Product Description

2

Abstract

Product description is a kind of marketing strategy that explains what a product is, what it does, what it can be used for, and what benefits it will provide. The chapter highlights the details of a product description of frozen shrimp like how to write a product description for international business communication, types and diversification (HOSO, PDTO, EZP, PUD, PUDC, PDC, P&D, deep cut, butterfly cut, grill cut, leaf cut, skewer, fantail round, etc.) of frozen shrimp, types of freezing method (IQF, semi-IQF, and block) with flowchart, blanched and cooked shrimp, grading, meaning of grading (what is 16/20 or 21/25, etc.), packing (regular and bulk packing) of shrimp, grading and grading methods (manual and mechanical), uniformity ratio, glazing and hardening, etc. The chapter also helps to know about different types of mathematical calculation like determination of grade with acceptable limit; counting of average pieces; counting of pieces per unit block/bag for semi-IQF, IQF, and block frozen shrimp (both real count and frozen count); standard limit; calculation of individual weight (maximum and minimum) of shrimp for every grade; and determination of glazing % and uniformity ratio with some related exercise.

Keywords

IQF · Semi-IQF · Block · Packing · Grading · Uniformity

2.1 Product Specification

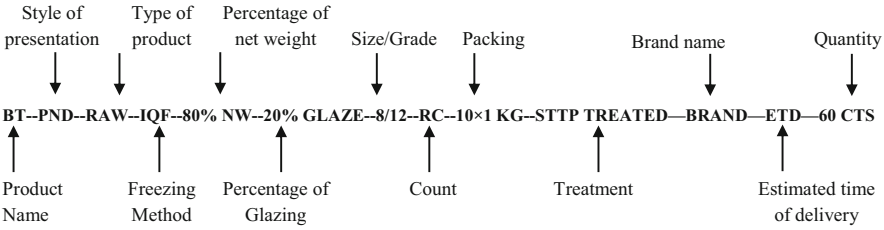
Frozen shrimps are important exportable items of global seafood business, especially the species black tiger shrimp, whiteleg shrimp and freshwater prawn which are utmost remarkable. A variety of diversified shrimp products are processed in the processing industries, whereas the diversification of frozen shrimps comes due to

M. A. Hannan et al., *Post-Harvest Processing, Packaging and Inspection of Frozen Shrimp: A Practical Guide*, https://doi.org/10.1007/978-981-19-1566-6_2

competitive seafood business in international seafood market and diversified customer's demand. Diversification of frozen shrimp occurs due to its freezing methods, cutting techniques, processing variations, style of presentation, value addition, and marination techniques. A product description is an important part of the seafood marketing. Generally, a product is a term which refers to an item offered for sale, whereas a product description is a kind of marketing strategy that explains what a product is, what it does, what it can be used for, and what benefits it will provide to its final consumers. The purpose of a product description is to provide necessary information to its customers about the features, ingredients, benefits, and instruction of the frozen products so that they can decide to buy that frozen shrimp. Everyone engaged in this sector should have proper knowledge about the details of product description; otherwise, it will be difficult to continue the business in international seafood market. The following should be covered for a complete description of exported frozen product:

- Name of product (English name and scientific name)
- Ingredients (e.g., 20% water, 80% shrimp, etc.)
- Type of product (raw or blanched or cooked)
- Style of presentation (HOSO or PD or EZP or PUD, etc.)
- Method of freezing (block or IQF or S.IQF)
- Net weight (NW) of frozen product (70% net weight or 80% net weight, etc.)
- Percentage (%) of glaze (30% glaze or 20% glaze or 10% glaze, etc.)
- Size grade of shrimp (2/4 or 8/12 or 13/15 or 16/20 or 200/300, etc.)
- Count of shrimp (frozen count/real count)
- Treatment (treated with approved additives or non-treated)
- Packing (regular packing or bulk packing or special packing)
- Brand name (supplier's brand or buyer's brand, etc.)
- Storage instruction
- Nutritional value
- Origin of product
- Supplier and importer information
- Customer-readable language
- Production date and expiry date
- Price
- Others

In international business world, importers and exporters are not willing to write in details product description during business communication or purchase negotiation. Usually, importers and exporters try to explain the necessary details or information within a single line. Sometimes, all necessary details may not present here, but displaying of all information in packaging unit is mandatory. See the following example of how to explain a specification within a single line during purchase negotiation of frozen shrimp.



[Note: BT = Black Tiger, PND = peeled and deveined, NW = net weight, RC = real count, STTP = sodium tri-polyphosphate, CTS = cartons].

2.2 Types of Frozen Shrimp

Shrimps are highly perishable, so it's important to take necessary steps to keep the shrimp fresh for longest possible time without any kind of quality deterioration. It's not because of freshness only but also the shelf life, test, texture, nutritional quality, and safety requirements. A variety of techniques are practiced in different types of processing industries in the world to keep the products safe, i.e., raw, blanched, cooked, canned, smoked, dried, and other forms of shrimps that are processed and ready to eat. Among the variety of products, this chapter highlights only the frozen shrimp and their product variations. There are three basic types of frozen shrimps, i.e. raw, blanched, and cooked frozen shrimps are commonly processed worldwide. These are as follows.

Raw:	Shrimps are frozen in a natural condition without cooking or blanching. Raw frozen shrimps are fresh, wholesome, hard translucent shells with natural color. M**uscles of raw frozen shrimp are** firm with full of flavor and absent odor. Any kind of discoloration or blackened/reddening edges, limp, slimy, or falling apart are the signs of quality deterioration of raw shrimp.
Blanched:	The word "blanched" means boiling of shrimps in water or stream for a very short time. Shrimps are blanched at a temperature of 65–100 °C for few seconds to a minute (15–60 s) depending on product specification and operation temperature. The raw shrimps changed its color immediately after blanching. Sometimes, blanched shrimps are considered as raw shrimps. Shrimps are transferred to cold water immediately after blanching to stop cooking. Leave the shrimps in water for 3–5 min, or until they cool completely. Stirring is done during cooling process to make sure all shrimps are cooled down properly. Always use an ice bath to cool blanched shrimp to avoid toughness; never allow shrimp to cool in the blanching water. Be careful about time duration; otherwise, shrimps will be cooked instead of blanched. Shrimps are frozen after blanching.
Cooked:	Cooking of shrimp can be done to inactivate the microbial load. The quality and safety of a cooked shrimp depend on cooking method, time duration, and temperature employed. Shrimps are boiled at 85–100 °C temperature for few minutes normally 1–5 min depending on size and type of shrimps. Cooking of shrimp is done using steam cooker. Shrimps are transferred to cold water immediately after cooking. Leave the shrimps in water until they cool completely. Avoid overcooking; otherwise, shrimps become tough and rubbery which leads to nutritional loss.

2.3 Diversification of Shrimp Products

The term "diversified product" refers to product changed or altered or improved or applied any kind of new technologies that makes it different. This is the process of value addition that helps to make opportunities for additional market potential and business expansion. This business strategy is used to increase the sales of products and provide an effective path for faster business growth in an international seafood market although it has some risks. Shrimps in processing industries are made diversified by developing their existing products by means of a variety of techniques such as freezing technique, processing technique, cutting technique, use of additives, marination, etc. Block, semi-IQF, and IQF are different types of freezing techniques that make the product diversified. Raw, blanched, cooked, marination, etc. are different types of processing techniques that make the product diversified. On the other hand, different types of cutting techniques, i.e., regular cut, two-segment cut, three-segment cut, deep cut, butterfly cut, grill cut, leaf cut, skewer, fantail round, etc., made the product diversified. The following are examples of some common diversified products produced worldwide:

- HOSO (head-on shell-on)
- Head-on body peeled or HO-body peeled
- HLSO (headless shell-on)
- PUD (peeled and un-deveined)
- EZP (easy peeled)
- P&D/PD/PND (peeled deveined tail-off)
- PDTO (peeled deveined tail-on)
- PUDC (peeled un-deveined and cooked)
- PDC (peeled deveined and cooked)
- Fantail round
- Peeled deveined tail-off skewer or P&D skewer
- Head-on skewer or HO-skewer
- Butterfly shrimp
- Broken
- Others

[Note that the shrimps that are already peeled, deveined, blanched, or cooked are not as flavorful as a raw fresh, wholesome shell on shrimp.]

The following are the images of some diversified products of frozen shrimp (Figs. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, and 2.9).

[Note: *Fantail round: Head and shell removed except last segment, shell on last segment, and tail fan present.

***Butterfly shrimp:** Peeled and deveined except for the last segment, and split longitudinally through the dorsal axis and make into two sections that remain attached on the ventral side.]

