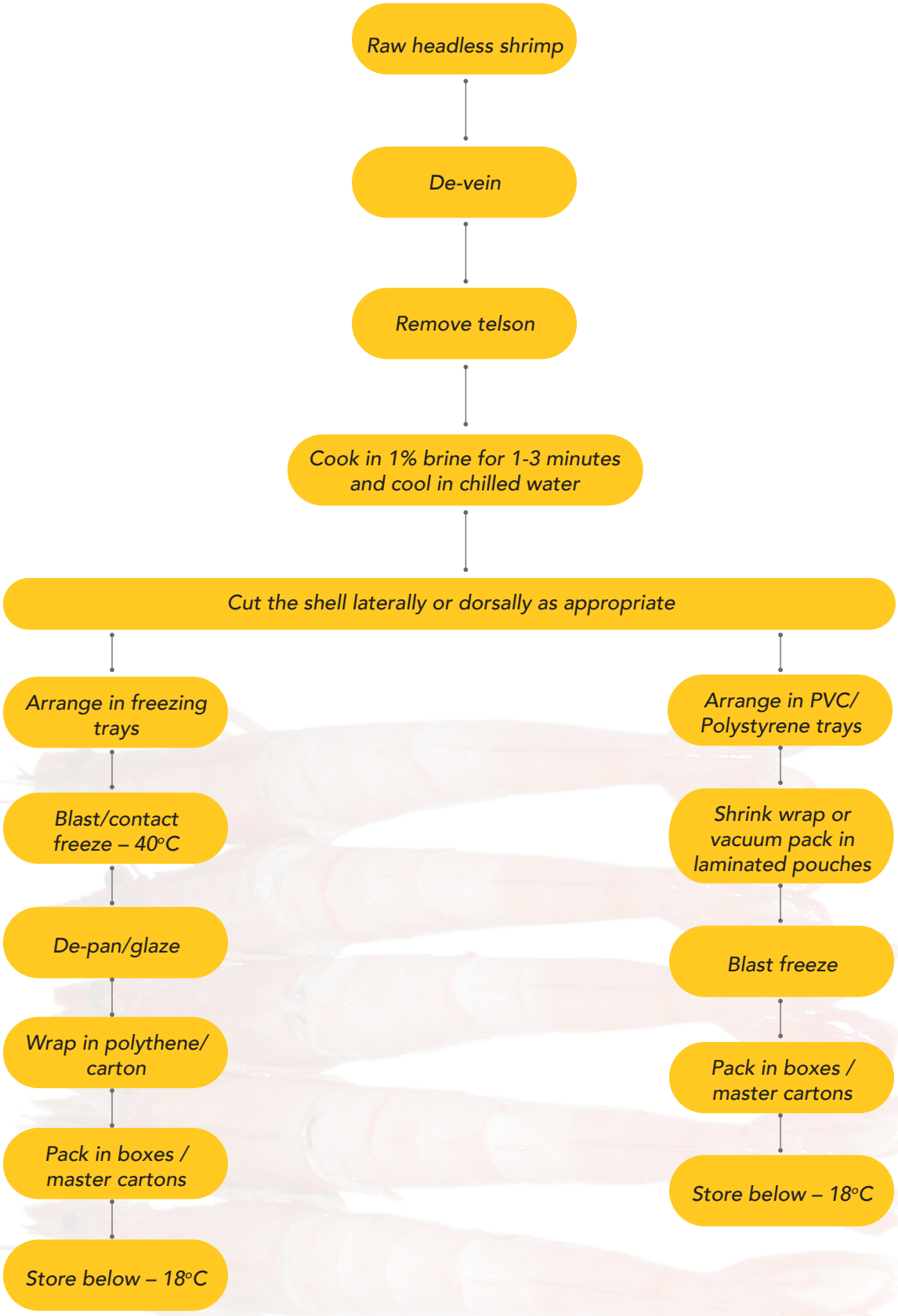
(Fig 5)

(Fig 6)

Arrange in freezer trays and contact/blast freeze. Pack in 1-2 kg poly bags (Fig 5). For consumer packs, arrange in PVC/Polystyrene trays and shrimp wrap or pack in laminated pouches and vacuum/blast freeze (Fig 6). Pack in boxes/master cartons as per buyer specification. Store below – 18°C.

PRODUCT: COOKED "EASY-PEEL" SHRIMP

FLOW DIAGRAM



PEELING AND DEVEINING EQUIPMENT

Shrimp cutter and de-veiner
(Prawnto.com, USA)

Shrimp peeling machine
(Asme.org, USA)

PRODUCT - 3

SHRIMP SKEWER

PRODUCT: SHRIMP SKEWER

Product description	:	Headless peeled shrimp, arranged on a skewer. The product is normally grilled for consumption
Raw material	:	Black tiger or *Vannamei* shrimp
Size grades	:	16/20 to 71/90 counts
Commercial pack sizes	:	300 – 500 gm tray packs, 1 kg or 2 kg ploy bags
Major markets	:	Japan, USA and EU

PROCESSING AND PACKAGING

Remove the telson and peel the shrimp completely, including the tails fan and de-vein (Fig 1).

(Fig 1)

Arrange about five shrimps on a skewer in an inverted U=Shape (Fig 2).

(Fig 2)

Arrange in freezer trays and blast/contact freeze (Fig 3). Pack in 500 gm or 1 kg weight, in polythene bags / master cartons as per buyer specifications. Store below -18°C .

(Fig 3)

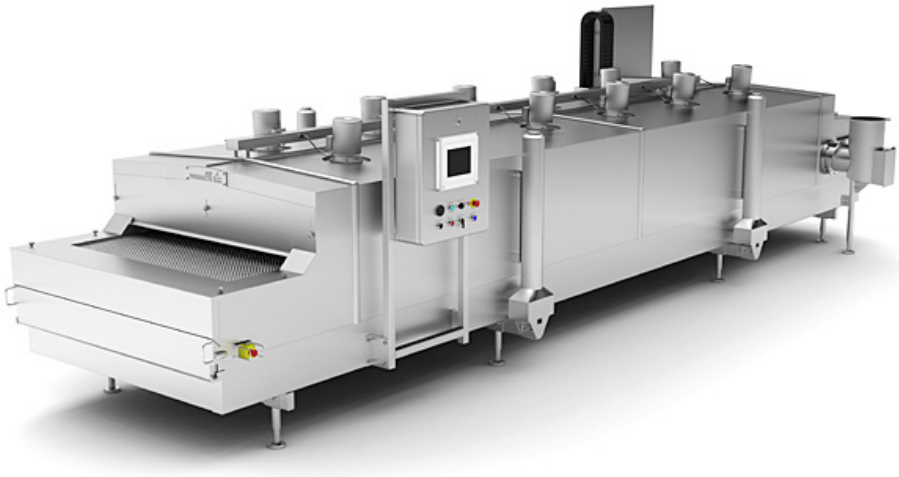
Arrange in PVC/Polystyrene trays, stretch wrap or pack in laminated pouches, vacuum and blast freeze (Fig 4). Pack in boxes/master cartons as per buyer specifications. Store below -18°C.

(Fig 4)

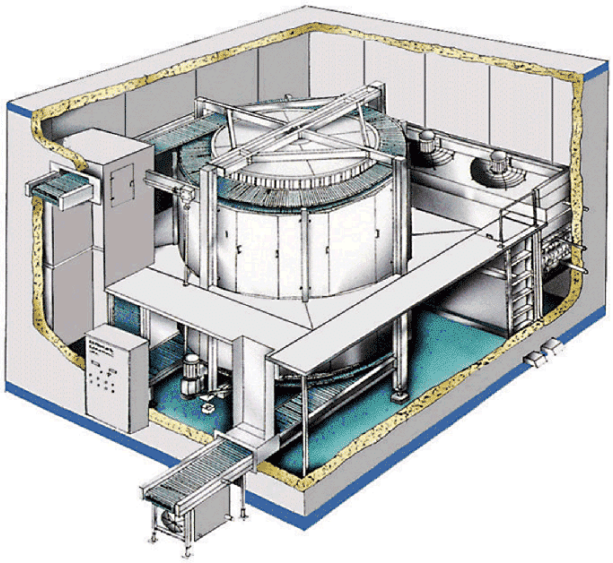
PRODUCT: SHRIMP SKEWER

FLOW DIAGRAM

FREEZING EQUIPMENT



Cryogenic tunnel freezer
(Air Products, USA)



Modular spiral belt freezer
(Advanced Equipment Inc, USA)

PRODUCT - 4

BUTTERFLY SHRIMP – TOP CUT

PRODUCT : BUTTERFLY SHRIMP-TOP CUT

PRODUCT DESCRIPTION : Headless peeled shrimp, cut open dorsally (from the top) to partially separate the lateral muscle blocks. However, the last segment is left shell-on, and hence the muscle intact, giving the processed shrimp a butterfly appearance.

Raw material : Black tiger and *Vannamei* shrimps

Size grades : 16/20 to 31/40 counts

Commercial pack sizes : 250-350 gm tray packs, 1 kg or 2 lb polythene bags

Major markets : Japan and USA

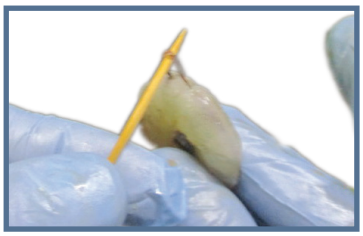
Product requirements : Shrimp with "button-holes" (see para 1, next page) should not exceed more than 3 – 5% by weight. The lateral muscle blocks should be symmetrical, undamaged and should be free of loose or hanging meat. The muscle should not show any haphazard cut-marks.

PROCESSING AND PACKAGING

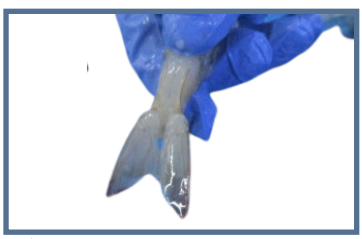
Remove the telson (Fig 1). Peel the shrimp leaving the shell intact on the last tail segment including the tail fans (Fig 2), and de-vein (Fig 3). Trim the tail fans using a pair of sharp scissors (Fig 4).

(Fig 1)

(Fig 2)



(Fig 3)



(Fig 4)

(Fig 5)

(Fig 6)

Cut open gently through the ventral side lengthwise using a sharp scalpel or knife without damaging the muscle blocks on either side (Fig 5). The cut should not be too deep as this will lead to complete or partial separation of the lateral muscle blocks. Partial separation at a particular point could lead to a product with a condition commonly termed as "button hole". If the cut is too shallow the muscle blocks can show tear marks when opened. Both these conditions are commercially unacceptable.

Gently open up the cut surface to reveal the butterfly shape (Fig 6). The lateral muscle blocks should be symmetrical, undamaged and should be free of loose or hanging meat and should not show any haphazard cut-marks.

(Fig 7)

(Fig 8)

Arrange in PVC/polystyrene trays (Fig 7) and shrink wrap or pack in laminated pouches and vacuum. Blast freeze. Pack in boxes/master cartons as per buyer specifications. Store below –18°C. For block frozen product, arrange in freezing trays (Fig 8) for 1 – 1.8 kg blocks. Contact/ blast freeze, de-pan, glaze and wrap in polythene and pack in boxes/master cartons as per buyer specifications. Store below – 18°C.

PRODUCT: BUTTERFLY SHRIMP – TOP CUT

FLOW DIAGRAM

PRODUCT - 5

BUTTERFLY SHRIMP – BOTTOM (BELLY) CUT

PRODUCT : BUTTERFLY SHRIMP-BOTTOM CUT

PRODUCT DESCRIPTION : Headless peeled shrimp, cut open from the belly side (ventrally) to separate the lateral muscle blocks. Unlike in the case of top (dorsal) cut shrimp, the shrimp is peeled completely, including the tail fans. However, some may prefer to keep the tail fans unpeeled, The final product will have a somewhat triangular appearance.

