

## Freezers

### Expected Learning Outcome

- Freezing principle
- Types of freezers
- Quick freezers and their working principle
- Variables which effect freezing time

### 5.1.Freezers

The purpose of freezing fish is to lower its temperature and thus slow down spoilage so that when the product is thawed after cold storage it is almost undistinguishable from fresh fish. Fish is largely water, normally 60-80 percent depending on the species, and the freezing process converts most of this water into ice. Freezing requires the removal of heat, and fish from which heat is removed falls in temperature. During the first stage of cooling, the temperature falls rapidly to just below 0°C (freezing point of water). As more heat requires to be extracted during the second stage, in order to turn bulk of the water to ice, the temperature changes very little and this stage is know as period of “thermal arrest” when about three quarters of the water is turned ice, the temperature again begins to fall and during the third stage most of the remaining water freezes. A comparatively small amount of heat has to be removed during this third stage. Quick freezing recommended that all the fish should be reduced from a temperature of 0°C to -5°C in 2 hours or less. The fish should then be reduced in temperature so that average temperature at the end of the freezing process is equivalent to the recommended storage temperature of -30°C. The recommendation that the fish should be reduced to the intended storage temperature is important and this should be included in all good codes of practices for quick freezing. The two basic requirement for freezing is that the fish be frozen quickly and be reduced to storage temperature, go together since it is likely that a freezer which can quick freeze fish can also operates at a sufficiently low temperature to ensure that the recommended product storage temperature can be achieved. The freezing rate is always quicker near the surface of the fish, where it is in contact with the cooling medium and slower at the centre. Freezing rates are therefore only average rates and they do not represent what happens in practices The freezing rates vary between 2 and 1000 mm /h. The table shows the freezing rates.

2mm /h	slow bulk freezing in a blast room
5 to 30 mm/h	quick freezing in a plate freezer or tunnel air blast freezer
50 to 100 mm/h	Rapid freezing 9- small products
100 to 1000 mm/h	ultra rapid freezing in liquefied gases such as nitrogen and carbon dioxide

There are now many different type of freezers available for freezing fish, three factors may be initially considered when selecting a freezer. Financial consideration, functional consideration and feasibility.