Fig. 2.1 HLSO shrimp

Fig. 2.2 Fantail round shrimp

2.4 Freezing Methods

Freezing is the method of preservation by lowering temperature that inhibits the growth of microorganisms and slows down the chemical changes (enzymatic reaction), resulting in the prevention of food spoilage and foodborne disease and extended shelf life of frozen shrimp. There are three basic types of freezing method used in shrimp processing industries worldwide. These are:

- IQF
- Semi-IQF
- Block

Time and temperature are two important factors for the freezing process. The time of freezing process depends on the following parameters:

Fig. 2.3 PND shrimp

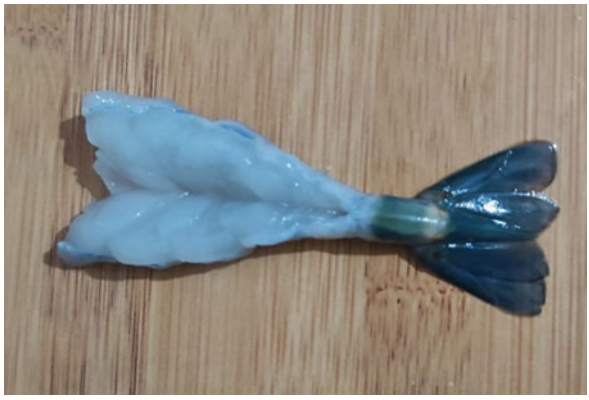


Fig. 2.4 Butterfly shrimp

Fig. 2.5 HO body peeled shrimp

Fig. 2.6 Shushi cut shrimp

Fig. 2.7 HOSO shrimp

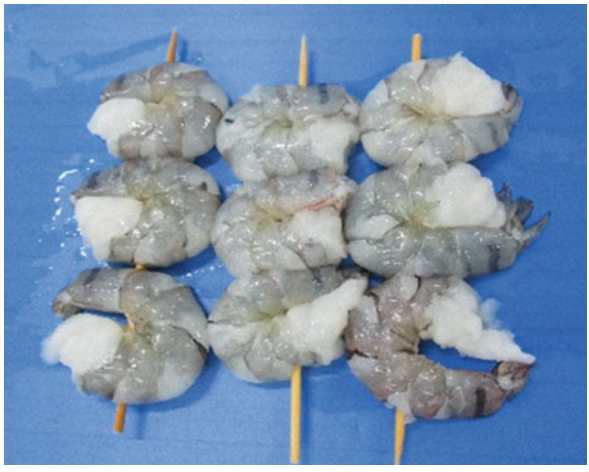


Fig. 2.8 P&D skewer shrimp

Fig. 2.9 HO-skewer shrimp

- Type of freezer and freezing method
- Operating temperature
- Type of product
- Percentage of glaze
- Temperature of product
- Size/grade of product
- Contact area and density of the product
- Thickness of product

[Note: Freezing of seafood products must be appropriated, because it preserves the quality, taste, nutritional value, and shelf life of frozen shrimp.]

2.4.1 Individual Quick Freezing (IQF)

IQF stands for individual quick freezing. Every single (individual) piece of shrimp is coated with water and frozen separately in this technique. The IQF shrimps are frozen at the temperature of −38 to −40 °C until the core temperature of the shrimp reached −18 °C. Spiral freezer is commonly used for IQF products as it freezes very quickly, as quickly as between 15 min and 1 h depending on thickness, size/grade, glaze %, and temperature of shrimps as well as the cooling performance of the machine. The conveyer belt is used to transport shrimp for various steps of IQF technique. Speed of conveyer belt is adjusted so that the products are frozen properly. IQF can be used to freeze raw, blanched, or cooked items of various diversified products. The following parameters should be checked carefully during IQF technique.

- Temperature of the freezer
- Temperature of raw materials (shrimp)
- Core temperature of shrimp

Fig. 2.10 Operation temperature

- Temperature of glazing water
- Percentage (%) of glazing
- Hardening temperature

[Note: The defect clumps arise from here. So attention should be given here to make sure the perfect arrangement of shrimp in conveyer belt and zero clumps in final products.]

The following are the images of different steps of IQF technique (Figs. 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16, 2.17, and 2.18).

In the case of blanched IQF, shrimps are blanched first and then are frozen. Shrimps are blanched to attain an attractive color. It also reduces microbial load and chemical reaction (enzymatic reaction) which can cause quality degradation, i.e., loss of flavor, color, texture, test, etc. Blanch frozen shrimp briefly to kill bacteria on their surface, extend the shelf life, and ensure that they are safe for human consumption. Salt and/or sugar may be added sometimes to the blanching water as per product specifications. It is necessary to blanch different grades of shrimps at different times to make blanched shrimps uniform. Shrimps of different grades are not allowed to be blanched at one time. Remember that blanched time is very short; otherwise, shrimp will be cooked instead of blanched.

In the case of cooked IQF, shrimps are almost same as blanched IQF shrimps except temperature variation. Typically, shrimps are cooked at 90–100 °C temperature. The cooking duration may vary from one to a few minutes depending on product size/grade, cooking methods, and specification. Generally, products are cooked in the cooking chamber by using the stem. The core temperature of the cooked product should be 72 °C. Shrimps of different grades are not allowed to be cooked at one time. Different grades of shrimp required different time and duration for uniform cooking. The following are the images of some blanched IQF and cooked IQF shrimps (Figs. 2.19, 2.20, 2.21, 2.22, 2.23, and 2.24).

2.4.1.1 Now the Question Is Why Shrimps Are Red After Cooking?

Raw shrimps are naturally grayish, but they turn into red when they are cooked. Biochemical reaction is the cause of this change. Chemicals inside the shellfish react

Fig. 2.11 Shrimp at conveyer belt

Fig. 2.12 Shrimp after freezing

Fig. 2.13 Glazing of shrimp

Fig. 2.14 Hardening chamber

Fig. 2.15 Shrimp after hardening

Fig. 2.16 IQF shrimp (BT HLSO-EP)

Fig. 2.17 IQF shrimp (BT P&D)

Fig. 2.18 IQF shrimp (FW HLSO)

to heat and turn its color from grayish to orange/reddish. In raw shrimps the pigment is attached to a certain protein within, but the pigment breaks away and becomes an independent orange/reddish substance when the shrimps are cooked. Raw shrimps are naturally observed grayish due to the accumulation of crustacyanin, a protein-astaxanthin complex that becomes orange with complex dissociation. This dissociation may occur because of heat/cooking (Parisenti et al. 2011).

- **Flowchart of raw/blanched/cooked-IQF shrimps** (Fig. 2.25)

2.4.2 Block Frozen

Block frozen is usually performed by plate freezer. Freezing temperature of block product varied from −38 °C to −40 °C, whereas core temperature of frozen shrimp must be at -18 °C. In case of block freezing, final/export grade shrimps are placed in

Fig. 2.19 Blanched IQF (HLSO EP)

Fig. 2.20 Blanched IQF (P&D)

Fig. 2.21 Blanched IQF (PUD)

Fig. 2.22 Cooked IQF (HOSO)

Fig. 2.23 Cooked IQF (HLSO)

Fig. 2.24 Cooked IQF (PDTO)

freezing pan in a way of systematic arrangement and wrapped with a loose low-density transparent liner polyethylene (LDPE film or HM-HDPE film). Chilled water is poured into the pan at right volume (considering the percentage of glaze as

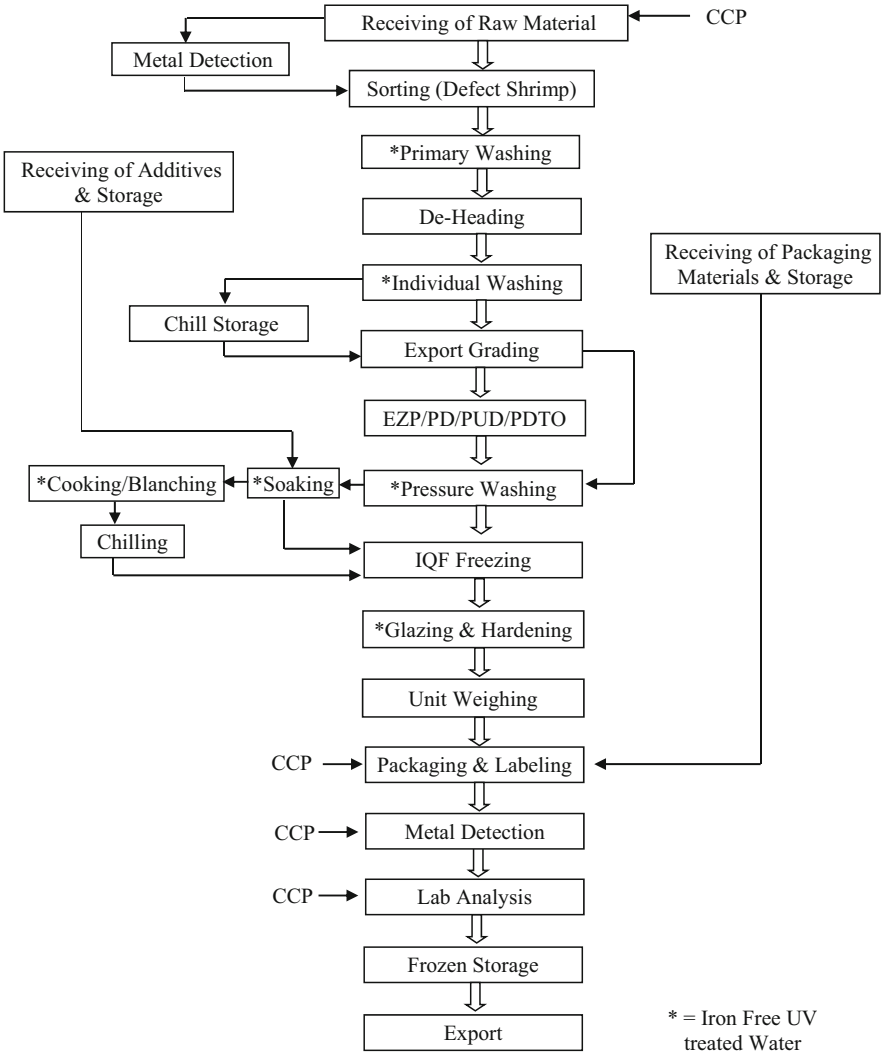


Fig. 2.25 Steps of IQF shrimp

per specification) to fill up the spaces among the shrimps and help to produce uniform block. Finally, the pans are transferred to contact plate freezer covered with a lid. Sometimes a little volume of flake ice is used at the top of the pan to maintain the temperature of the water and forwarded to next step of freezing. In contact plate freezer, shrimps are frozen at -40 °C for several hours (normally 1.5–4 h) depending on the thickness of the slab and the cooling performance of the freezer. Remember that the quicker the freezing, the better the quality of blocked shrimp. The core temperature of the block frozen shrimp should be at least −18 °C. After completion of the freezing process, blocks are brought out from the freezer and