Raw material : Black tiger and *Vannamei* shrimps

Size grades : 16/20 to 31/40 counts

Commercial pack sizes : 250-350 gm tray packs, 1 kg or 2 lb polythene bags

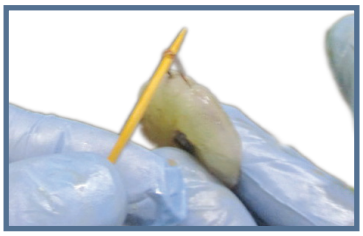
Major markets : Japan and USA

Product requirements : shrimp with "button-holes" should not exceed more than 3 – 5% by weight. The lateral muscle blocks should be symmetrical, undamaged and should be free of loose or hanging meat. The muscle should not show any haphazard cut-marks.

PROCESSING AND PACKAGING

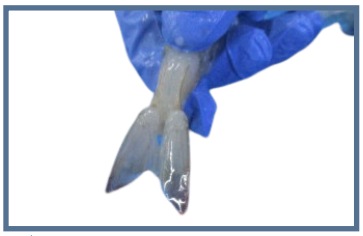
(Fig 1)

(Fig 2)

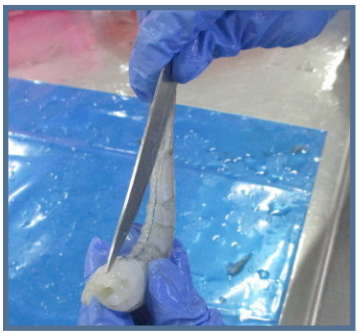


(Fig 3)

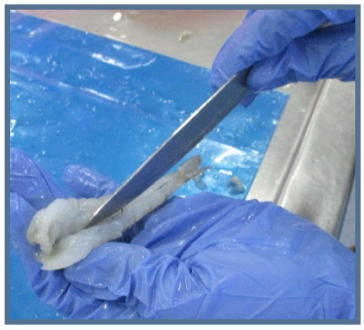
(Fig 4)



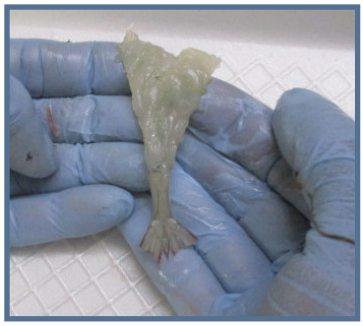
Remove the telson (Fig 1). Peel the shrimp completely including the tail fans (Fig 2) and de-vein (Fig 3). Trim the tail fans using a pair of sharp scissors (Fig 4).



(Fig 5)



(Fig 6)



Cut open gently through the ventral side lengthwise using a sharp scalpel or knife without damaging the muscle blocks on either side (Fig 5). The cut should not be too deep as this will lead to complete or partial separation of the lateral muscle blocks. If the cut is too shallow the muscle block can show tear marks when opened. Both these conditions are commercially unacceptable. Gently open up the cut surface (Fig 6). The lateral muscle blocks should be symmetrical, undamaged and should be free of loose or hanging meat and should not show any haphazard cut-marks. The final product will have a somewhat triangular shape.

(Fig 7)

(Fig 8)

Arrange in PVC/Polystyrene trays (Fig 7) and shrink wrap or pack in laminated pouches and vacuum. Blast freeze and pack in boxes/master cartons as per buyer specifications. Store below –18°C. For block frozen product, arrange in freezing trays (Fig 8) or 1kg or 2 lb blocks. Contact/ blast freeze, de-pan, glaze and wrap in polythene and pack in boxes/master cartons as per buyer specifications. Store below –18°C.

PRODUCT: BUTTERFLY SHRIMP-BOTTOM CUT

FLOW DIAGRAM

PRODUCT - 6

BUTTERFLY "SUSHI" SHRIMP

PRODUCT : BUTTERFLY "SUSHI" SHRIMP

PRODUCT DESCRIPTION	:	Headless peeled shrimp, blanched/lightly cooked and cut open ventrally to partially separate the lateral muscle blocks. Unlike in butterfly shrimp, the complete length of the shrimp is peeled and cut open. Blanching gives the surface of the shrimp a reddish orange colour.
Raw material	:	Black tiger and *vannamei* shrimp
Sizes grades	:	21/30 – 51/60 counts
Commercial pack sizes	:	250 – 350 gm tray packs
Major markets	:	Japan and USA

PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)

(Fig 3)

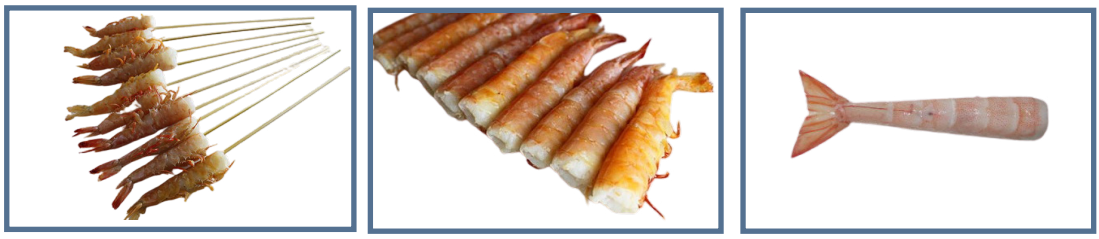
Remove telson and de-vein (Fig 1). Insert bamboo skewer along the dorsal side lengthwise up to the last segment so as to stretch the shrimp completely (Fig 2 and 3). This will avoid curling of the shrimp during subsequent cooking.

Blanch (or mechanically steam cook) for 60 -120 seconds in boiling water containing 1% salt w/w (Fig 4): smaller sizes (31/40 and over) may require about 60 seconds while larger sizes (16/20 and below) may need longer duration. Transfer the cooked shrimp immediately into potable chilled water. Ensure the ice used is made of good quality potable water (Fig 5).

(Fig 4)

(Fig 5)

Peel the cooked shrimp completely, including the tail fans (Fig 6). Cut gently down the ventral side lengthwise up to the last segment using a sharp scalpel or knife without damaging the lateral muscle blocks on either side (Fig 7). The cut should not be too deep as this will lead to complete or partial separation of the lateral muscle blocks.

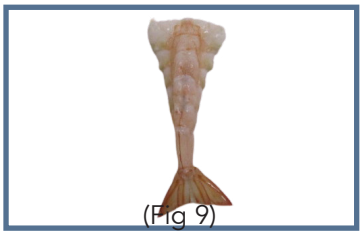


(Fig 6)

Gently open up the cut surface (Fig 8). Arrange in Polystyrene/PVC trays, cut surface down (Fig 9) and the reddish colour skin surface up. Arrange as per buyer specifications.

(Fig 7)

(Fig 8)



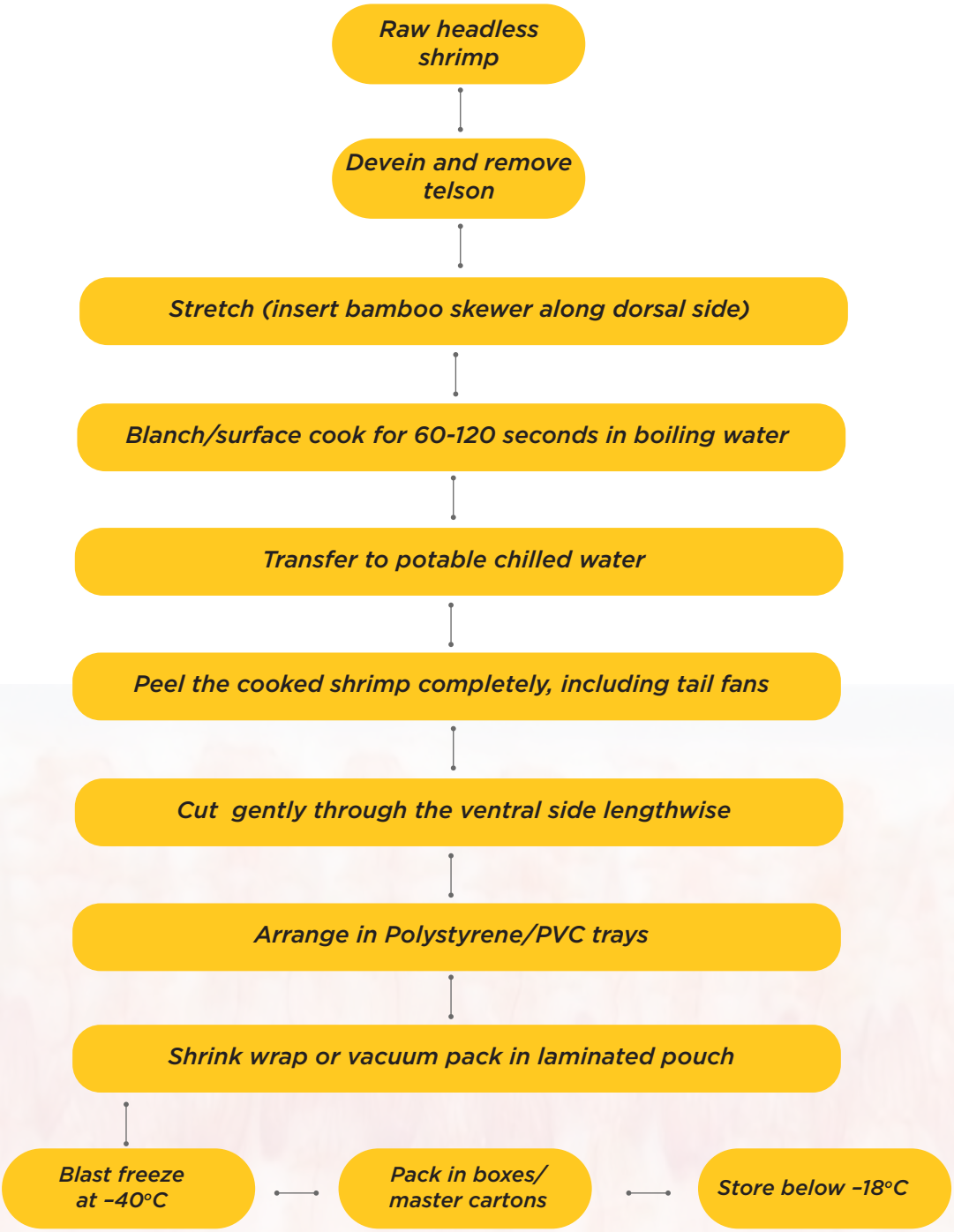
(Fig 9)

(Fig 10)

Shrink wrap or vacuum pack (avoid excessive vacuuming) in laminated pouches (Fig 10) and blast freeze. Pack in boxes/master cartons as per buyer specifications. Store below – 18°C.

PRODUCT : BUTTERFLY "SUSHI" SHRIMP

FLOW DIAGRAM



Automatic batch cooker
(Carnitech A/S)

Cooking and chilling equipment
(Polar Systems, UK)

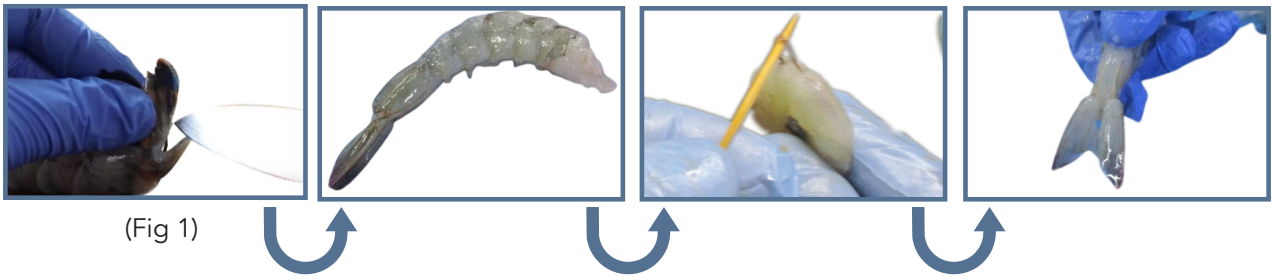
PRODUCT - 7

STRETCHED SHRIMP "NOBASHI EBI"

PRODUCT : STRETCHED SHRIMP OR "NOBASHI EBI" (Japan)

PRODUCT DESCRIPTION	:	Headless peeled shrimp, stretched lengthwise by making several transverse cuts on the belly side and applying slight pressure using a mould. Product may be subsequently processed into breaded (tempura) Nobashi.
Raw material	:	Black tiger and *vannamei* shrimp
Sizes grades	:	21/30 – 41/60 counts
Commercial pack sizes	:	250 – 350 gm tray packs
Major markets	:	Japan and USA

PROCESSING AND PACKAGING



(Fig 1)

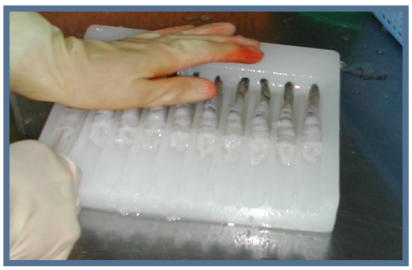
Remove the telson. Peel the shrimp leaving the shell intact on the last tail segment and the tail fans and de-vein. Trim the tail fans using a pair of sharp scissors (Fig 1).

