

FISH MEAL AND FISH OIL



Introduction

- Started in northern Europe and North America at the beginning of the 19th century
- Was based mainly on surplus catches of herring from seasonal coastal fisheries
- This was essentially an oil production activity; the oil finding industrial uses in leather tanning and in the production of soap and glycerol and other non-food products
- The residue was originally used as fertilizer, but since the turn of this century it has been dried and ground into fish meal for animal feeding

What is fish meal?



- A product obtained by drying and grinding or otherwise treating fish or fish waste to which no other matter has been added
- A solid product obtained by removing most of the water and some or all of the oil from fish or fish waste.



Importance of fish meal

- Traditionally used as live stock feed supplement
- Contains high quality of animal protein with essential amino acids like lysine, methionine and cysteine
- Good source of B group vitamins like cyanocobalamine (B₁₂), choline, niacin, pantathonic acid and riboflavine
- Rich in minerals like calcium, phosphorous, copper and iron and is also the source of some trace elements referred as unknown growth factors (UGFs)

Use of fish meal as feed ingredient

- Fishmeal is fed to farm animals, not only to improve productivity, but also to protect health and welfare and reduce dependence on antibiotics and other drugs
- Fishmeal has low antigenicity, making it easy for young animals to digest. Fishmeal has anti-inflammatory properties which improve animal's disease resistance
- Fishmeal and fish oil can claim to be the first “functional feeds” – offering, through their high omega-3 content, specific health and welfare benefits to both farmed livestock and to the human population eating the animal products.

Processing Method

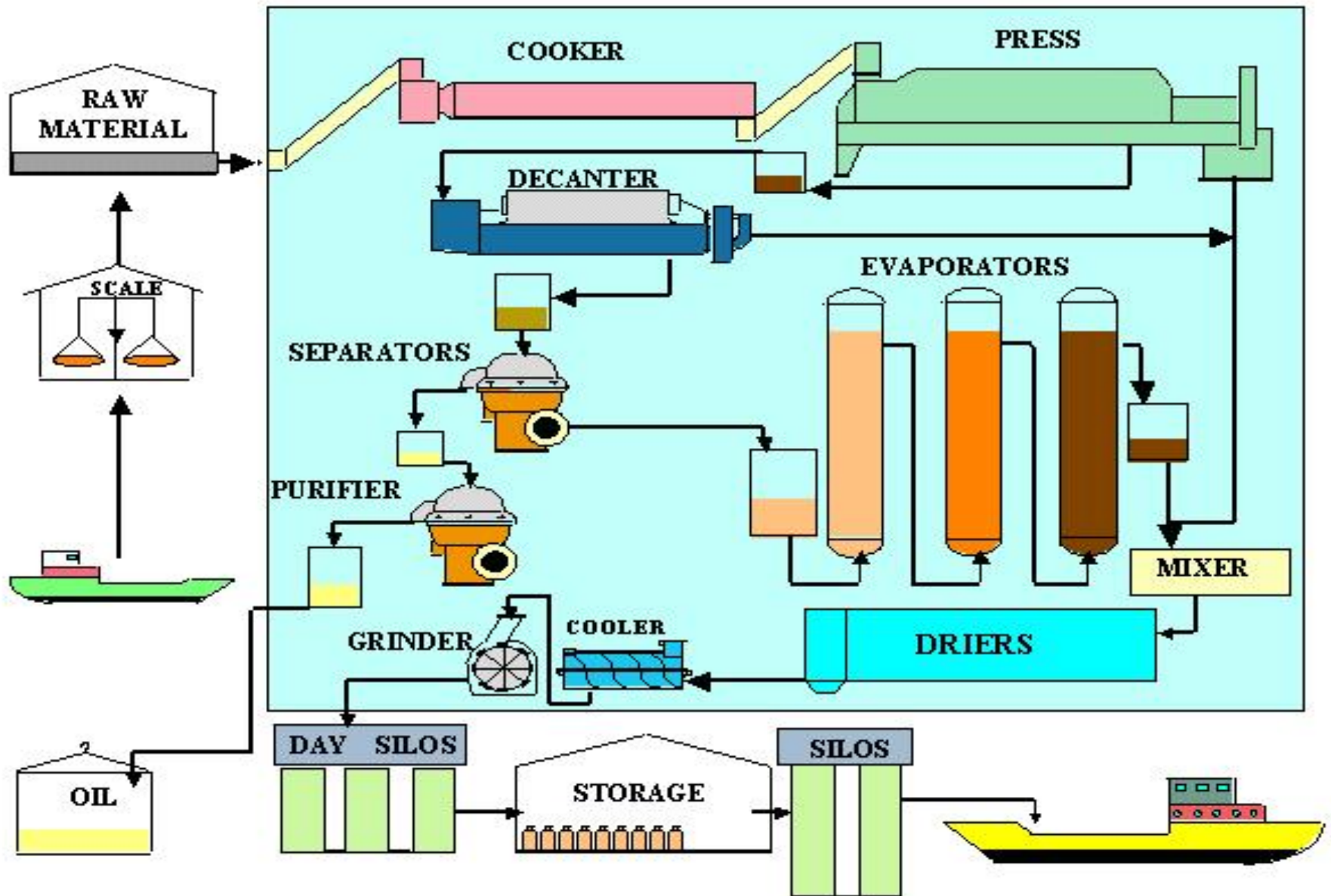
- Composed of three major fractions:
 - Solid (fat free dry matter)
 - Oil
 - Water