Fig. 2.26 Shrimp arrangement

made separated from the pan using water spray over it. Water should be spread from the back side of the freezing pans to isolate the block from pan. Sometimes the separated blocks are glazed again for its shiny color and smart appearance. Finally, the blocks are sent for final packaging. Packaging materials are prepared previously. The following parameters should be checked properly during the freezing process:

- Temperature of raw materials (shrimp)
- Temperature of water
- Freezer temperature and duration
- Core temperature of shrimp
- Percentage (%) of glaze water
- Proper tagging (lot, size/grade, etc.)

The following are the images of different steps of block frozen shrimp (Figs. 2.26, 2.27, 2.28, 2.29, 2.30, 2.31, 2.32, 2.33, and 2.34).

[Note: Volume of glaze water should be accurate; sometimes excess volume of water are used for block freezing that may create problem in final inspection and weighing in port. Handling of frozen block should be very careful and in hygienic way.]

- **Flowchart of block frozen shrimp** (Fig. 2.35)

2.4.3 Semi-IQF

Semi-IQF is a freezing method which is performed for HOSO shrimps. Semi-IQF is itself a block product, but the difference is that the whole products are not submerged within water like frozen block. In case of semi-IQF products, whole shrimps are not covered with water. Only about 50% shrimps (at the bottom part) are submerged into water, and the rest of the products remains open (not in submerged condition).

Fig. 2.27 Pan with water and ice

Fig. 2.28 Wrapped with poly

Semi-IQF is usually performed by plate/contact freezer. Freezing temperature varied from −38 °C to −40 °C depending on freezer, whereas the core temperature of the semi-IQF shrimp should be at least −18 °C. Freezing duration also depends on product specification and types of freezers. The following parameters should be checked properly during the freezing process.

- Temperature of raw materials (HO shrimp)
- Temperature of water
- Freezer temperature and duration
- Core temperature of shrimp
- Percentage (%) of glaze water
- Proper tagging (lot, size/grade etc.)

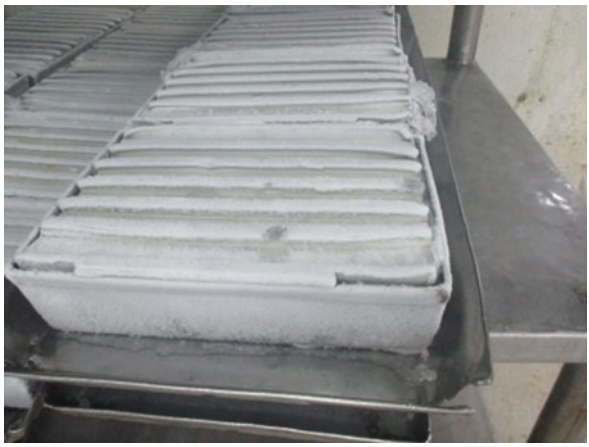


Fig. 2.29 Pan with lid

Fig. 2.30 Freezer (inner view)

Fig. 2.31 Freezer (loading)

Fig. 2.32 Block in pan

Fig. 2.33 Spray to separate block

Fig. 2.34 Final block

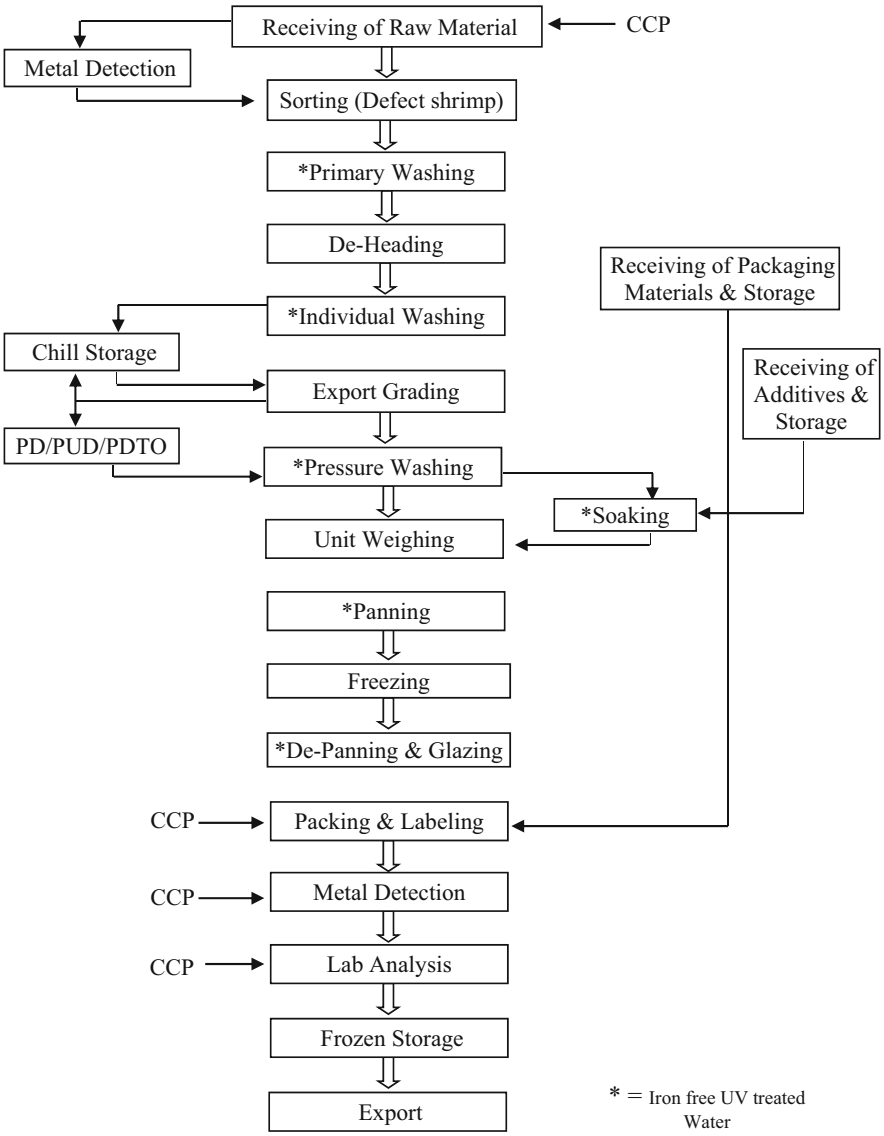


Fig. 2.35 Steps of block frozen shrimp

The following are the images of some semi-IQF shrimp (Figs. 2.36, 2.37, and 2.38).

[Note: Dropping head/lose head, yellow head, black head, discolored, decomposed, broken, and lower grade shrimp have to be removed during processing of semi-IQF shrimp.]

Fig. 2.36 HOSO straight

Fig. 2.37 HO body-peeled-straight

- **Flowchart of HOSO semi-IQF shrimp** (Fig. 2.39)

2.5 Packing of Shrimp

The terms "packing" and "packaging" are often confusing but not exactly of same meaning. Packing is a part of packaging. Packing means the unit volume or quantity of shrimps that are used to pack, whereas packaging is the process of wrapping goods for marketing and shipping. Packing is different for different types of frozen products. Variation of packing depends on its end users, customers' demands, and final destinations. Importers specified their packing variation as per their business strategy. The following are the examples of packing variation of different products.

Fig. 2.38 HOSO-flat

2.5.1 Packing of Block Product

Usually, 6 × 1.8 kg packing is used for block frozen shrimp. Here, 6 × 1.8 kg packing means six inner blocks/boxes are present inside the master carton, whereas the weight of a single block is 1.8 kg (1800 g) and weight of whole master carton is 6 × 1.8 = 10.80 kg. Packing of block frozen shrimp is not a rigid thing; it may vary as per customer's requirements, i.e., 6 × 2 kg, 6 × 1.2 kg, 6 × 1.4 kg, 6 × 1.8 kg, etc. are commonly used packing of block frozen shrimp. Specific freezing pans are used for specific sizes of block. Pan is a metallic structure and mandatory for block frozen shrimp. Pan of different dimensions is used for different packing (Figs. 2.40 and 2.41).

2.5.2 Packing of Semi-IQF Product

In case of Semi-IQF product 10 × 1 kg packing usually used. It means ten inner boxes are present within a master carton, whereas weight of an inner box is 1.0 kg and weight of whole master carton is 10 × 1 = 10.0 kg. Special type of inner box is used for semi-IQF product. The box contains two parts: (1) upper part (top part) and (2) lower part (bottom part). Another special character of semi-IQF box is window. A window is present in every box. Finally, inner box is wrapped with poly paper.