(Fig 2)

(Fig 3)

Make three or four parallel cuts, across or diagonally (Fig 2) on the ventral side. The cuts should not be too deep and should not exceed about 2/3 the thickness of the meat (Fig 3). Deeper cuts could lead to breaking of the tail meat during subsequent stretching. Cuts could be made using

a sharp razor or a combination razor. If you use a combination razor you have to lay the shrimp in a plastic drain type mold, stretch the shrimp by pinning it down using fingers and then use the combination razor.



(Fig 4)

(Fig 5)

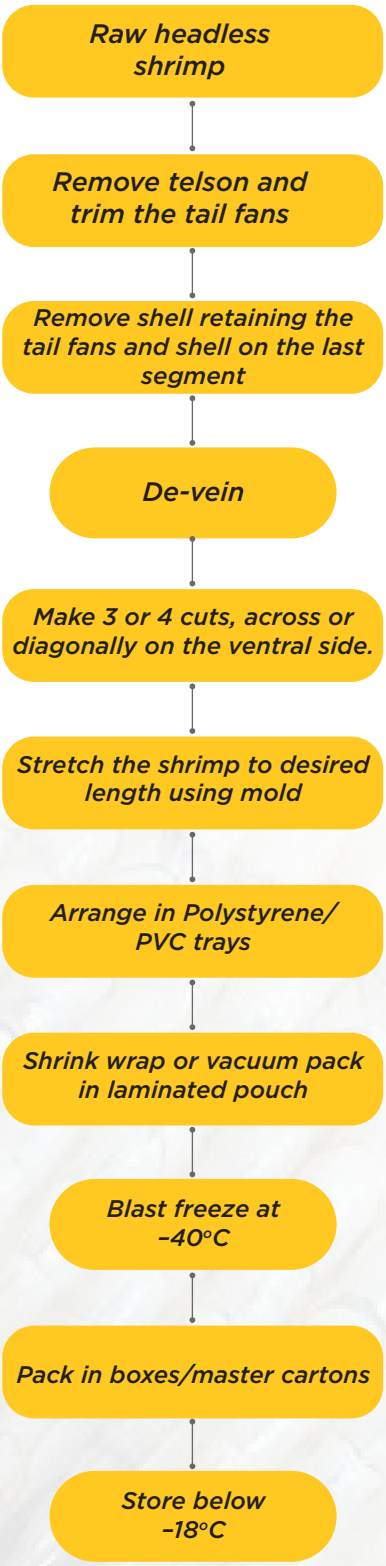
Stretch the shrimp to desired length using a stainless steel or plastic (food grade) mold. The shrimp is placed on a cutting board or a suitable clean surface and the mold is placed over the shrimp and gently pressed (Fig 4). The mold should suit the size of the shrimp, if the mold is smaller than ideal size, the flesh gets unduly squashed and damaged leading to possible quality deterioration during storage. If the mold is too big, the desired stretching effect cannot be achieved. Stretching can add around an extra 20 – 30 % to the length of the shrimp (Fig 5)

(Fig 6)

Arrange in Polystyrene/PVC trays, preferably in ("well") molded trays (Fig 6). Shrimp wrap or vacuum pack in laminated pouches and blast freeze. Pack in boxes/master cartons as per buyer specifications. Store below -18°C.

PRODUCT: STRETCHED SHRIMP OR "NOBASHI EBI" (Japan)

FLOW DIAGRAM



PRODUCT - 8

BREADED "NOBASHI"

PRODUCT : BREADED NOBASHI

PRODUCT DESCRIPTION	:	Nobashi (stretched shrimp) covered in batter/breading material. The colour and thickness of the breading is as per buyer specifications. For tempura type of Nobashi for the Japanese market, a special self raising tempura type batter has to be used.
Raw material	:	Nobashi (stretched shrimp) made by using Black tiger or *vannamei* shrimp.
Sizes grades	:	31/40 counts (original size)
Commercial pack sizes	:	250 – 350 gm tray packs
Major markets	:	Japan and USA

PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)

(Fig 3)

Stretched (Nobashi) a thin layer of pre-dust (Fig 1). Mechanical or manual operations may be used for this purpose. It is advisable to use a standard commercial formula to ensure product quality and uniformity. In the manual operation the shrimp is gently rolled on a bed of pre-dust contained in a tray.

After applying pre-dust the shrimp is dipped in batter (Fig 2). For tempura type of Nobashi the Japanese market, a special self-raising tempura type batter has to be used.

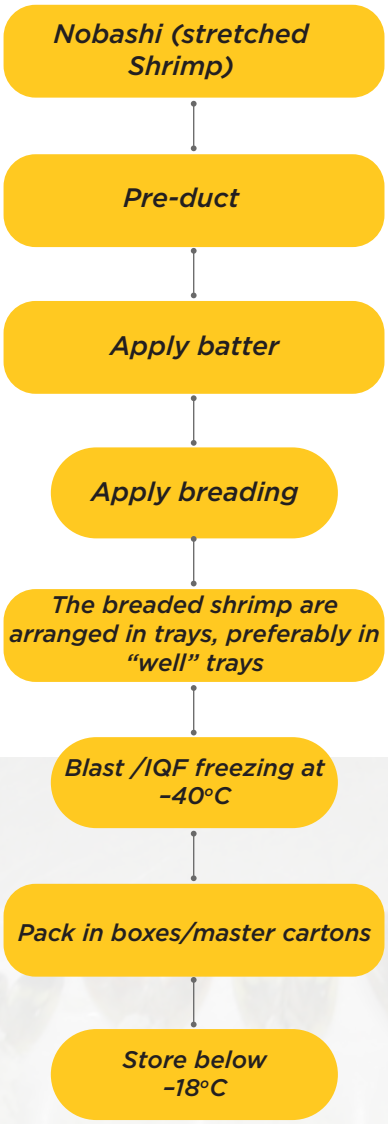
(Fig 4)

After applying batter, the shrimp is coated with breading (Fig 3). The type of breading to be used depends on buyer specifications. Most commonly used are the Japanese style lightly coloured large particle sized crumbs. Darker coloured crumbs (yellow-orange) are being used for European and US markets.

Arrange in Polystyrene/PVC trays, preferably in ("well") molded trays alternating the direction of layering the individual shrimp (Fig 4), Shrink wrap or vacuum pack in laminated pouches and blast freeze. Pack in boxes/master cartons as per buyer specifications. Store below -18°C.

PRODUCT: BREADED NOBASHI

FLOW DIAGRAM



BREADING EQUIPMENT

Battering and breading line
(Barsso, Belgium)

Automatic pre-duster
(Scotraco B.V. The Netherlands)

PRODUCT - 9

SHRIMP SINGLE KEBAB

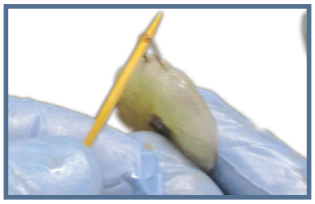
PRODUCT : SHRIMP SINGLE KEBAB

PRODUCT DESCRIPTION	:	A single, headless peeled shrimp presented on a skewer. The product is normally grilled for consumption.
Raw material	:	Black tiger or *vannamei* shrimp
Size grades	:	16/20 and 21/25 counts
Commercial packs	:	300 – 500 gm tray pack
Major markets	:	Japan and USA

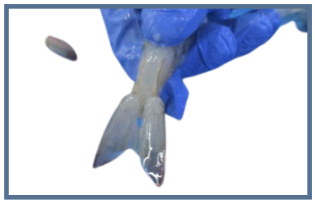
PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)



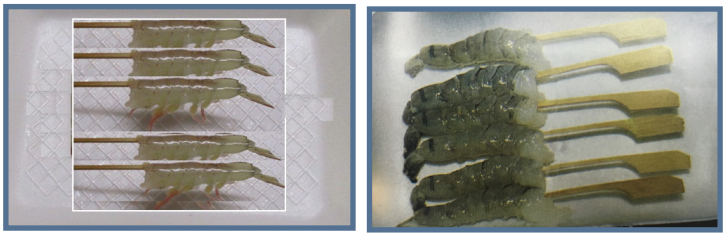
(Fig 3)



(Fig 4)

Wash shrimp in potable chilled water. Remove telson and peel completely including the tail fans (Fig 1 and 2). Shrimp are now de-veined, tail fans trimmed. (Fig 3 and 4), and washed in chilled water.

(Fig 5)

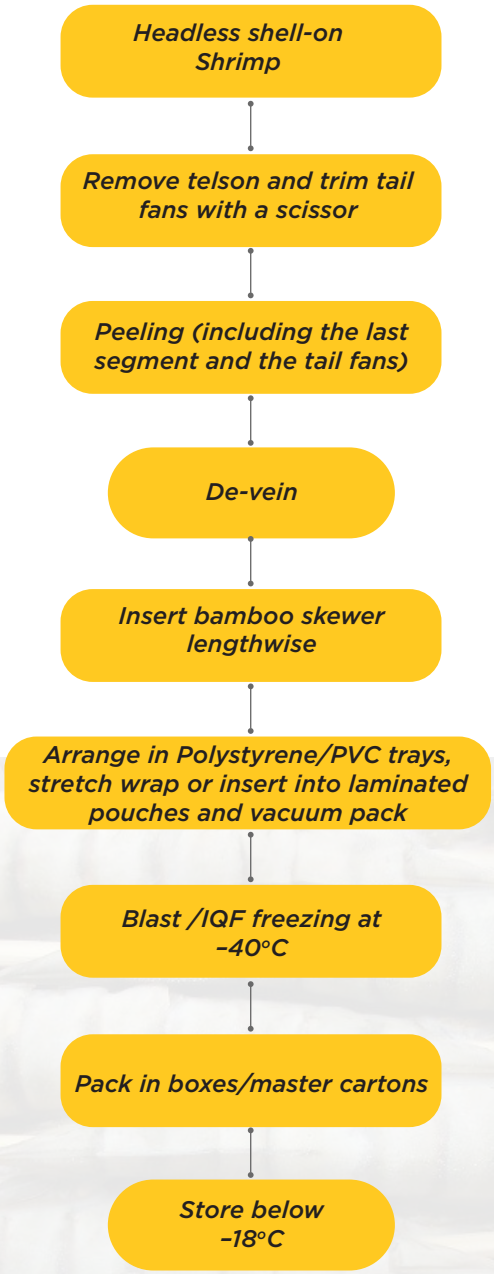


(Fig 6)

Insert a bamboo skewer (pin or fan shape as per buyer specifications) along the dorsal side lengthwise up to the last segment so as to stretch the shrimp completely (Fig 5). Arrange in Polystyrene/PVC trays, stretch wrap or pack in laminated pouches, vacuum and contact/blast freeze (Fig 6). Pack in boxes/master cartons as per buyer specifications. Store below -18°C.

PRODUCT: SHRIMP SINGLE KEBAB

FLOW DIAGRAM



PRODUCT - 10

SEAFOOD KEBAB

PRODUCT : SEAFOOD KEBAB

PRODUCT DESCRIPTION : Diced vegetables and one or more seafood arranged on a skewer. Vegetables normally used are carrots, onions and capsicum, while the seafood used are shrimp, cuttlefish (pine-cut), squid etc.

