4. Fish Meal Production: An Overview

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About 2/3\textsuperscript{rd} of the quantity of fish is utilized for direct human consumption whereas, rest of the fish production goes for fish meal production or other non-consumption purposes.

Fish meal is a dry product having brownish grey colour and milled to a fine or coarse powder which is produced by removing water and fat from the fish.

\textbf{Production of fish meal}

Raw material required for fish meal production is discussed in a separate chapter. The main objective in fish meal manufacture is reducing moisture and oil content of fish to less than 10%.

Methods of production of fish meal

- Dry rendering
- Wet rendering

Dry rendering or dry reduction method is suitable for lean fish containing less than 2-3\% oil. It is not a continuous process. Wet reduction method is continuous and can be used for production of fish meal from fatty fish. Wet rendering is a commonly used method of fish meal production throughout the world.
Process of Fish Meal Production

Raw material receiving

Fish which have not entered putrefaction level are accepted as raw material for fish meal production.

Cooking

The fish are dumped into fish hold which is fitted with the screw conveyors. Fish are carried through screw conveyors and fed to continuous cooker hopper. Cooker consists of a long, jacketed cylindrical vessel having hopper at one end and exit for cooked fish to come out at another end. The cylindrical vessel has a perforated plate and wire mesh to drain the liquid coming out from fish during cooking. Cooker is also fitted with a screw conveyor and both the shaft of screw conveyor and jacket are heated to cook the fish indirectly. In some cookers, steam may be directly injected into the fish mass through the nozzles fixed to the shaft by passing steam. Cooker may be fitted with automatic level control for raw material and temperature and a trap for collecting foreign materials and also have removable panels for inspection and cleaning. Cooking is done at 95 to 100 degree Celsius within 15-20 minutes. Cooking is most important step in fish meal production as overcooking and undercooking of fish is not admissible. The time of cooking is dependent on fish species. Cooking step is carried out to denature fish proteins and rupture cell wall of fish tissues which aid in separation of water from fish. Handling of stale fish during cooking is difficult wherein coagulating agents such as formaldehyde are added. After cooking, fish is converted to screw conveyor by which fish exits the cooker and also separates liquid coming out of fish. Straining is
often performed in the cooker itself.

**Pressing**

Pressing separates cooked fish into two distinct phases namely, solid phase (Press cake), liquid phase (press liquor). Pressing is done using screw press. It may be single or double screw press. Double screw press is preferred over single as it removes maximum quantity of oil and moisture from cooked fish. The press consists of a cylindrical vessel constructed using thick steel plates with perforation on the sides and bottom for drainage of press liquor. A tapered helical screw rotates inside the vessel with an axis same as that of the cylindrical vessel. When the screw rotates, it exerts minimum pressure at the entry point and maximum pressure at the exit as a result the space available for cooked fish gets reduced as it moves towards the exit and hence gets pressed. In double screw press, two screws are kept side by side along with cylindrical vessel and surround the screw. The screw rotates in the opposite direction. Usually press cake coming out of screw press contains 45-55% of water and 2-3% of fat. Press liquor coming out of the press is saved for oil extraction.

**Fluffing**

Press cake coming out if the press is in the form of large lumps. In order to increase the efficiency, lumps are broken into pieces of about 1 cm size by low speed hammer mill. This step is combined with pressing phase in recent years.

**Drying**

Press cake with about 50% moisture, it is dried to moisture content less than 10%. Usually there are direct or indirect dryers used but indirect
Dryers are used widely. It consists of a large jacketed cylindrical vessel in which an assembly of circular coils fitted to a hollow shaft is fixed. The shaft rotates in the same axis as that of the cylindrical vessel. Vapors are removed with suction arrangement. Steam is passed in the cylindrical vessel and it takes about 20 minutes for press cake to travel from hopper to the exit of dryer. The dried press cake is then passed through separator to remove any steel contaminants.

**Cooling**

Fish meal is cooled in coolers similar to dryer except use of cold water instead of steam. Cooling is applied unless and until dried fish temperature reaches ambient temperature.

**Milling**

Dried press cake is passed through a vibratory screen to separate extraneous material such as wood, cloth, fishing hooks, shells and nails prior to milling. In milling, hammer mill is used. Hammers may be of moving type or fixed type. Dried fish meal is fed to grinding chamber through an opening near the centre, hammers hit the big particles and break into small particles which will pass through sieve at the bottom of the chamber which is fitted with cyclone separator to reduce the dusting problem.

**Packing, labelling and storage**

Fish meal is usually packed in polyethylene lined jute bags or PE lined paper bags or PE lined HDPE woven sacks. The outer packaging is properly labelled. Addition of antioxidants may prevent oxidation of fish meal. The packaging material should have water vapour barrier property.