2.5.3 Packing of IQF Product

There are two types of packing that are used for IQF products.

- Regular packing (10 × 1 kg)
- Bulk packing (1 × 10 kg)

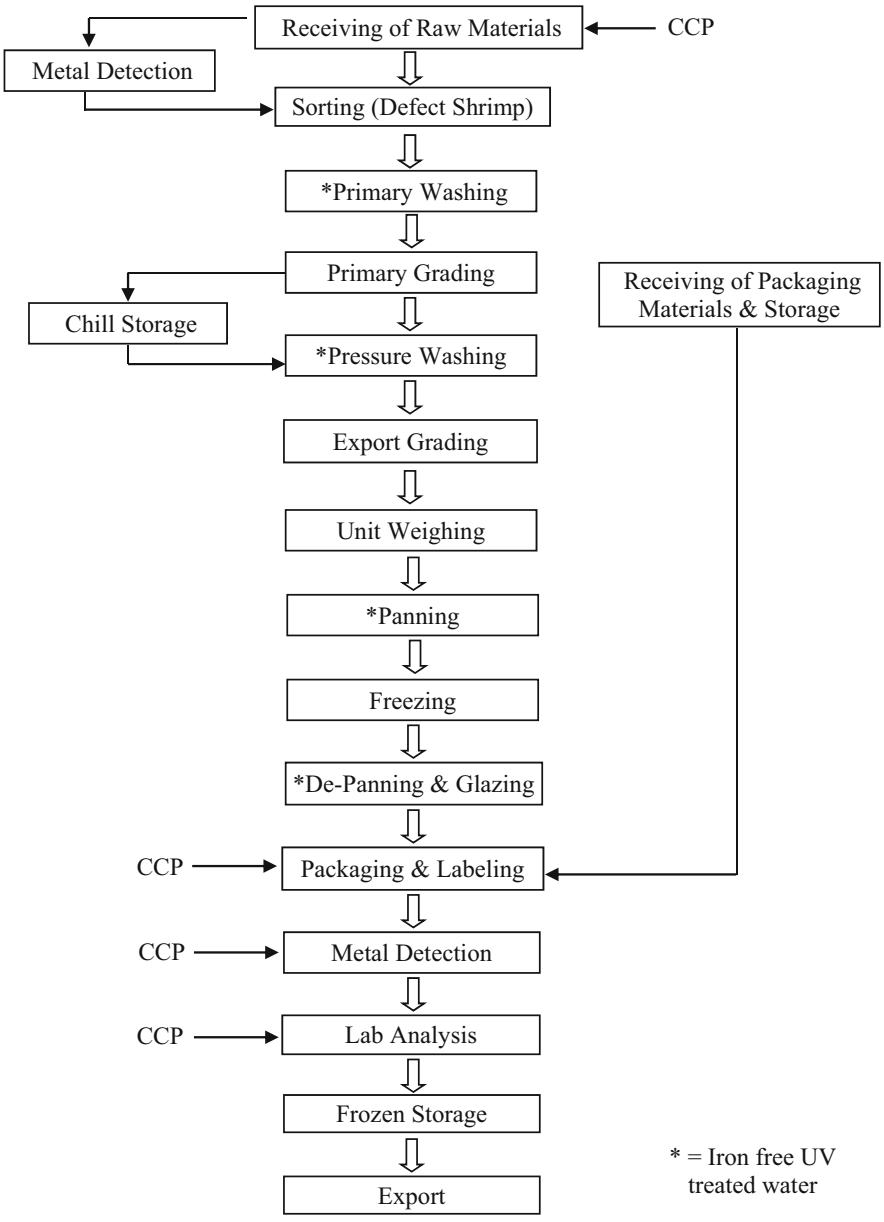


Fig. 2.39 Steps of HOSO semi-IQF shrimp

2.5.3.1 Regular Packing (10 × 1 kg)

Regular packing of shrimp is the most commonly used worldwide. Generally, 10 × 1 kg packing is commonly used regular packing of IQF shrimps. It means ten inner bags (individual bags) are present inside the master carton, whereas the

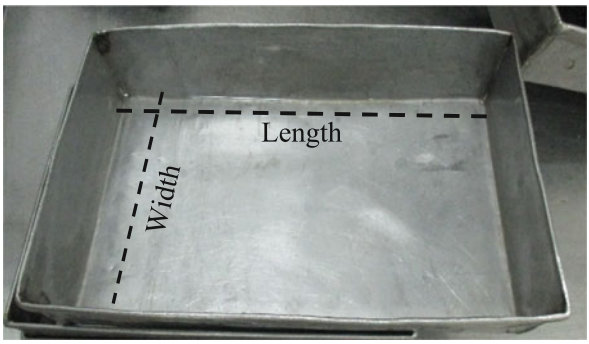


Fig. 2.40 Pan of block frozen shrimp

Fig. 2.41 Arrangement of shrimps in pan

Fig. 2.42 IQF packing (10 × 1 kg) in MC

weight of one bag is 1.0 kg and weight of whole master carton is 10.0 kg (10 × 1 = 10.0 kg). Recommended poly bag and rider/header card are used for IQF packing. Dimension and design of master cartons, poly bags, and rider cards are specified previously. See the following image of regular packing (10 × 1 kg) of IQF shrimp (Figs. 2.42 and 2.43).

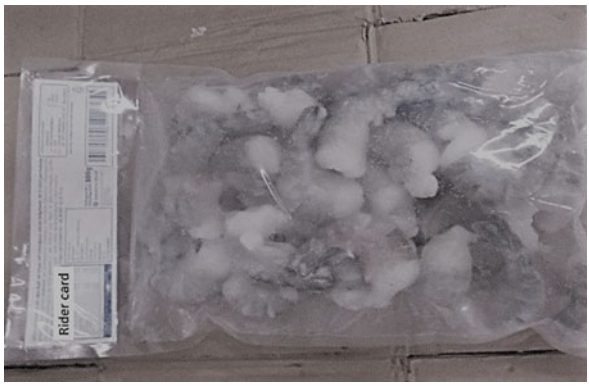


Fig. 2.43 IQF packing (polybag)

2.5.3.2 Bulk Packing (1 × 10 kg)

Bulk packing (1 × 10 kg) is a special type of packing but hardly used in shrimp business. In bulk packing (1 × 10 kg), the whole shrimps are packed in a bulk condition instead of individual IQF packing (10 × 1 kg). It means the whole 10 kg IQF shrimps are packed in a special type of single poly bag instead of individual 1.0 kg poly bag. A plain (not printed) large size of special type of poly bag is used for bulk packing. Suitable dimension of bulk poly bag is 700 × 700 mm ± 20 mm, whereas dimension of individual poly bag is 400 × 250 mm ± 10 mm. Dimension is not a rigid thing; it may vary on client's requirement and specification of the products. There are two types of color (blue and white) bags that are mostly used for bulk packing. Blue color bags are too much appreciated because of their good-looking characteristics. Bulk packing is performed for IQF products only, whereas the shrimps that need to be re-processed further. Re-processing of shrimp is mainly performed as per client requirements and better prices. The following are the images of bulk packing shrimp (Figs. 2.44, 2.45, 2.46, and 2.47).

2.6 Weight Declaration

Weight declaration is a crucial part of international seafood business. It means confirmation of actual weight or net weight of shrimp within the frozen products. Different types of weight are calculated in frozen seafood business, i.e., gross weight, frozen weight, deglazed weight, defrost weight, net weight, etc. Shrimps are biological products and perishable food items that need to be frozen for long-term preservation. It is quite impossible to freeze shrimp without water so that water must be added to shrimp before proceeding to freezing process. Now the question is how much volume of water should be added in frozen shrimp? Actually, percentage of water and percentage of shrimp are pre-determined as per specifications. Percentage of water, i.e., 10%, 20%, 25%, 30%, or 40% water, is mixed with percentage of shrimps, i.e., 90%, 80%, 75%, 70%, or 60% shrimp, respectively, whereas the total volume (water + shrimp) is 100%. Importers fixed up the percentage of water as per

Fig. 2.44 Bulk packing: 1 × 10 kg (open view)

Fig. 2.45 Bulk packing: 1 × 10 kg (inner view)

customers' preference and types of product specification. The price of frozen products can also be calculated based on their actual/net weight of frozen products.

For example, a product of BT is HLSO, raw, block, 80% net weight, 6 × 1.8 kg packing; now calculate the volume of water and net weight of shrimp. Here, net weight of product is 80% and the rest of 20% is water. See the following calculation.

Block product	
80% net weight means = 80% of 1800 g $= \frac{80}{100} \times 1800$ g = 1440 g **Or,** Volume of water = 1800–1440 g = 360 g	Here, Net weight = 80% Packing = 6 × 1.8 kg (means 1800 g/Block) Net weight of product = ? Volume of water = ?
Result: Net weight of shrimp is 1440 g and weight of water is 360 g.	
IQF/semi-IQF product	
Net weight product = 80% of 1000 g $= \frac{80}{100} \times 1000$ g = 800 g **Or,** Volume of water = 1000–800 g = 200 g	Here, Net weight = 80% Packing = 10 × 1 kg (means 1000 g/Box or block) Net weight of product = ? Volume of water = ?
Result: Net weight of shrimp is 800 g and weight of water is 200 g.	