Raw material : Small size shrimp, small pine-cut cuttlefish, diced carrots, onion and capsicum

Commercial pack sizes : 400-500 gm tray packs, 1 kg or 2 lb poly bags

Major markets : Japan and USA

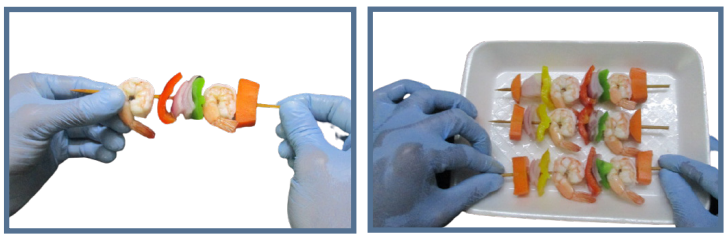
PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)

(Fig 3)

(Fig 4)



(Fig 5)

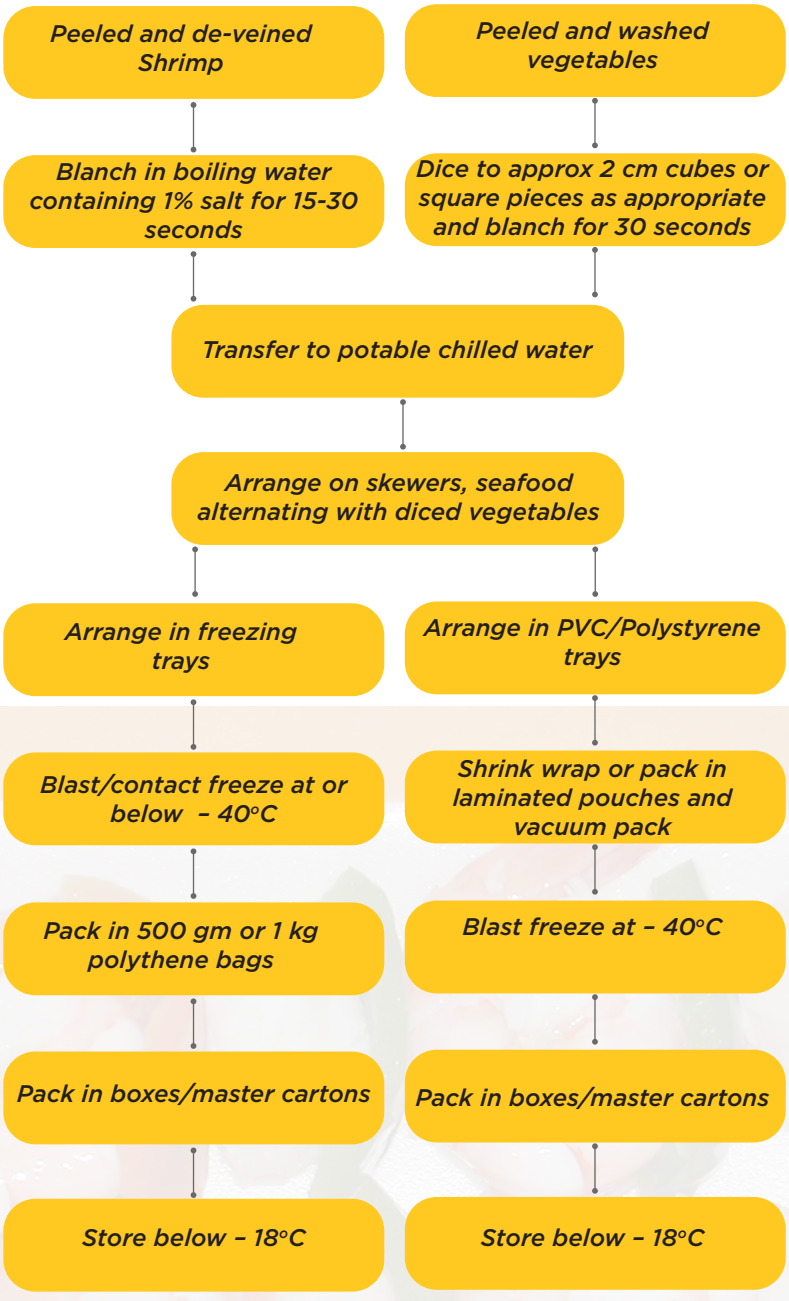
Peeled and de-veined shrimp are blanched in boiling water containing 1% salt for 15-30 seconds (Fig 1). Vegetables are washed in potable water and diced to approximately 2 cm cubes or cut into square pieces as appropriate and blanched for 30 – 60 seconds (Fig 2). Transfer to chilled potable water (Figs 3 & 4).

(Fig 6)

Arrange on the skewer, seafood alternating with diced vegetables or as per buyer specifications (Fig 5). Arrange in freezer trays and blast/contact freeze. For consumer packs, arrange in PVC/ Polystyrene trays, stretch wrap or pack in laminated pouches, vacuum and blast freeze, Packed in 500gm or 1kg or 2 lb weight in poly bags or 400-500gm tray packs. Pack in boxes/master cartons as per buyer specifications (Fig 6). Store below -18°C.

PRODUCT : SEAFOOD KEBAB

FLOW DIAGRAM



PRODUCT - 11

CUTTLE FISH – PINE CUT & SHELL CUT

PRODUCT: CUTTLE FISH – PINE CUT & SHELL CUT

PRODUCT DESCRIPTION : Blanched fillets of small cuttlefish. The fillet, with crisscrossing superficial cuts, curls take on a pineapple-like appearance when blanched and hence the name Pine-cut. Also known as "Matsukasa" in Japanese.

Raw material : Cuttlefish fillet (Small size)

Size grades : 25-35 pieces/kg

Commercial pack sizes : 250-350 gm tray packs

Major markets : Japan

PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)

(Fig 3)

(Fig 4)

Remove head and viscera and wash the cuttlefish fillets well in potable water (Fig 1). Skin the animal starting from the tapered end (Fig 2). Remove the belly tissues and the wings, and wash well in chilled potable water (Fig 3).

Make slanted, superficial diagonal cuts, parallel to the lateral margins of the fillet with a sharp razor blade, about 5-6 mms apart (Fig 4). If cuts are made parallel to only one margin the end product will have the "shell cut" (Fig 5) whereas if the cuts are made parallel to both the lateral margins, they will crisscross the fillet, giving the end product a "pine-cut appearance" (Fig 6).

(Fig 5)

(Fig 6)

(Fig 7)

The cut fillets are transferred to boiling water containing 1% salt and blanched for about 15-30 seconds. Depending on the size of the fillet, some need slightly more time than smaller ones. During blanching the fillets will curl up, while the cuts open up, giving a somewhat shell shape or pineapple shape appearance to the product. Transfer the product to potable chilled water.

Arrange in freezer trays and blast/contact freeze or arrange in PVC/Polystyrene trays, stretch wrap or pack in laminated pouches, vacuum pack and blast freeze. Pack in 500gm or 1 kg polythene bags or 400-500gm tray packs (Fig 7). Pack in boxes/master cartons as per buyer specifications. Store below – 18°C.

PRODUCT: CUTTLE FISH – PINE CUT

FLOW DIAGRAM

PRODUCT - 12

STUFFED CRAB

PRODUCT : STUFFED CRAB

PRODUCT DESCRIPTION	:	Raw crab shells or boiled/heat treated crab shells with reddish/ orange colour may be used as per buyer specifications.
Raw material	:	Whole crab (*Portunus, Charybdis* or any other species)
Size grades	:	As per buyer specifications
Commercial pack sizes	:	3-6 pieces or more per tray : 250-500 gm/tray
Major markets	:	Japan

PROCESSING AND PACKING

(Fig 1)

Wash the crab well with chilled potable water. Gently remove the carapace from behind by lifting the tail flaps upwards, exposing the gills and the viscera. (Fig 1). Wash the crab in chilled water, remove the visceral mass and wash again. Remove the gills by pulling them upward and outward or cutting them off with a scissor. Cut/break the claws and the legs off the body and keep them aside for meat extraction later on (Fig 2).

(Fig 2) (Fig 3) (Fig 4)

Portion the crab into two on the mid line using a sharp knife (Fig 3) and wash the crab portions well in chilled potable water. Remove the body meat into a clean vessel by gently pressing the membrane covering the meat with fingers (Fig 4). Alternatively, a small scoop may be used for the purpose. Care must be taken to avoid contaminating the meat with broken pieces of shell, membranous septa etc. Keep the meat in chilled storage.

(Fig 5)

The claws/legs are washed well and opened up along the length using a pair of scissors or a special type of cracker used for the purpose (similar to a nut-cracker) (Fig 5). Meat from claws and legs may be picked using a needle/pincer. The claw/leg meat is stored well chilled, separately from body meat (Fig 6).

(Fig 6)

(Fig 7)

Crab shells are cleaned of all meat adhering to the interior of the shell and washed well with potable water and allowed to dry. The shells may be stored in cold storage in this condition for future use. Alternatively, the cleaned shells may be boiled in water for few seconds to impart a reddish/orange colour to them.

Mix the crab meat uniformly with about 1-2 percent of a suitable binder (normally a starch-based binder such as a commercial batter mix). The bottom of the shell is layered with more reddish/ orange coloured claw/leg meat, followed by top filler layers of white coloured body meat (Fig 7)

(Fig 8)

Arrange stuffed crabs in polystyrene/paper board packing trays, stuffed side up (Fig 8). Depending on the size of the shell, the trays may be packed with 3-6 or more pieces per 250-500gm tray. Stretch wrap/shrink wrap or vacuum pack in laminated pouches. Plate/blast freeze and pack in boxes/master cartons as per buyer specifications. Store below – 18°C.

PRODUCT: STUFFED CRAB

FLOW DIAGRAM

PRODUCT - 13

STUFFED CRAB CLAWS *(CRAB BALLS)*

PRODUCT : STUFFED CRAB CLAWS (CRAB BALLS)

Product description	Crab claws stuffed with body and claw/leg meat of crab.
Raw material	Whole crab (Portunus, Charybdis or any other species)
Size grades	As per buyer specifications
Commercial pack sizes	3-6 pieces or more per tray : 250-500 gm/tray
Major markets	Japan

PROCESSING AND PACKAGING

(Fig 1)

(Fig 2)

Crab claws or swimming legs of crab may be used for this purpose. Crab claws are severed from the body and washed well in chilled potable water. The last (distal) segment carrying the pincers is used in processing (Fig 1). The hard shell of this segment is cut open using a pair of scissors or cracked open using a cracker and shell removed leaving the cartilaginous septa (which provides mechanical support and holds the meat) and muscle intact (Fig 2).

(Fig 3)

(Fig 4)

Crab body/leg meat, recovered as per the guidelines given under the product “stuffed crab” (Page 43) is used to stuff the claws (Fig 3). The meat is mixed with 1-2 percent binder (generally starch based commercial batter mix) and the meat is stuffed on the exposed end of the claw (Fig 4). This may be carried out in two stages, the claw being stuffed partially initially, after which the semi-finished product is frozen solid overnight. The finishing layers of meat are built on the already frozen semi-finished product. The stuffed crab claws can be battered and breaded as per buyer Specifications (Fig 5).

(Fig 5)

Arrange the stuffed claws in polystyrene/paper board packing trays. Depending on the unit size of the finished product, the trays may be packed with 3 to 6 or more pieces per 250 - 500 gm tray (Fig 5). Stretch wrap/shrink wrap or vacuum pack in laminated pouches. Plate/blast freeze and pack in boxes/master cartons as per buyer specifications. Store below -18°C.