Fig. 2.46 Weighing of bulk packing (1 × 10 kg)

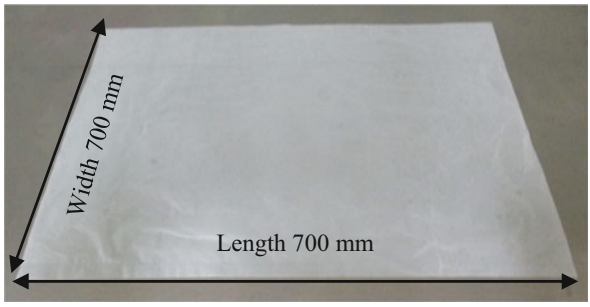


Fig. 2.47 White bag for bulk packing (1 × 10 kg)

[Note: Shortage of weight is a kind of crime. It affects business reputation of the company as well as the whole country. Importers stop buying shrimp from that supplier and even from that country and claim demurrage charge for such types of offense. Sometimes, weight shortage may happen unintentionally during deglazing and storage; that's why some importers put some extra weight to avoid that type of awkward situation.]

2.7 Brand Selection

Brand is a term/name/symbol/design or another feature that distinguishes the products or business organization from its rivals. Brand image is an important fact in business world; it helps to develop business through marketing and advertising. Customers distinguish and choose products based on its brand image. Suppliers and buyers both have their own brand. Selection of brand greatly depends on buyer's instruction: either it is exporters' brand or importers' brand. Buyers select their brand based on market reputation and customer's demand. On the other hand, customers choose their brand based on product quality as well as market reputation of that products.

2.8 Size/Grade of Shrimp

Grading comes from the verb grade; it means "classify or sort." Grading of shrimp is done for the uniform sizes of shrimp. Shrimps are graded according to their weight. Quality grading is very much important to assess the quality of frozen shrimp. It helps to create brand value. If grading is not in proper way, uniformity goes high that may not be accepted by the buyer or may lead the buyer to complain demurrage charge against supplier for improper grading of shrimp. Grading starts from receiving of raw materials and continues in different stages of processing. Proper sanitation, standard chilled temperature, and appropriate grading must be maintained during grading procedure. Sometimes it was observed that professional graders are not willing to wear hand gloves during their grading procedure because it makes their activity slower.

[Note that some processing industries don't have their own professional graders but are performing their grading activities using contractual graders. The contractual graders are now willing to grade shrimp as per specifications. However, suppliers should bear in mind, seafood business in international market greatly depends on good reputation. It will take a long time to recover the reputation if anyone loses it once.]

There are two types of grading that are practiced in shrimp in processing industries. These are as follows.

1. Primary grading:	Primary grading is the first step of grading procedure. Suppliers grade their shrimp during receiving of raw materials at processing industry premises. The shrimps are unloaded from the trawlers or refrigerated vehicle and transported to receiving room for grading. Temperature of the receiving room must be at least 4 °C. Quality control (QC) personnel should check the quality (temperature/disease/softshell/pushed/dart/filth, etc.) of raw materials and discards the products if the products didn't meet the requirements buyer's specifications during primary grading.
2. Final grading or export grading:	Final grading or export grading is performed after soaking (if necessary) of shrimp and before going to freezing process. This is the last stage of grading before packaging. Suppliers follow the international standard of grading procedure for final grading. Quality graders are necessary for this type of grading, and it must be cross-checked by the expert personnel. Uniformity arises from here which is the major concern of importers. So, attention should be very carefully in final stage of grading and need to avoid contractual graders.

- The following gradings are practiced for international shrimp business throughout the world.

• 2/4	• 40/50
• 4/6	• 41/50
• 6/8	• 50/60
• 8/12	• 51/60

(continued)

• 13/15 • 16/20 • 21/25 • 26/30 • 21/30 • 31/35 • 30/40 • 31/40	• 61/70 • 70/90 • 71/90 • 100/200 • 150/250 • 300/500 • U/5 • U/10

- **Now the question is what is the meaning of 16/20? Is there any real meaning?**

Yes, of course it has a real meaning. 16/20 is a range of shrimp. It means 16 to 20 pieces (pcs) of shrimps are present in 454 g (1 *lb)*, whereas 16 pcs/*lb* is the largest grade and 20 pcs/*lb* is the smallest grade of shrimp. Any grades of shrimps within the range of 16–20 are acceptable, but shrimps out of range are not acceptable. See the following example for the clarification:

16 pieces of shrimp per 454 g. [Acceptable]
17 pieces of shrimp per 454 g. [Acceptable]
18 pieces of shrimp per 454 g. [Acceptable]
19 pieces of shrimp per 454 g. [Acceptable]
20 pieces of shrimp per 454 g. [Acceptable]
21 pieces of shrimp per 454 g. [Not Acceptable]
22 pieces of shrimp per 454 g. [Not Acceptable]
23 pieces of shrimp per 454 g. [Not Acceptable]
24 pieces of shrimp per 454 g. [Not Acceptable]

But what will happen if suppliers provide lower than 16 pieces of shrimp per pound? For example, are 15 pcs/*lb*, or 14 pcs/*lb*, or 13 pcs/*lb* shrimp acceptable by the buyer or not? Normally, buyers are not interested to buy these types of grading because the labeling is not matched with declared number of shrimp. As a result, customers think that suppliers betray with them and they are losing some pieces of shrimps. Sometimes buyers may accept it without any hesitation, but suppliers won't provide ever that types of grading because they will sell this higher-graded shrimp with higher price. The following are the images of 16/20 grade shrimp (Fig. 2.48):

[Note: U/10 means there are 10 or less than 10 shrimps present per pound. Remember that 1 pound = 453.59237 g. Normally, suppliers consider it 454 g for easier calculation.]

Processing industries are used to make average pcs/*lb* for the calculation of grading. As per standard protocol, average pcs/*lb* will be 18 {(16 + 20)/2} for 16/20 grade of shrimp, but practically, suppliers perform their grading through a technical way. Suppliers estimate their average grading by counting lower grade of shrimp. It means suppliers calculate their average grade by counting (18 + 22)/2 = 20 pcs/*lb* instead of (16 + 20)/2 = 18 pcs/*lb* for 16/20 grade of shrimp, but total pcs/*lb* will be the same within standard limit. They never exceed 20 pcs/*lb* for 16/20 shrimp. Total pcs/bag will also be within the limit.

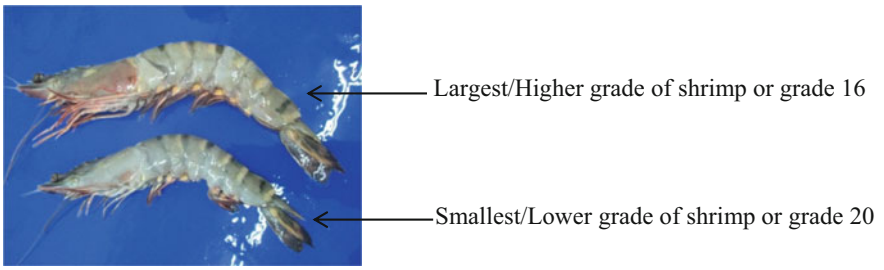


Fig. 2.48 Largest and smallest grades of shrimp

Table 2.1 Calculation of average pieces and grades in shrimp

Export grade	Higher grade + lower grade	Average	Status	Remarks
16/20	16 + 20	= 18 pcs	Standard	Rare practice
	18 + 22	= 20 pcs	Practical	Common practice
	17 + 23	= 20 pcs	Practical	Rare practice

As a result, suppliers are doing 18/22 grade instead of 16/20 grading, but total pcs/bag will be same as standard; just some small pieces are included here. In case of 18/22, lower grade is 22 and higher grade is 18 but average 20 pcs/*lb*. Sometimes some corrupt suppliers use 17/23 grading instead of 16/20 that is alarming for international seafood business. See the following example for more clarification (Table 2.1).

- **The reasons for use of 17/23 or 18/22 grade instead of 16/20**
  - Unavailability of 16/20 grades at that time.
  - Availability of 17/23 or 18/22 grades at the same time.
  - Proper utilization of all sizes of shrimps.
  - For the calculation of total pcs/bag within the limit.
  - Sometimes grading may not be accurate because of manual/hand grading. As 18/22 and 17/23 are very close to 16/20 grade and the possibility of chances of mixing some lower grade shrimp.
  - Sometimes corrupt suppliers intentionally mixed lower grade shrimp with the desired grade shrimp. They did it for selling smaller shrimp at higher price and higher profit. That is, the illegal way sometimes occurs in processing industries. This type of illegal activities must be stopped immediately.

2.8.1 Grading Method

There are two types of grading method that are practiced in processing industries. These are as follows.