PRODUCT: STUFFED CRAB CLAWS

FLOW DIAGRAM

PRODUCT - 14

RIBBON FISH – HEADLESS, TAIL-OFF

PRODUCT : RIBBON FISH – HEADLESS, TAIL-OFF

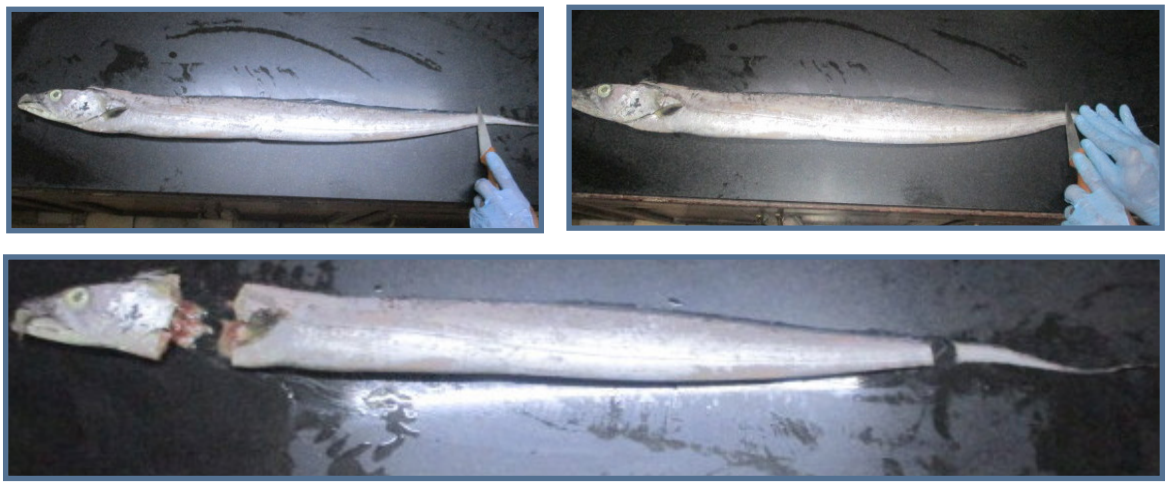
Product description : Ribbonfish, without the head, the tail and terminal part of the trunk. The fish is gutted and wrapped in polythene sheet or packed in tubular polythene

Raw material : Ribbonfish *(Lepturacanthus savala)*

Size grades : 300-500 gm per piece

Pack sizes : 10 kg master cartons

Major markets : China and Japan



(Fig 1)

Remove pectoral fins, and head with straight transverse cut at a point about 1-2 cm behind the gill covers. Similarly, the tail and part of the trunk at a point where the trunk tapers to a width of about 3 cm (Fig 1).

(Fig 2)

(Fig 3)

Remove the gut from the abdominal cavity, without opening up the belly area (Fig 2). A transverse cut of about 1 cm just before the anal opening will sever its attachment to the anal area, thus facilitating the complete removal of the gut in one piece.

Trim the ventral and dorsal sheaths of the fins (Fig 3). Wash the fish well in chilled potable water. Special attention should be given to the belly cavity. A mild jet of water and a soft brush could be used to clean any gut contents, blood and gastric juices contaminating the belly cavity.

(Fig 4)

(Fig 5)

Drain and wrap in polythene or insert into cuts of tubular polythene (Fig 4). Arrange in freezer trays and blast freeze, also packed as skin-on chunks (Fig 5). Pack in master cartons. Store below -18°C.

PRODUCT : RIBBON FISH – HEADLESS, TAIL-OFF

FLOW DIAGRAM

PRODUCT - 15

FISH CUBE

PRODUCT FISH CUBE (BLOCKS)

Product description : Approximately 60-80 gm triangular blocks of fish flesh. The blocks are made of skinless, boneless fillet or strips of fish flesh and any loose meat produced during processing of species such as ribbon fish, tongue sole, snapper etc. Fish of small size, unsuitable for producing high grade fillet are normally used for the purpose.

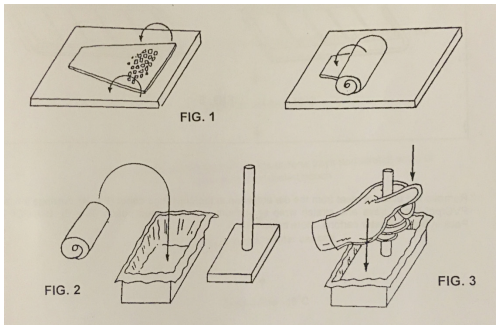
Raw material : Fillets from small sized fish and processed meat of tongue sole *(Cynoglossus lingua)*, Ribbonfish *(Lepturacanthus savala)*, snapper spp. *(Lutjanidae)* etc

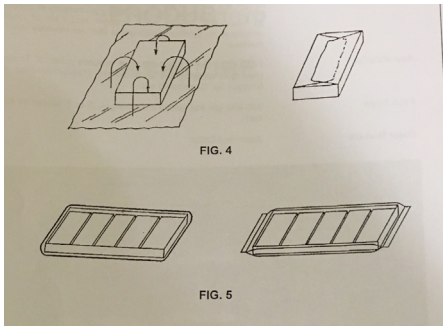
Pack sizes : 300-400 gm tray packs containing 4, 5 or 6 blocks of 60-80 gm each.

Major markets : Japan and China

PROCESSING AND PACKAGING

Weigh out the desired quantity of fillet and loose meat. Lay the fillet on a plastic cutting board and roll it up with the loose meat sandwiched in the fillet (Fig 1). Stuff the meat into the die, line with polythene sheet of approximately 16 cm x 10 cm. Use a stainless steel metal die of approximately 6 cm x 4 cm dimension (Fig 2). Press the meat in the die with the lid of the die (Fig 3).

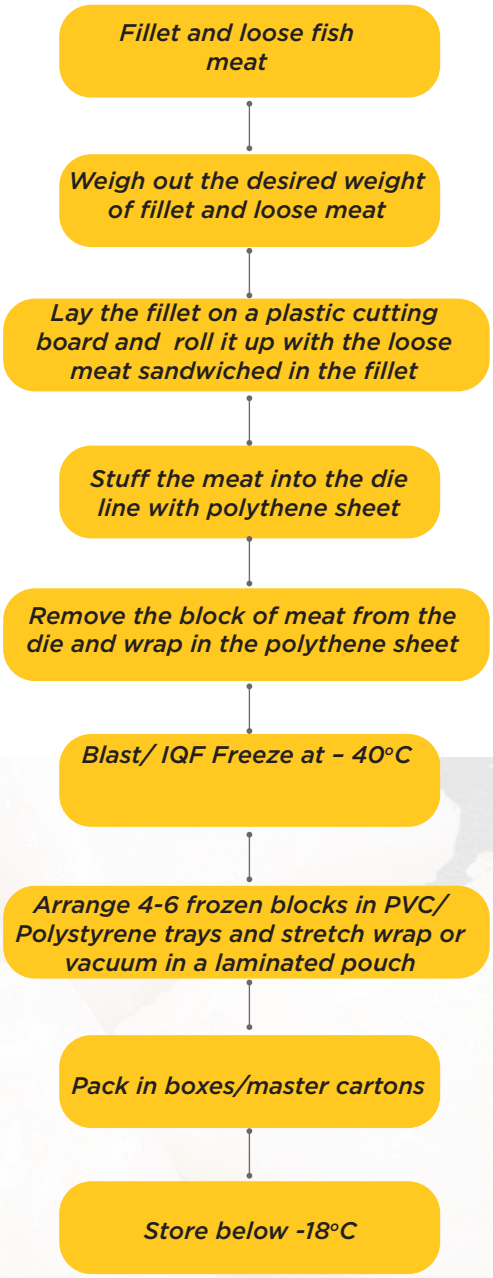




Remove the block of meat from the die and wrap in the polythene sheet (Fig 4). Arrange 4 to 6 blocks in PCV/Polystyrene trays and stretch wrap or vacuum pack in a laminated pouch (Fig 5). Blast/IQF freeze. Pack in boxes/master cartons. Store below –18°C.

PRODUCT FISH CUBE (BLOCKS)

FLOW DIAGRAM



Manufacturers and Suppliers

3.1 Manufacturers and suppliers of processing machineries and equipments Suppliers and manufacturers of handling and processing machineries and equipments

MANUFACTURERS AND SUPPLIERS OF EQUIPMENT AND INGREDIENTS

3.1 Manufacturers and suppliers of processing machineries and equipments Suppliers and manufacturers of handling and processing machineries and equipments

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EXPORTABLE MARINE FISHES OF SOUTH & SOUTHEAST ASIA

Latin Name	Common Name	Fresh/Frozen	Preserved/Cured	Canned	Surimi/others
Fin Fish					
Anguilla spp	Freshwater eel	+			
Argyrops spinifer	Red bream	+	+		
Chirocentrus dorab	Wolf herring	+	+		
Chorinemus lysan	Leather skin	+	+		
Conger cinereus	Conger eel	+			
Cynoglossus lingua	Tongue sole	+			
Epinephelus lanceolatus	Grouper	+	+		
Harpodon nehereus	Bombay duck		+		
Hilsa spp	River & sea shads	+	+		
Johnius spp	Croakers	+	+		+
Katsuwonus pelamis	Skipjack	+	+	+	
Lutianus spp	Snappers	+	+		
Mugil cephalus	Mullet	+	+		
Muraenesox talabonoides	Golden conger eel	+			
Nemipterus japonicus	Threadfin bream	+	+		+
Otolithes spp	Jew fishes	+	+		
Parastromateus niger	Black pomfret	+			
Polynemus indicus	Indian Salmon	+			
Psenes indicus	Butter fish	+	+		
Psettodes erumei	Indian halibut	+			
Saurida tumbil	Lizard fish	+	+		
Scomberomorous spp	Spanish mackerels	+	+		
Sillago domina	Lady fish	+	+		
Sphyraena jello	Barracuda	+	+		
Stromateus chinensis	Chinese pomfret	+			
Stromateus cinereus	Silver pomfret	+			
Tachysurus spp	Sea Catfishes	+	+		
Thunnus albacares	Yellowfin tuna	+	+	+	
Thunnus obesus	Big eye tuna	+		+	
Trichiurus savala	Ribbon fish	+	+		+
Upeneus sulphureus	Red mullet	+	+		

Latin Name	Common Name	Fresh/Frozen	Preserved/Cured	Canned	Surimi/others
Crustacea					
Penaeus monodon	Black tiger	+			
Penaeus semisulcatus	Flower shrimp	+	+	+	
Penaeus indicus	White shrimp	+	+	+	
Parapaeneus sculptilis	Cat tiger	+	+	+	
Metapenaeus dobsoni	Brown shrimp	+	+	+	
Metapenaeus monoceros	Brown shrimp	+	+	+	
Macrobrachium rosenbergii	Freshwater prawn	+	+	+	
Litopenaeus vannamei	Pacific white shrimp	+			
Thenus orientalis	Sand lobster	+			
Panulirus spp	Spiny lobster	+			
Puerulus spp	Deep-sea lobster	+			
Scylla serrata	Mud crab	+			
Portunus spp	Sea crab	+		+	
Molluscs					
Sepia spp	Cuttlefish	+	+	+	
Loligo spp	Squid	+	+	+	
Octopus spp	Octopus	+			
Katelysia opima	Clam	+	+	+	
Anadara granosa	Blood clam	+	+	+	
Crassostrea madrasensis	Oyster	+	+	+	
Mytilus viridis	Green mussel	+	+	+	
Meretrix meretrix	Clam	+	+	+	
Villorita cyprinoides	Clam	+	+	+	
Achatina fulica	Giant African snail	+	+	+	
Others					
Rhopilema spp	Jelly fishes		+		
Holothuria spp	Sea cucumber		+		
Tripneustes spp	Sea urchin		+		

APPENDIX I

Current Good Manufacturing Practice in Manufacturing, Processing, Packing or Holding Human Food

Source : Reference Manual. Plant and Personal Hygiene and Sanitation Training Program, Southeast Asia Seafood Processing industry, July 15-16, 1998, Dhaka, Bangladesh. Presented by Joseph W Slavin & Associates.

Current Good Manufacturing Practice in Manufacturing, Processing, Packing or Holding Human Food

21 CFR PART 110

SUBPART A - GENERAL PROVISIONS

SUBPART B - BUILDINGS AND FACILITIES

SUBPART C- EQUIPMENT

SUBPART D – (Reserved)

SUBPART E – PRODUCTION AND PROCESS CONTROLS

SUBPART A - GENERAL PROVISIONS

110.3 Definitions

The definitions and interpretations of terms in section 201 of the Federal Food, Drug and Cosmetic Act (the act) are applicable to such terms when used in this part. The following definitions shall also apply.

(a) " Acid foods or acidified foods" means food that have an equilibrium pH of 4.6 or below

(b) "Adequate" means that which is needed to accomplish the intended purpose in keeping with good public health practice.

(c) "Batter" means a semi-fluid substance, usually composed of flour and other ingredients, into which principal components of food are dipped or with which they are coated, or which may be used directly to form bakery foods.

(d) "Blanching", except for tree nuts and peanuts, means a pre-packing heat treatment of food stuffs for a sufficient time and at a sufficient temperature to partially or completely inactive the naturally occurring enzymes and to effect other physical or biochemical changes in the food.

(e) "Critical control point" means a point in a food process where there is a high probability that improper control may cause, allow or contribute to a hazard or to filth in the final food or decomposition of the final food.

(f) "Food" means food a defined in section 201(f) of the act and includes raw materials and ingredients.

(g) " Food –contact surfaces" are those surfaces that contact human food and those surfaces from which drainage onto the food or onto surfaces that contact the food ordinarily occurs during the normal course of operations. "Food-contact surfaces" includes utensils and food-contact surfaces of equipment.

(h) "Lot" means the food produced during a period of time indicated by a specific code.

(i) "Microorganisms" means yeasts, molds, bacteria, and viruses and includes, but is not limited to, species having public health significance. The term "undesirable microorganisms" includes those microorganisms that are of public health significance, that subject food to decomposition, that indicate that food is contaminated with filth, or that otherwise may cause food to be adulterated within the meaning of the act. Occasionally in these regulations, FDA used the adjective "microbial" instead of using an adjectival phrase containing the word microorganism.

(j) "Pest" refers to any objectionable animals or insects including, but not limited to, birds, rodents, flies, and larvae.

(k) "Plant" means the building or facility or parts thereof, used for or in connection with the manufacturing, packaging, labeling, or holding of human food.

(l) "Quality control operation" means a planned and systematic procedure for taking all actions necessary to prevent food from being adulterated within the meaning of the act.

(m) "Rework" means clean, unadulterated food that has been removed from processing for reasons other than insanitary conditions or that has been successfully reconditioned by reprocessing and that is suitable for use as food.

(n) "Safe-moisture" level is a level of moisture low enough to prevent the growth of undesirable microorganisms in the finished product under the intended conditions of manufacturing, storage, and distribution. The maximum safe moisture level for a food is based on its water activity (aw). An aw will be considered safe for a food if adequate data are available that demonstrate that the food at or below the given aw will not support the growth of undesirable microorganisms.

(o) "Sanitize" means to adequately treat food-contact surfaces by a process that is effective in destroying vegetative cells of microorganisms of public health significance, and in substantially reducing numbers of other undesirable microorganisms, but without adversely affecting the product or its safety for the consumer.

(p) "Shall" is used to state mandatory requirements.

q) “Should” is used to state recommended or advisory procedures or identify recommended equipment.

(r) “Water activity” (aw) is a measure of the free moisture in a food and is the quotient of the water vapor pressure of the substance divided by the vapor pressure of pure water at the same temperature.

Sec. 110.5 Current good manufacturing practice.

(a) The criteria and definitions in this part shall apply in determining whether a food is adulterated (1) within the meaning of section 402(a)(3) of the act in that the food has been manufactured under such conditions that it is unfit for food; or (2) within the meaning of section 402(a)(4) of the act in that the food has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health. The criteria and definitions in this part also apply in determining whether a food is in violation of section 361 of the Public Health Service Act (42 U.S.C. 264).

(b) Food covered by specific current good manufacturing practice regulations also is subject to the requirements of those regulations.

Sec. 110.10 Personnel.

The plant management shall take all reasonable measures and precautions to ensure the following:

(a) Disease control. Any person who, by medical examination or supervisory observation, is shown to have, or appears to have, an illness, open lesion, including boils, sores, or infected wounds, or any other abnormal source of microbial contamination by which there is a reasonable possibility of food, food-contact surfaces, or food-packaging materials becoming contaminated, shall be excluded from any operations which may be expected to result in such contamination until the condition is corrected. Personnel shall be instructed to report such health conditions to their supervisors.

(b) Cleanliness. All persons working in direct contact with food, food-contact surfaces, and food-packaging materials shall conform to hygienic practices while on duty to the extent necessary to protect against contamination of food. The methods for maintaining cleanliness include, but are not limited to:

(1) Wearing outer garments suitable to the operation in a manner that protects against the contamination of food, food-contact surfaces, or food-packaging materials.

(2) Maintaining adequate personal cleanliness.

(3) Washing hands thoroughly (and sanitizing if necessary to protect against contamination with undesirable microorganisms) in an adequate hand-washing facility before starting work, after each absence from the work station, and at any other time when the hands may have become soiled or contaminated.

(4) Removing all unsecured jewelry and other objects that might fall into food, equipment, or containers, and removing hand jewelry that cannot be adequately sanitized during periods in which food is manipulated by hand. If such hand jewelry cannot be removed, it may be covered by material which can be maintained in an intact, clean, and sanitary condition and which effectively protects against the contamination by these objects of the food, food-contact surfaces, or food-packaging materials.

(5) Maintaining gloves, if they are used in food handling, in an intact, clean, and sanitary condition. The gloves should be of an impermeable material.

(6) Wearing, where appropriate, in an effective manner, hair nets, headbands, caps, beard covers, or other effective hair restraints.

(7) Storing clothing or other personal belongings in areas other than where food is exposed or where equipment or utensils are washed.

(8) Confining the following to areas other than where food may be exposed or where equipment or utensils are washed: eating food, chewing gum, drinking beverages, or using tobacco.

(9) Taking any other necessary precautions to protect against contamination of food, food-contact surfaces, or food-packaging materials with microorganisms or foreign substances including, but not limited to, perspiration, hair, cosmetics, tobacco, chemicals, and medicines applied to the skin.

(c) Education and training. Personnel responsible for identifying sanitation failures or food contamination should have a background of education or experience, or a combination thereof, to provide a level of competency necessary for production of clean and safe food. Food handlers and supervisors should receive appropriate training in proper food handling techniques and food-protection principles and should be informed of the danger of poor personal hygiene and insanitary practices.

a) Supervision. Responsibility for assuring compliance by all personnel with all requirements of this part shall be clearly assigned to competent supervisory personnel.

[51 FR 22475, June 19, 1986, as amended at 54 FR 24892, June 12, 1989]

Sec. 110.19 Exclusions.

(a) The following operations are not subject to this part: Establishments engaged solely in the harvesting, storage, or distribution of one or more "raw agricultural commodities," as defined in section 201(r) of the act, which are ordinarily cleaned, prepared, treated, or otherwise processed before being marketed to the consuming public.

(b) FDA, however, will issue special regulations if it is necessary to cover these excluded operations.

Subpart B--Buildings and Facilities

Sec. 110.20 Plant and grounds.

(a) Grounds. The grounds about a food plant under the control of the operator shall be kept in a condition that will protect against the contamination of food. The methods for adequate maintenance of grounds include, but are not limited to:

(1) Properly storing equipment, removing litter and waste, and cutting weeds or grass within the immediate vicinity of the plant buildings or structures that may constitute an attractant, breeding place, or harborage for pests.

(2) Maintaining roads, yards, and parking lots so that they do not constitute a source of contamination in areas where food is exposed.

(3) Adequately draining areas that may contribute contamination to food by seepage, foot-borne filth, or providing a breeding place for pests.

(4) Operating systems for waste treatment and disposal in an adequate manner so that they do not constitute a source of contamination in areas where food is exposed.

If the plant grounds are bordered by grounds not under the operator's control and not maintained in the manner described in paragraph (a) (1) through (3) of this section, care shall be exercised in the plant by inspection, extermination, or other means to exclude pests, dirt, and filth that may be a source of food contamination.

(b) Plant construction and design. Plant buildings and structures shall be suitable in size, construction, and design to facilitate maintenance and sanitary operations for food-manufacturing purposes. The plant and facilities shall:

(1) Provide sufficient space for such placement of equipment and storage of materials as is necessary for the maintenance of sanitary operations and the production of safe food.

(2) Permit the taking of proper precautions to reduce the potential for contamination of food, food-contact surfaces, or food-packaging materials with microorganisms, chemicals, filth, or other extraneous material. The potential for contamination may be reduced by adequate food safety controls and operating practices or effective design, including the separation of operations in which contamination is likely to occur, by one or more of the following means: location, time, partition, air flow, enclosed systems, or other effective means.

(3) (3) Permit the taking of proper precautions to protect food in outdoor bulk fermentation vessels by any effective means, including:

(i) Using protective coverings.

(ii) Controlling areas over and around the vessels to eliminate harborages for pests.

(iii) Checking on a regular basis for pests and pest infestation.

(iv) Skimming the fermentation vessels, as necessary.

(4) Be constructed in such a manner that floors, walls, and ceilings may be adequately cleaned and kept clean and kept in good repair; that drip or condensate from fixtures, ducts and pipes does not contaminate food, food-contact surfaces, or food-packaging materials; and that aisles or working spaces are provided between equipment and walls and are adequately unobstructed and of adequate width to permit employees to perform their duties and to protect against contaminating food or food-contact surfaces with clothing or personal contact.

(5) Provide adequate lighting in hand-washing areas, dressing and locker rooms, and toilet rooms and in all areas where food is examined, processed, or stored and where equipment or utensils are cleaned; and provide safety-type light bulbs, fixtures, skylights, or other glass suspended over exposed food in any step of preparation or otherwise protect against food contamination in case of glass breakage.

(6) Provide adequate ventilation or control equipment to minimize odors and vapors (including steam and noxious fumes) in areas where they may contaminate food; and locate and operate fans and other air-blowing equipment in a manner that minimizes the potential for contaminating food, food-packaging materials, and food-contact surfaces.

(7) Provide, where necessary, adequate screening or other protection against pests.

Sec. 110.35 Sanitary operations.

(a) General maintenance. Buildings, fixtures, and other physical facilities of the plant shall be maintained in a sanitary condition and shall be kept in repair sufficient to prevent food from becoming adulterated within the meaning of the act. Cleaning and sanitizing of utensils and equipment shall be conducted in a manner that protects against contamination of food, food-contact surfaces, or food-packaging materials.

(b) Substances used in cleaning and sanitizing; storage of toxic materials.

(1) Cleaning compounds and sanitizing agents used in cleaning and sanitizing procedures shall be free from undesirable microorganisms and shall be safe and adequate under the conditions of use. Compliance with this requirement may be verified by any effective means including purchase of these substances under a supplier's guarantee or certification, or examination of these substances for contamination. Only the following toxic materials may be used or stored in a plant where food is processed or exposed:

(i) Those required to maintain clean and sanitary conditions;

(ii) Those necessary for use in laboratory testing procedures;

(iii) Those necessary for plant and equipment maintenance and operation; and

(iv) Those necessary for use in the plant's operations.

(2) Toxic cleaning compounds, sanitizing agents, and pesticide chemicals shall be identified, held, and stored in a manner that protects against contamination of food, food-contact surfaces, or food-packaging materials. All relevant regulations promulgated by other Federal, State, and local government agencies for the application, use, or holding of these products should be followed.

(c) Pest control. No pests shall be allowed in any area of a food plant. Guard or guide dogs may be allowed in some areas of a plant if the presence of the dogs is unlikely to result in contamination of food, food-contact surfaces, or food-packaging materials. Effective measures shall be taken to exclude pests from the processing areas and to protect against the contamination of food on the premises by pests. The use of insecticides or rodenticides is permitted only under precautions and restrictions that will protect against the contamination of food, food-contact surfaces, and food-packaging materials.

(d) Sanitation of food-contact surfaces. All food-contact surfaces, including utensils and food-contact surfaces of equipment, shall be cleaned as frequently as necessary to protect against contamination of food.

(1) Food-contact surfaces used for manufacturing or holding low-moisture food shall be in a dry, sanitary condition at the time of use. When the surfaces are wet-cleaned, they shall, when necessary, be sanitized and thoroughly dried before subsequent use.