Fig. 2.49 Manual grading

1. **Manual Grading**
   Manual grading means grading of shrimp performed by the hand of expert graders. Manual grading is nothing but an assumption of expert grader based on the size and weight of shrimp. Expert graders make grading as per their basic knowledge, experience, and instruction received from the industry. The quality of manual grading depends on the quality and experience of expert graders. Suppliers usually preferred manual grading because manual grading is very fast comparing to mechanical grading. Manual grading sometimes may not be accurate as mechanical grading. Manual grading is also called hand grading.
   The following are the images of grading of shrimp (Figs. 2.49, 2.50, and 2.51).
2. **Mechanical Grading**
   Mechanical grading means grading of shrimp through automatic grading machine. Mechanical grading is also called automatic grading. Grader machine mechanically grades the shrimp by passing them over a series of inclined rollers set to segregate individual shrimp by differences in thickness/weight. As the shrimps cascade through the rollers, the various sizes are diverted by chutes into baskets. The baskets of various sizes of shrimp are placed in separate totes. Mechanical grading is more accurate than manual grading. Processing industries all over the world are now grading their shrimps by using automatic grading machine; however, some still preferred manual grading because mechanical grading is a time-consuming process. Mechanical grading is also a high-speed grading system that is more accurate and can be performed with minimizing operator's workload (Fig. 2.52).

- **Precaution of grading**
  - Manual grading is too fast. It may cause poor grading.
  - Professional graders are mostly illiterate and not aware of quality grading or uniformity.
  - Lack of proper supervision from factory personnel.

Fig. 2.50 Grade of 16/20 (HOSO)

Fig. 2.51 Grade of 6/8 (HLSO)

Fig. 2.52 Grading of shrimp with automatic grading machine

- Be careful in grading when performed by third-party people with a contract basis. They don't have any concerns about quality grading.
- Sometimes graders make rough grading intentionally as per instruction of factory personnel. It may happen because of the scarcity of raw materials, the politics of rivals, or more profit. These types of practices are illegal and must be stopped.

Grading should be supervised very carefully because uniformity arises from here. Uniformity is a too important criterion for shrimp business. If any kinds of anomalies are found in the grading system, necessary steps should be taken immediately to diminish it as early as possible. Importers are more serious about uniformity. If the buyer found abnormal uniformity, it may cause to stop shipment immediately as well as business in the future.

[Note: It is necessary to avoid contract basis grading system. If not possible to avoid contract basis grading system then processing industries should train the professional graders to understand the quality of grading, uniformity, and prospects of grading in these sectors. Only consciousness of expert graders and factory owner can solve this type of problem.]

2.9 Uniformity of Shrimp

Uniformity is the quality or state of being uniform or homogeneity of shrimp. It's related to the grading of shrimp. It means the uniform size as well as uniform weight of shrimp. Uniformity ensures precise pieces and the weight of shrimp. Uniformity is one of the important parts of quality control of shrimp. Uniformity ratio helps buyer to assess the quality of shrimp. The lower uniformity implies good quality product, but higher uniformity implies less quality product. It is expected that the uniformity ratio should not be more than 1.5. The following parameters should be ensured during confirmation of standard grade of uniformity ratio:

- Uniform size of every shrimp.
- Uniform weight of every shrimp. Individual weight of shrimp must be within limit.
- Underweight shrimp should be avoided.
- Overweight shrimp should also be avoided.
- No. of pcs/*lb* or pcs/kg must be within the limit. Never cross the standard limit.
- No. of pcs/bag must also be accurate. Pieces out of limit are strictly prohibited.

The following are the images of some uniform shrimp (Figs. 2.53, 2.54, and 2.55).

- **How Can We Determine Uniformity Ratio?**

The following steps should be followed to determine the uniformity ratio:

Fig. 2.53 Uniformity (HOSO)

Fig. 2.54 Uniformity (HLSO)

Fig. 2.55 Uniformity (PND)

Step 1:	At first, shrimp of upper grade (largest size) and shrimp of lower grade (smallest size) should be separated.
Step 2:	Weight of 10% largest shrimp should be taken and noted down
Step 3:	Weight of 10% smallest shrimp should also be taken and noted down
Step 4:	Divide the weight of 10% largest shrimp by the weight of 10% smallest shrimp for the calculation of uniformity ratio

$$\text{Uniformity Ratio} = \frac{\text{Weight of 10\%largest shrimp (g)}}{\text{Weight of 10\%smallest shrimp (g)}}$$

The tolerance limit of uniformity ratio may vary from product to product and buyer to buyer. Generally, buyer asked to maintain uniformity ratio within 1.20 or 1.30, but it may be accepted till 1.5 based on size and type of products. Sometimes buyer may accept uniformity ratio out of 1.5 for larger grade of shrimp.

[Note: Uniformity ratio should be measured in a deglazed condition, not in defrost condition. Measurement of uniformity ratio in defrost condition is a wrong method. If, someone measures uniformity ratio in defrost condition, soaking gain of the products may be released out, resulting in a shortage of weight and higher uniformity ratio.]

*Calculate and justify uniformity ratio for BT, HLSO-EZP, raw, 8/12, FC, 80% net weight, and 10 × 1 kg IQF products, whereas total pcs/bag is 26, weight of 10% largest shrimp is 106 g, and the weight of 10% smallest shrimp is 82 g

Uniformity Ratio: $= \frac{\text{Weight of 10\%largest shrimp (g)}}{\text{Weight of 10\%smallest shrimp (g)}}$ $= \frac{106}{82}$ $= 1.29$	Here, Total pcs/block = 26 Weight of 10% largest shrimp = 106 g Weight of 10% largest shrimp = 82 g Uniformity ratio = ?

Justification: Now cross-check with standard uniformity ratio. Standard uniformity ratio is 12/8 = 1.50. In this product uniformity ratio is 1.29 that indicates the shrimps are within the limit and uniform in size. If the uniformity ratio observed is within the limit, the product should be accepted; otherwise, product may not be accepted or decision goes to the buyer's opinion (Figs. 2.56 and 2.57).

[Note: Count total pcs per bag first. Suppose it has 26 pcs/bag. 10% of 26 = 2.6 or 3 pcs (0.6 shrimp is not possible). That means 3 largest pcs and 3 smallest pcs should be taken for the calculation of uniformity ratio for this product. Here, the weight of 3 pcs largest shrimp is 106 g and the weight of 3 pcs smallest shrimp is 82 g.]

Perform the following exercises

Exercise 1:	Calculate uniformity ratio, when the weight of 10% largest shrimps is 95 g and weight of 10% smallest shrimps is 72 g.
Exercise 2:	Calculate uniformity ratio and justify for BT, HLSO, raw, 21/25, RC, 80% net weight, 10 × 1 kg IQF shrimps. The individual weight of largest grade and smallest grade shrimp is 22 g and 18 g, respectively. [Hints: Pcs should be standard.]
Exercise 3:	Suppose this is BT, HLSO, raw, 31/40, RC, 70% net weight, 6 × 1.8 kg block products. If total pcs per block is 110, calculate the uniformity ratio and justify it. [Hints: The individual weight of shrimp should be standard.]

(continued)

Fig. 2.56 Weight of 10% smallest shrimp

Fig. 2.57 Weight of 10% largest shrimp

Exercise 4:	Calculate and justify uniformity ratio for BT, HOSO, raw, 8/12, FC, 80% net weight, 10 × 1 kg semi-IQF shrimps, whereas the weight of the largest and smallest shrimp is 99 g and 70 g, respectively.
Exercise 5:	Calculate and justify uniformity ratio for BT, PD, raw, 26/30, FC, 75% net weight, 10 × 1 kg IQF products. [Hints: Everything should be standard and maximum.]

2.10 Count of Shrimp

There are two types of counting system that are practiced in shrimp processing industries. These are:

- Frozen count (FC)
- Real count (RC)

The count of shrimp is very important. The price of shrimp depends on these count variations. The price of the real count is higher than the price of frozen count for same grade of shrimp. The main difference in frozen count and real count is the

variation of individual weight and number of pcs/*lb*. The individual weight of shrimp is lower and the larger number of pcs/*lb* observed is higher in frozen count (FC), whereas vice versa in real count (RC). The details of frozen count and real count are as follows.

2.10.1 Frozen Count (FC)

Simply, frozen count (FC) means frozen weight of shrimp or weighing of shrimp in frozen condition. Frozen count is calculated including the weight of shrimp plus weight of glaze. In frozen counting method, the individual weight of shrimp goes lower and total pcs/*lb* goes higher because the shrimps are weighted with their glazing.

- **Calculation of Pieces (Pcs) for IQF Shrimp (FC)**

*Calculate how many pieces of shrimp will be in a bag for BT, HLSO, raw, 8/12, FC, 80% net weight, 10 × 1 kg IQF products.

Maximum no. of pcs per bag $= \frac{\text{Lowest grade}}{454} \times$ Frozen weight $= \frac{12}{454} \times 1000$ $= 26.43$ or 26 pcs/bag **Again,** Minimum no. of pcs per bag $= \frac{\text{Highest grade}}{454} \times$ Frozen weight $= \frac{8}{454} \times 1000$ $= 17.6$ or 18 pcs/bag (0.6 shrimp is not possible)	Here, Size/grade = 8/12 Lowest grade is = 12 pcs/*lb* Highest grade is = 8 pcs/*lb* Packing =10 × 1 kg Frozen weight = 1000 g 80% Net weight = 800 g 1 *lb* = 454 g Max. Pcs/bag = ? Min. Pcs/bag = ?

Result: Pieces range is 18–26 per bag. It means a maximum of 26 pcs and a minimum of 18 pcs should be presented in a bag for 8/12, FC, 80% net weight, 10x1 kg, IQF products.

Perform the following exercises

Exercise 1:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO-EZP, 13/15, FC, 80% net weight, 10 × 1 kg, IQF products.
Exercise 2:	Calculate how many pcs of shrimp will be in a bag for BT, PD, 16/20, FC, 75% net weight, 10 × 1 kg, IQF products.
Exercise 3:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, 21/25, FC, 60% net weight, 10 × 1 kg, IQF products.
Exercise 4:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, PDTO, 31/40, FC, 70% net weight, 10 × 1 kg, IQF products.
Exercise 5:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, 71/90, FC, 75% net weight, 10 × 1 kg, IQF products.

[Appendix B: Size and weight table]

- **Calculation of Pieces (Pcs) for Semi-IQF Shrimp (FC)**

*Calculate how many pcs of shrimps will be in a box for BT, HOSO, raw, 16/20, FC, 75% net weight, 10 × 1 kg semi-IQF products.

Maximum no. of pcs per box $= \frac{\text{Lowest grade}}{1000} \times$ Frozen weight $= \frac{12}{1000} \times 1000$ $= 12$ pcs/box **Again,** Minimum no. of pcs per box $= \frac{\text{Highest grade}}{1000} \times$ Frozen weight $= \frac{8}{1000} \times 1000$ $= 8$ pcs/box	Here, Size/grade = 8/12 Lowest grade is = 12 pcs/kg Highest grade is = 8 pcs/kg Packing = 10 × 1 kg Frozen weight = 1000 g 75% Net weight = 750 g 1 kg = 1000 g Max. Pcs/box =? Min. Pcs/box = ??

Result: The range of pieces is 8–12 per box or semi-IQF block; it means final grade is same as a grade of requirement. Maximum 12 and minimum 8 pcs can be presented in a box for BT, HOSO, raw, 16/20, FC, 75% net weight, 10 × 1 kg semi-IQF shrimp.

[Note: Calculation of pcs for semi-IQF is different. Here, unit weights are calculated in kg instead of the pound (*lb*) and total pcs/box or semi-IQF block is same as the final grade.]

Perform the following exercises

Exercise 1:	Calculate how many pcs of shrimp will be in a box for BT, HOSO, raw, 13/15, FC, 80% net weight, 10 × 1 kg, semi-IQF products.
Exercise 2:	Calculate how many pcs of shrimp will be in a block for BT, HOSO, raw, 16/20, FC, 75% net weight, 10 × 1 kg, semi-IQF products.
Exercise 3:	Calculate how many pcs of shrimp will have in a box for BT, HOSO, raw, 21/30, FC, 80% net weight, 10 × 1 kg, semi-IQF products.
Exercise 4:	Calculate how many pcs of shrimp will be in a box for BT, HOSO, raw, 40/50, FC, 70% net weight, 10 × 1 kg, semi-IQF products.
Exercise 5:	Calculate how many pcs of shrimp will be in a block for BT, HOSO, raw, 41/50, FC, 60% net weight, 10 × 1 kg, semi-IQF products.

[Appendix B: Size and weight table]

2.10.2 Real Count (RC)

Real count means weighing of shrimp in deglaze condition or weighing of shrimp without considering their glaze. Real count is the method where the individual weight of shrimp is higher and total pcs/*lb* goes lower because glaze is not considered here. It means total pcs of shrimp per unit weight (*lb* or kg) is calculated based on their net weight only. Net weight should be calculated after deglazing/defrosting/thawing of shrimp. The price of real count shrimp is higher.

- **Calculation of Pieces (Pcs) for IQF Shrimp (RC)**

*Calculate how many pcs of shrimps can be present in a bag for BT, HLSO, 8/12, RC, 80% net weight, 10 × 1 kg, IQF products?

Maximum no. of pcs per bag $= \frac{\text{Lowest grade}}{454} \times$ Net weight $= \frac{12}{454} \times 800$ $= 21.14$ or 21 pcs/bag **Again,** Minimum no. of pcs per bag $= \frac{\text{Highest grade}}{454} \times$ Net weight $= \frac{8}{454} \times 800$ $= 14.1$ or 14 pcs/bag (0.1 shrimp is not possible)	Here, Size/grade = 8/12 Lowest grade is = 12 Highest grade is = 8 Packing = 10 × 1 kg Frozen weight = 1000 g 80% Net weight = 800 g 1 *lb* = 454 g Max. Pcs/bag = ? Min. Pcs/bag = ?

Result: Pieces range is 14–21 per bag. It means a maximum of 21 pcs and a minimum of 14 pcs should be presented in a bag for 8/12, RC, 80% net weight, 10x1 kg, IQF products.

Perform the following exercises

Exercise 1:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO-EZP, raw, 13/15, RC, 80% net weight, 10 × 1 kg, IQF products.
Exercise 2:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, raw, 16/20, RC, 60% net weight, 10 × 1 kg, IQF products.
Exercise 3:	Calculate how many pcs of shrimp will be in a bag for BT, PD, raw, 21/25, RC, 75% net weight, 10 × 1 kg, IQF products.
Exercise 4:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, raw, 26/30, RC, 78% net weight, 10 × 1 kg, IQF products.
Exercise 5:	Calculate how many pcs of shrimp will be in a bag for BT, HLSO, raw, 71/90, RC, 70% net weight, 10 × 1 kg, IQF products.

[Appendix B: Size and weight table]

- **Calculation of Pieces (Pcs) for Block Frozen Shrimp (RC)**

*Calculate how many pcs of shrimp will be in a block for BT, HLSO, raw, 8/12, RC, 80% net weight, 6 × 1.8 kg block products

Maximum pcs per bag $= \frac{\text{Lowest grade}}{454} \times$ Net weight $= \frac{12}{454} \times 1440$ $= 38.06$ or 38 pcs/block Again, Minimum pcs per bag $= \frac{\text{Highest grade}}{454} \times$ Net weight $= \frac{8}{454} \times 1440$ $= 25.4$ or 25 pcs/block	Here, Size/grade = 8/12 Lowest grade is = 12 Highest grade is = 8 Packing = 6 × 1.8 kg Frozen weight = 1800 g Net weight = 80% = 1800 × 80% = 1440 g 1 *lb* (Pound) = 454 g Max. Pcs/Block =? Min. Pcs/Block = ??

Result: Pieces range is 25–38 per block. It means a maximum of 38 pcs and a minimum of 25 pcs should be presented in a block for 8/12, RC, 80% net weight, 6 × 1.8 kg, block frozen shrimps.

Perform the following exercises

Exercise 1:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 16/20, RC, 70% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 2:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 21/25, RC, 70% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 3:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 16/20, RC, 80% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 4:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 26/30, RC, 80% net weight, 6 × 1.2 kg block frozen shrimp.
Exercise 5:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 16/20, RC, 90% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 6:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 31/40, RC, 90% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 7:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 16/20, RC, 100% net weight, 6 × 1.8 kg block frozen shrimp.
Exercise 8:	Calculate how many pcs can be presented in a block for BT, HLSO, raw, 41/50, RC, 100% net weight, 6 × 1.2 kg block frozen shrimp.

[Appendix B: Size and weight table]

2.11 Individual Weight of Shrimp

Individual weight means the weight of every single shrimp. Individual weight of shrimp is fixed and individual shrimp out of limit is not to be accepted anymore. Variation of individual weight shows abnormal uniformity so it must be within limit. Standard individual weight must be met during final grading shrimp. The individual weight of shrimp can be calculated by using following procedure.

- **Calculation of Individual Weight of Frozen Count (FC) Shrimp**

*Calculate the individual weight of shrimp for BT, HLSO, raw, 8/12, FC, 80% net weight, 10 × 1 kg, IQF products?

Min. individual weight of shrimp $= \frac{454}{\text{Lowest grade}} \times \%$ of net weight $= \frac{454}{12} \times 80\%$ $= \frac{454}{12} \times 0.8$ $= 30.3$ g or 30 g **Again,** Max. individual weight of shrimp $= \frac{454}{\text{Lowest grade}} \times \%$ of net weight $= \frac{454}{8} \times 80\%$ $= \frac{454}{8} \times 0.8$ $= 45.4$ g or 45 g	Here, Size/grade = 8/12 Lowest grade is = 12 pcs/*lb* Highest grade is = 8 pcs/*lb* Packing = 10 × 1 kg Net weight = 80% 1 *lb* (pound) = 454 g Max. Individual weight = ? Min. Individual weight = ?

Result: The range of individual weight of shrimp is 30–45 g. It means the minimum individual weight of shrimp will be 30 g and the maximum individual weight of shrimp will be 45 g for BT, HLSO, raw, 8/12, FC, 80% net weight, 10 × 1 kg IQF products. Shrimps out of this limit are not accepted.

Perform the following exercise

Exercise 1:	Calculate the individual weight of shrimp for BT, HLSO-EZP, 13/15, FC, 80% net weight, 10 × 1 kg, IQF products.
Exercise 2:	Calculate the individual weight of shrimp for BT, HLSO, 16/20, FC, 70% net weight, 10 × 1 kg, IQF products.
Exercise 3:	Calculate the individual weight of shrimp for BT, PD, 21/25, FC, 75% net weight, 10 × 1 kg, IQF products.
Exercise 4:	Calculate the individual weight of shrimp for BT, PDTO, 26/30, FC, 78% net weight, 10 × 1 kg, IQF products.
Exercise 5:	Calculate the individual weight of shrimp for BT, P&D, 61/70, FC, 90% net weight, 6 × 2 kg, IQF products.