(2) In wet processing, when cleaning is necessary to protect against the introduction of microorganisms into food, all food-contact surfaces shall be cleaned and sanitized before use and after any interruption during which the food-contact surfaces may have become contaminated. Where equipment and utensils are used in a continuous production operation, the utensils and food-contact surfaces of the equipment shall be cleaned and sanitized as necessary.

(3) Non-food-contact surfaces of equipment used in the operation of food plants should be cleaned as frequently as necessary to protect against contamination of food.

(4) Single-service articles (such as utensils intended for one-time use, paper cups, and paper towels) should be stored in appropriate containers and shall be handled, dispensed, used, and disposed of in a manner that protects against contamination of food or food-contact surfaces.

(5) Sanitizing agents shall be adequate and safe under conditions of use. Any facility, procedure, or machine is acceptable for cleaning and sanitizing equipment and utensils if it is established that the facility, procedure, or machine will routinely render equipment and utensils clean and provide adequate cleaning and sanitizing treatment.

(e) Storage and handling of cleaned portable equipment and utensils. Cleaned and sanitized portable equipment with food-contact surfaces and utensils should be stored in a location and manner that protects food-contact surfaces from contamination.

[51 FR 22475, June 19, 1986, as amended at 54 FR 24892, June 12, 1989]

Sec. 110.37 Sanitary facilities and controls.

Each plant shall be equipped with adequate sanitary facilities and accommodations including, but not limited to:

(a) Water supply. The water supply shall be sufficient for the operations intended and shall be derived from an adequate source. Any water that contacts food or food-contact surfaces shall be safe and of adequate sanitary quality. Running water at a suitable temperature, and under pressure as needed, shall be provided in all areas where required for the processing of food, for the cleaning of equipment, utensils, and food-packaging materials, or for employee sanitary facilities.

(b) Plumbing. Plumbing shall be of adequate size and design and adequately installed and maintained to:

(1) Carry sufficient quantities of water to required locations throughout the plant.

(2) Properly convey sewage and liquid disposable waste from the plant.

(3) Avoid constituting a source of contamination to food, water supplies, equipment, or utensils or creating an unsanitary condition.

(4) Provide adequate floor drainage in all areas where floors are subject to flooding-type cleaning or where normal operations release or discharge water or other liquid waste on the floor.

(5) Provide that there is not backflow from, or cross-connection between, piping systems that discharge waste water or sewage and piping systems that carry water for food or food manufacturing.

(c) Sewage disposal. Sewage disposal shall be made into an adequate sewerage system or disposed of through other adequate means.

(d) Toilet facilities. Each plant shall provide its employees with adequate, readily accessible toilet facilities. Compliance with this requirement may be accomplished by:

(1) Maintaining the facilities in a sanitary condition.

(2) Keeping the facilities in good repair at all times.

(3) Providing self-closing doors.

(4) Providing doors that do not open into areas where food is exposed to airborne contamination, except where alternate means have been taken to protect against such contamination (such as double doors or positive air-flow systems).

(e) Hand-washing facilities. Hand-washing facilities shall be adequate and convenient and be furnished with running water at a suitable temperature. Compliance with this requirement may be accomplished by providing:

(1) Hand-washing and, where appropriate, hand-sanitizing facilities at each location in the plant where good sanitary practices require employees to wash and/or sanitize their hands.

(2) Effective hand-cleaning and sanitizing preparations.

(3) Sanitary towel service or suitable drying devices.

(4) Devices or fixtures, such as water control valves, so designed and constructed to protect against recontamination of clean, sanitized hands.

(5) Readily understandable signs directing employees handling unprotected food, unprotected food-packaging materials, of food-contact surfaces to wash and, where appropriate, sanitize their hands before they start work, after each absence from post of duty, and when their hands may have become soiled or contaminated. These signs may be posted in the processing room(s) and in all other areas where employees may handle such food, materials, or surfaces.

(6) Refuse receptacles that are constructed and maintained in a manner that protects against contamination of food.

(f) Rubbish and offal disposal. Rubbish and any offal shall be so conveyed, stored, and disposed of as to minimize the development of odor, minimize the potential for the waste becoming an attractant and harborage or breeding place for pests, and protect against contamination of food, food-contact surfaces, water supplies, and ground surfaces.

Subpart C—Equipment

Sec. 110.40 Equipment and utensils.

(a) All plant equipment and utensils shall be so designed and of such material and workmanship as to be adequately cleanable, and shall be properly maintained. The design, construction, and use of equipment and utensils shall preclude the adulteration of food with lubricants, fuel, metal fragments, contaminated water, or any other contaminants. All equipment should be so installed and maintained as to facilitate the cleaning of the equipment and of all adjacent spaces. Food-contact surfaces shall be corrosion-resistant when in contact with food. They shall be made of nontoxic materials and designed to withstand the environment of their intended use and the action of food, and, if applicable, cleaning compounds and sanitizing agents. Food-contact surfaces shall be maintained to protect food from being contaminated by any source, including unlawful indirect food additives.

(b) Seams on food-contact surfaces shall be smoothly bonded or maintained so as to minimize accumulation of food particles, dirt, and organic matter and thus minimize the opportunity for growth of microorganisms.

(c) Equipment that is in the manufacturing or food-handling area and that does not come into contact with food shall be so constructed that it can be kept in a clean condition.

(d) Holding, conveying, and manufacturing systems, including gravimetric, pneumatic, closed, and automated systems, shall be of a design and construction that enables them to be maintained in an appropriate sanitary condition.

(e) Each freezer and cold storage compartment used to store and hold food capable of supporting growth of microorganisms shall be fitted with an indicating thermometer, temperature-measuring device, or temperature-recording device so installed as to show the temperature accurately within the compartment, and should be fitted with an automatic control for regulating temperature or with an automatic alarm system to indicate a significant temperature change in a manual operation.

(f) Instruments and controls used for measuring, regulating, or recording temperatures, pH, acidity, water activity, or other conditions that control or prevent the growth of undesirable microorganisms in food shall be accurate and adequately maintained, and adequate in number for their designated uses.

(g) Compressed air or other gases mechanically introduced into food or used to clean food-contact surfaces or equipment shall be treated in such a way that food is not contaminated with unlawful indirect food additives.

Subpart D [Reserved]

Subpart E--Production and Process Controls

Sec. 110.80 Processes and controls.

All operations in the receiving, inspecting, transporting, segregating, preparing, manufacturing, packaging, and storing of food shall be conducted in accordance with adequate sanitation principles. Appropriate quality control operations shall be employed to ensure that food is suitable for human consumption and that food-packaging materials are safe and suitable. Overall sanitation of the plant shall be under the supervision of one or more competent individuals assigned responsibility for this function. All reasonable precautions shall be taken to ensure that production procedures do not contribute contamination from any source. Chemical, microbial, or extraneous-material testing procedures shall be used where necessary to identify sanitation failures or possible food contamination. All food that has become contaminated to the extent that it is adulterated within the meaning of the act shall be rejected, or if permissible, treated or processed to eliminate the contamination.

(a) Raw materials and other ingredients.

(1) Raw materials and other ingredients shall be inspected and segregated or otherwise handled as necessary to ascertain that they are clean and suitable for processing into food and shall be stored under conditions that will protect against contamination and minimize deterioration. Raw materials shall be washed or cleaned as necessary to remove soil or other contamination. Water used for washing, rinsing, or conveying food shall be safe and of adequate sanitary quality. Water may be reused for washing, rinsing, or conveying food if it does not increase the level of contamination of the food. Containers and carriers of raw materials should be inspected on receipt to ensure that their condition has not contributed to the contamination or deterioration of food.

(2) Raw materials and other ingredients shall either not contain levels of microorganisms that may produce food poisoning or other disease in humans, or they shall be pasteurized or otherwise treated during manufacturing operations so that they no longer contain levels that would cause the product to be adulterated within the meaning of the act. Compliance with this requirement may be verified by any effective means, including purchasing raw materials and other ingredients under a supplier's guarantee or certification.

(3) Raw materials and other ingredients susceptible to contamination with aflatoxin or other natural toxins shall comply with current Food and Drug Administration regulations and action levels for poisonous or deleterious substances before these materials or ingredients are incorporated into finished food. Compliance with this requirement may be accomplished by purchasing raw materials and other ingredients under a supplier's guarantee or certification, or may be verified by analyzing these materials and ingredients for aflatoxins and other natural toxins.

(4) Raw materials, other ingredients, and rework susceptible to contamination with pests, undesirable microorganisms, or extraneous material shall comply with applicable Food and Drug Administration regulations and defect action levels for natural or unavoidable defects if a manufacturer wishes to use the materials in manufacturing food. Compliance with this requirement may be verified by any effective means, including purchasing the materials under a supplier's guarantee or certification, or examination of these materials for contamination.

(5) Raw materials, other ingredients, and rework shall be held in bulk, or in containers designed and constructed so as to protect against contamination and shall be held at such temperature and relative humidity and in such a manner as to prevent the food from becoming adulterated within the meaning of the act. Material scheduled for rework shall be identified as such.

(6) Frozen raw materials and other ingredients shall be kept frozen. If thawing is required prior to use, it shall be done in a manner that prevents the raw materials and other ingredients from becoming adulterated within the meaning of the act.

7) Liquid or dry raw materials and other ingredients received and stored in bulk form shall be held in a manner that protects against contamination.

(b) Manufacturing operations.

(1) Equipment and utensils and finished food containers shall be maintained in an acceptable condition through appropriate cleaning and sanitizing, as necessary. Insofar as necessary, equipment shall be taken apart for thorough cleaning.

(2) All food manufacturing, including packaging and storage, shall be conducted under such conditions and controls as are necessary to minimize the potential for the growth of microorganisms, or for the contamination of food. One way to comply with this requirement is careful monitoring of physical factors such as time, temperature, humidity, aw, pH, pressure, flow rate, and manufacturing operations such as freezing, dehydration, heat processing, acidification, and refrigeration to ensure that mechanical breakdowns, time delays, temperature fluctuations, and other factors do not contribute to the decomposition or contamination of food.

(3) Food that can support the rapid growth of undesirable microorganisms, particularly those of public health significance, shall be held in a manner that prevents the food from becoming adulterated within the meaning of the act. Compliance with this requirement may be accomplished by any effective means, including:

(i) Maintaining refrigerated foods at 45 deg. F (7.2 deg. C) or below as appropriate for the particular food involved.

(ii) Maintaining frozen foods in a frozen state.

(iii) Maintaining hot foods at 140 deg. F (60 deg. C) or above.

(iv) Heat treating acid or acidified foods to destroy mesophilic microorganisms when those foods are to be held in hermetically sealed containers at ambient temperatures.

(4) Measures such as sterilizing, irradiating, pasteurizing, freezing, refrigerating, controlling pH or controlling aw that are taken to destroy or prevent the growth of undesirable microorganisms, particularly those of public health significance, shall be adequate under the conditions of manufacture, handling, and distribution to prevent food from being adulterated within the meaning of the act.

(5) Work-in-process shall be handled in a manner that protects against contamination.

(6) Effective measures shall be taken to protect finished food from contamination by raw materials, other ingredients, or refuse. When raw materials, other ingredients, or refuse are unprotected, they shall not be handled simultaneously in a receiving, loading, or shipping area if that handling could result in contaminated food. Food transported by conveyor shall be protected against contamination as necessary.

(7) Equipment, containers, and utensils used to convey, hold, or store raw materials, work-in-process, rework, or food shall be constructed, handled, and maintained during manufacturing or storage in a manner that protects against contamination.

(8) Effective measures shall be taken to protect against the inclusion of metal or other extraneous material in food. Compliance with this requirement may be accomplished by using sieves, traps, magnets, electronic metal detectors, or other suitable effective means.

(9) Food, raw materials, and other ingredients that are adulterated within the meaning of the act shall be disposed of in a manner that protects against the contamination of other food. If the adulterated food is capable of being reconditioned, it shall be reconditioned using a method that has been proven to be effective or it shall be reexamined and found not to be adulterated within the meaning of the act before being incorporated into other food.