[Appendix B: Size and weight table]

- **Calculation of Individual Weight of Real Count (RC) Shrimp**

*Calculate the individual weight of shrimp for BT, HLSO, raw, 8/12, RC, 80% net weight, 10 × 1 kg IQF products?

Minimum weight of shrimp $= \frac{454}{\text{Lowest grade}}$ $= \frac{454}{12}$ $= 37.8$ g or 38 g **Again,** Maximum weight of shrimp $= \frac{454}{\text{Lowest grade}}$ $= \frac{454}{8}$ $= 56.8$ g or 57 g	Here, Size/grade = 8/12 Lowest grade is = 12 pcs/*lb* Highest grade is = 8 pcs/*lb* Packing = 10 × 1 kg Net weight = 80% 1 *lb* (pound) = 454 g Max. Individual weight = ? Min. Individual weight = ?

Result: The range of individual weight of shrimp is 38–57 g. It means the minimum individual weight of shrimp will be 38 g and the maximum individual weight of shrimp will be 57 g for BT, HLSO, raw, 8/12, RC, 80% net weight, 10x1 kg IQF products. Shrimps out of this limit are not accepted.

Perform the following exercise

Exercise 1:	Calculate the individual weight of shrimp for BT, HLSO-EZP, raw, 13/15, RC, 80% net weight, 10 × 1 kg, IQF products.
Exercise 2:	Calculate the individual weight of shrimp for BT, HLSO, raw, 26/30, RC, 75% net weight, 10 × 1 kg, IQF products.
Exercise 3:	Calculate the individual weight of shrimp for BT, PD, raw, 21/25, RC, 70% net weight, 6 × 1.8 kg, block products. [Hints: Same as IQF product]
Exercise 4:	Calculate the individual weight of shrimp for BT, HLSO, raw, 71/90, RC, 80% net weight, 6 × 1.8 kg, block products. [Hints: Same as IQF product]

(continued)

Exercise 5:	Calculate the individual weight of shrimp for BT, HLSO, raw, 16/20, RC, 100% net weight, 6 × 1.2 kg, block products? [Hints: As same as IQF product]
Exercise 6:	Calculate the individual weight of shrimp for BT, HLSO, raw, 8/12, RC, 90% net weight, 6 × 1.4 kg, block products? [Hints: As same as IQF product]

[Appendix B: Size and weight table]

- **Calculation of Individual Weight of Semi-IQF Shrimp (FC)**

*Calculate individual weight of shrimp for BT, HOSO, Raw, 8/12, FC, 20% glaze, 10 × 1 kg, Semi-IQF products

Minimum weight of shrimp $= \frac{1000}{\text{Lowest grade}} \times \%$ of net weight $= \frac{1000}{12} \times 80\%$ $= \frac{1000}{12} \times 0.8$ $= 66.7$ g or 67 g **Again,** Maximum weight of shrimp $= \frac{1000}{\text{Lowest grade}} \times \%$ of net weight $= \frac{1000}{8} \times 80\%$ $= \frac{1000}{8} \times 0.8$ $= 100$ g	Here, Size/grade = 8/12 Lowest grade is = 12 pcs/kg Highest grade is = 8 pcs/kg Net weight = 80% Packing = 10 × 1 kg 1 kg = 1000 g Max. individual weight = ? Min. individual weight = ?

Result: The range of individual weight of shrimp is 67–100 g. It means the minimum individual weight of shrimp is 67 g and the maximum individual weight of shrimp is 100 g for BT, HOSO, raw, 8/12, FC, 80% net weight, 10 × 1 kg semi-IQF products. Shrimps out of this limit are not accepted.

Perform the following exercise

Exercise 1:	Calculate the individual weight of shrimp for BT, HOSO, raw, 13/15, FC, 20% glaze, 10 × 1 kg, semi-IQF products.
Exercise 2:	Calculate the individual weight of shrimp for BT, HOSO, raw, 16/20, FC, 25% glaze, 10 × 1 kg, semi-IQF products.
Exercise 3:	Calculate the individual weight of shrimp for BT, HOSO, raw, 16/20, FC, 22% glaze, 10 × 1 kg, semi-IQF products.
Exercise 4:	Calculate the individual weight of shrimp for BT, HOSO, raw, 21/30, FC, 30% glaze, 10 × 1 kg, semi-IQF products.
Exercise 5	Calculate the individual weight of shrimp for BT, HOSO, raw, 31/40, FC, 40% glaze, 10 × 1 kg, semi-IQF products.

[Appendix B: Size and weight table]

2.12 Glazing and Hardening of Shrimp

Glazing is a protective layer of ice that is added to the surface of frozen shrimp. Shrimps are glazed automatically through brushing water, immersion/dipping them into water, or spraying water over them that helps to preserve the freshness of frozen shrimps. Potable water or potable water with approved additives should be added for appropriate glazing. After glazing, shrimps are shifted to hardening chamber for hardening of glaze. Hardening is performed to secure the glazing of shrimp. Glazing and hardening are a significant issue for IQF products. The percentage of glaze depends on buyer requirements. The following things should be checked during glazing of shrimp:

- Temperature of product (shrimp)
- Source of glaze water
- Temperature of glaze water
- Surface area of the product means size/grade of shrimp
- Percentage of glaze
- Duration of glazing
- Temperature of hardening chamber and duration

The following are the images of glazing and hardening of shrimp (Figs. 2.58, 2.59, and 2.60).

- **Importance of Glazing**

  Glazing is important for the following reasons:

- Acts like packaging aid and minimizes the risk of contact with the air
- Reduces oxidation and minimizes rancidity
- Protects from surface dehydration
- Protects from discoloration and decomposition
- Protects against temperature fluctuations and freeze burn during storage and transport
- Preserves freshness, improves quality, and extends the shelf life of the product

In recent years processing industries are interested to use edible coatings from polysaccharides, proteins, and lipids to extend shelf life of food products (Sun 2005).

Fig. 2.58 Glazing

Fig. 2.59 Glazing

- **How can we determine the percentage (%) of glazing?**

The following steps are used to determine the percentage glazing:

Step 1:	Weight of frozen shrimp (frozen weight) should be taken first
Step 2:	Sufficient water should be taken for deglazing of shrimp or standard water volume is eight times of frozen sample
Step 3:	Leave the shrimp in water until the ice melted. Remember that shrimp should be deglazed without defrosting the shrimp itself
Step 4:	Temperature should be maintained at 20 °C ± 5 °C for 20 s to 2 min depending on glazing percentage, type, and the size of product
Step 5:	Weight of deglazed shrimp (deglazed weight) should be taken
Step 6:	Calculate the percentage (%) of glazing using the following formula:

Fig. 2.60 Hardening

$$\%\text{ofGlaze} = \frac{\text{Frozen weight} - \text{Deglazed weight}}{\text{Frozen weight}} \times 100$$

*Calculate the percentage of glazing for BT, HLSO-EZP, 8/12, 80% net weight, RC, 10 × 1 kg packing IQF products where frozen weight is 1000 g and deglazed weight is 810 g.

$\%\text{of Glazing} = \frac{\text{Frozen weight} - \text{Deglazed weight}}{\text{Frozen weight}} \times 100$ $= \frac{1000-810}{1000} \times 100$ $= \frac{190}{1000} \times 100$ $= 19$	Here, Frozen weight = 1000 g Deglazed weight = 810 g % of glazing = ?

Result: Percentage (%) of glazing is 19 or 19%. It means percentage (%) of glaze is 19 and percentage (%) of deglaze shrimp is 81. Moreover, the weight of glaze is 190 g, whereas the weight of deglaze shrimp is 810 g for this product.

Perform the following exercise

Exercise 1:	Calculate the percentage of glazing for BT, HLSO, IQF, 6/8, FC, 75% NW, 10 × 1 kg packing, where frozen weight is 1060 g and deglazed weight is 768 g
Exercise 2:	Calculate the percentage of glazing for BT, HLSO, IQF, 13/15, RC, 80% NW, 10 × 1 kg packing, where frozen weight is 1020 g and deglazed weight is 808 g
Exercise 3:	Calculate the percentage of glazing for FW, P & D, IQF, 16/20, RC, 80% NW, 10 × 1 kg packing, where frozen weight is 1038 g and deglazed weight is 815 g
Exercise 4:	Suppose a product of BT, HLSO, IQF, 21/25, FC, 70% NW, 10 × 1 kg packing, where 60% shrimps are the largest grade and the rest of shrimps are the lowest grade. Deglazed weight of the largest shrimp and smallest shrimp is 15 g and 12 g, respectively. Frozen weight is 1030 g. Now calculate the % of glazing

- **Precaution of deglazed weight**
  - Glaze should be removed properly.
  - Soaking gain should not be removed.
  - Measurement of weight should be more accurate.
  - Chilled water should be used for deglazing of process. Use of hot water is not a standard procedure.
  - Never let the sample long time in water for removing of glaze; otherwise, it will be defrosted instead of deglazed.
  - Special care should be taken for small size shrimp. It has the tendency to defrost within a very short time.

References

Parisenti J, Henrique L, Mourino JLB, do Nascimento Vieira F, Buglione CC, Maraschim M (2011) Effect of background color on shrimp pigmentation. Bol Inst Pesca 37(2):177–182

Sun DW (2005) Handbook of frozen food processing and packaging. CRC Press