(10) Mechanical manufacturing steps such as washing, peeling, trimming, cutting, sorting and inspecting, mashing, dewatering, cooling, shredding, extruding, drying, whipping, defatting, and forming shall be performed so as to protect food against contamination. Compliance with this requirement may be accomplished by providing adequate physical protection of food from contaminants that may drip, drain, or be drawn into the food. Protection may be provided by adequate cleaning and sanitizing of all food-contact surfaces, and by using time and temperature controls at and between each manufacturing step.

(11) Heat blanching, when required in the preparation of food, should be effected by heating the food to the required temperature, holding it at this temperature for the required time, and then either rapidly cooling the food or passing it to subsequent manufacturing without delay. Thermophilic growth and contamination in blanchers should be minimized by the use of adequate operating temperatures and by periodic cleaning. Where the blanched food is washed prior to filling, water used shall be safe and of adequate sanitary quality.

(12) Batters, breading, sauces, gravies, dressings, and other similar preparations shall be treated or maintained in such a manner that they are protected against contamination. Compliance with this requirement may be accomplished by any effective means, including one or more of the following:

(i) Using ingredients free of contamination.

(ii) Employing adequate heat processes where applicable.

(iii) Using adequate time and temperature controls.

(iv) Providing adequate physical protection of components from contaminants that may drip, drain, or be drawn into them.

(v) Cooling to an adequate temperature during manufacturing.

(vi) Disposing of batters at appropriate intervals to protect against the growth of microorganisms.

(13) Filling, assembling, packaging, and other operations shall be performed in such a way that the food is protected against contamination. Compliance with this requirement may be accomplished by any effective means, including:

(i) Use of a quality control operation in which the critical control points are identified and controlled during manufacturing.

(ii) Adequate cleaning and sanitizing of all food-contact surfaces and food containers.

(iii) Using materials for food containers and food- packaging materials that are safe and suitable, as defined in 130.3(d) of this chapter.

(iv) Providing physical protection from contamination, particularly airborne contamination.

(v) Using sanitary handling procedures.

(14) Food such as, but not limited to, dry mixes, nuts, intermediate moisture food, and dehydrated food, that relies on the control of aw for preventing the growth of undesirable microorganisms shall be processed to and maintained at a safe moisture level. Compliance with this requirement may be accomplished by any effective means, including employment of one or more of the following practices:

(i) Monitoring the aw of food.

(ii) Controlling the soluble solids-water ratio in finished food.

(iii) Protecting finished food from moisture pickup, by use of a moisture barrier or by other means, so that the aw of the food does not increase to an unsafe level.

(15) Food such as, but not limited to, acid and acidified food, that relies principally on the control of pH for preventing the growth of undesirable microorganisms shall be monitored and maintained at a pH of 4.6 or below. Compliance with this requirement may be accomplished by any effective means, including employment of one or more of the following practices:

(i) Monitoring the pH of raw materials, food in process, and finished food.

(ii) Controlling the amount of acid or acidified food added to low-acid food.

(16) When ice is used in contact with food, it shall be made from water that is safe and of adequate sanitary quality, and shall be used only if it has been manufactured in accordance with current good manufacturing practice as outlined in this part.

(17) Food-manufacturing areas and equipment used for manufacturing human food should not be used to manufacture nonhuman food-grade animal feed or inedible products, unless there is no reasonable possibility for the contamination of the human food.

[51 FR 22475, June 19, 1986, as amended at 65 FR 56479, Sept. 19, 2000]

Sec. 110.93 Warehousing and distribution.

Storage and transportation of finished food shall be under conditions that will protect food against physical, chemical, and microbial contamination as well as against deterioration of the food and the container.

Subpart F [Reserved]

Subpart G--Defect Action Levels

Sec. 110.110 Natural or unavoidable defects in food for human use that present no health hazard.

(a) Some foods, even when produced under current good manufacturing practice, contain natural or unavoidable defects that at low levels are not hazardous to health. The Food and Drug Administration establishes maximum levels for these defects in foods produced under current good manufacturing practice and uses these levels in deciding whether to recommend regulatory action.

(b) Defect action levels are established for foods whenever it is necessary and feasible to do so. These levels are subject to change upon the development of new technology or the availability of new information.

(c) Compliance with defect action levels does not excuse violation of the requirement in section 402(a)(4) of the act that food not be prepared, packed, or held under unsanitary conditions or the requirements in this part that food manufacturers, distributors, and holders shall observe current good manufacturing practice. Evidence indicating that such a violation exists causes the food to be adulterated within the meaning of the act, even though the amounts of natural or unavoidable defects are lower than the currently established defect action levels. The manufacturer, distributor, and holder of food shall at all times utilize quality control operations that reduce natural or unavoidable defects to the lowest level currently feasible.

(d) The mixing of a food containing defects above the current defect action level with another lot of food is not permitted and renders the final food adulterated within the meaning of the act, regardless of the defect level of the final food.

(e) A compilation of the current defect action levels for natural or unavoidable defects in food for human use that present no health hazard may be obtained upon request from the Center for Food Safety and Applied Nutrition (HFS-565), Food and Drug Administration, 5001 Campus Dr., College Park, MD 20740.

[51 FR 22475, June 19, 1986, as amended at 61 FR 14480, Apr. 2, 1996; 66 FR 56035, Nov. 6, 2001]

APPENDIX II

BUYER SPECIFICATIONS FOR RAW HEADLESS SHRIMP (US MARKET)

1. BUYER'S SPECIFICATIONS FOR RAW HEADLESS SHRIMP

1.1 General Quality Criteria

(a) Product shall be food grade in all respects, including labeling, in compliance with relevant food standards/regulations in the market.

(b) Product shall be manufactured under sanitary conditions strictly in accordance with Good Manufacturing Practices (GMP)

(c) The appearance and odor of shrimp shall be indicative of freshness of the raw material. There shall be no extraneous odors in the products. The product shall be free from processing debris and all forms of foreign materials.

(d) Product shall be free from decomposition and dehydration

(e) Net weight shall not be less than declared net weight and the average count per pound/kg shall fall within the declared count range.

(f) The uniformity ratio shall not exceed 1.5 for five-count size ranges and shall not exceed 1.7 for ten-count size ranges for raw headless and 1.3 and 1.5 respectively for P&D and PDTO and as specified by the buyer for other products

$$\text{Uniformity ratio} = \frac{\text{Weight of 10 largest shrimp}}{\text{Weight of 10 smallest shrimp}}$$

(g) Pieces and broken shrimp shall not exceed 5% by weight

(h) There should not be more than 10% by weight with melanosis (black spot) on the shell and not more than 3% by weight on the meat

(i) The residual sodium bisulfite in the shrimp meat shall be with in the permitted level

1.2 Microbial quality

The microbial safety and quality of the product will be in commensurate with the use of high quality ingredients and raw materials, following Good Manufacturing Practices during production, the use of appropriate packaging and control of distribution procedures to prevent product deterioration, Internationally accepted methods and standards should be used in microbiological analysis of the product. However, sampling requirements can vary depending on the market.

For example, for raw headless shrimp, the US Food and Drug Administration's criteria for Salmonella testing is as per classification of the product as class III. As such product requires analysis of fifteen (15) 25-gram samples per lot. Acceptance of the lot requires all fifteen (15) samples to be negative for Salmonella.

	n	**c**	**m**	**M**
Aerobic plate count (35°C)	5	3	5.0×10^5	5.0×10^6
Staphylococcus aureus	5	2	100	500
E coli	5	2	<10	23
Coliform	5	3	100	500

n = Number of sample unit
c = Number of samples which may fall between m and M
m = Target number of bacteria per gram
M = Maximum number of bacteria per gram. No samples may exceed this number

1.3 Packaging

The product shall be packed in the size and weight for individual packs and master cartons as specified by the buyer. At the time of receipt the mater cartons shall be intact and master cartons and inner packages shall be constructed in a manner to preserve product integrity. In addition to information to be given in the label as per regulatory requirements, each master cartons shall be identified with the name of the product, net weight, ingredient declaration and production code which is easily identifiable.

1.4 Shipping and storage

Product shall be shipped and stored in a clean, dry environment under mechanical refrigeration to ensure maintenance of product temperatures 0°F/-18°C or below. Documents accompanying each shipment shall indicate production code(s) and the number of cartons within each code.

APPENDIX III

GUIDE TO RAW SHRIMP CRITICAL CONTROL POINTS

Source: HACCP Regulatory Model, National Marine Fisheries Service Office of Trade and industry Services, National Seafood Inspection Laboratory, Pascagoula, Ms October, 1989.

RAW SHRIMP CRITICAL CONTROL POINTS

Step	Hazard	Control points	Importance	Preventive measures	Monitoring	Records
1. Unload/receive examined	Mislabeling mis-representation	Receiving room	5[2]	Purchasing specifications	Visual observation	Fresh product buy ticket
	Decomposition	Dock		Employee training in sanitation/ product handling	sensory evaluation	Frozen product receiving report i.e. lot number, temperature
	Excessive additives (Sulfite)	Receiving containers and tanks		Control time/ temperature on the dock	Check temperature of product	
	Filth	Belt or table		Equipment sanitation	Chemical and/or microbiological analysis as appropriate	
	Container contamination				Check net drained weight	Log of notice of Unusial occurrence and corrective action (NUOCA)

[2] The importance rating scale is 1-5 with 5 being the most important. Any step with an importance rating of 4 or 5 is considered a critical control point

Step	Hazard	Control points	Importance	Preventive measures	Monitoring	Records
1. unload/receive examined (cont'd)	Contaminants Human error (e.g.) acceptance rejection of production Foreign material fuel oil				Check size count supervisor checks of operation	
2. Thaw/rack slacking of frozen product (in air or chilled room)	Temperature abuse Filth Dehydration Microbial contamination Non potable water un-sanitary unsuitable equipment Over capacity	stacking room or cooler Tanks Thawing machine	4	Time/temperature control Regular cleaning of equipment use potable water	visual observation	Log of NUOCA

Step	Hazard	Control points	Importance	Preventive measures	Monitoring	Records
3. Examin nation/Inspection	Microbial contamination Temperature abuse Improper personal hygiene Foreign material	Belt or Table Personal hygiene	4	Time/ temperature control Personal hygiene/GMP[3] Product movement control	visual observation	Log of NUOCA Personal hygiene log

4. Sizing	Incorrect sizing Microbial contamination Temperature abuse Chemical contamination (from water) Economic fraud	Machine	4	Equipment calibration Personal training Equipment cleaning and sanitation on a regular basis Use of approved cleaning materials and procedures	Supervisory controls Visual observation	Count/label record

[3] Good Manufacturing Practices

Step	Hazard	Control points	Importance	Preventive measures	Monitoring	Records
5 Optional dip	unapproved additives Additive abuse Temperature abuse Contaminated dip	Tank cups additives Buckets	5	Use manufacturer's specifications use only approved additives Use GMP	Visual observations Measure amount of additive for each batch Supervisory checks of operations	Log of additive usage Log of NUOCA
6. Glaze (Blast freezing or opt IQF[4])	Over glaze under glaze Microbial contamination Foreign material Insanitary/ unsuitable equipment Non potable water	Belt	4	Control glaze weight use potable water Equipment cleaning and sanitation	Measure glaze percentage Visual observation	Log of NUOCA Log of percent glaze

[4] Individually Quick Frozen

Step	Hazard	Control points	Importance	Preventive measures	Monitoring	Records
7 Packaging weighing	Filth	Table or scale	5	Control packaging	Visual observation	Scale calibration report
	Defective packaging	Personnel		Purchase specifications for package materials	Supervisory checks of operations	Log of NUOCA
	Foreign material			Inspection of packaging materials	Daily check of scales	
	Microbial contamination			Personal hygiene		
	Temperature abuse			Calibration of scales		
	Human error (fill or weighing)			Include product ID (code number) on final package		
8. Repack	Time/ Temperature	Packing area	4	Minimize time in packing area	Supervisory controls	Original production records and labels used
	Introduction of foreign material			Sanitation and proper handling	visual checking	
	Economic malpractice					

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