- There are two methods:
 - Wet reduction method
 - Dry reduction method

Common Steps to all Methods of Practical Importance

- Heating, which coagulates the protein, ruptures the fat depots and liberates oil and physico-chemically bound water
- Pressing (or occasional centrifugation), which removes a large fraction of the liquids from the mass
- Separation of the liquid into oil and water (stickwater). This step may be omitted if the oil content of the fish is less than 3%
- Evaporation of the stickwater into a concentrate (fish solubles)
- Drying of the solid material (presscake) plus added solubles, which removes sufficient water from the wet material to form a stable meal
- Grinding the dried material to the desired particle size

Process flow diagram for fish meal and fish oil production



Wet reduction/rendering process

- Leaves a high amount of moisture in the product, until, or if, it is to be dried
- Primarily for fatty fish - menhaden, herring, pilchards, anchovy, sardine etc.
- This process is continuous rather than batch process and is particularly suitable for large scale operation.

Essential Steps

- Grinding or hashing of large fish
- Cooking and heating usually with steam
- Pressing to squeeze out water and oil
 - The liquid portion is known as press liquor and is passed through a screen to remove solid particles of fish which are then returned to the solid portion called press cake which contains about 50-55% moisture and 3-4% oil
- Fluffing out of press cake
- Drying the press cake to a moisture level of 10%
- Grinding and packing the dried

Dry reduction/rendering process

- Principally applied to the conversion of fish or fish offal of low fat content
- Batch process and is easier to manipulate than the wet rendering

Essential steps in dry reduction process

- Fish are coarsely ground in a hacker or grinder
- The hacked fish are cooked in a steam jacketed cooker with a stirrer.
- The cooker also acts as a drier and is usually referred as cooker/ drier. Presser and separate drier or optional extras with this type of plant the cooker/drier may be operated at atmospheric pressure or under slight vacuum to facilitate drying.

Advantages and disadvantages of Wet reduction process

Advantages	Disadvantages
➤ Good quality oil produced	➤ Meal low in water soluble unless concentrated stick water is added back
➤ Faster process	➤ Lower yield
➤ Lower installation and operation cost	➤ Rigid operation condition
➤ Suitable for processing large quantities of material	
➤ Can yield a valuable by product i.e fish soluble	

Advantages and disadvantages of Dry reduction process

Advantages	Disadvantages
➤ High yield of oil even for non fatty fish	➤ Oil of inferior quality (due to rancidity)
➤ Suitable for small batch operation	➤ High installation and operating costs
➤ Easy to manipulate cooking/drying times	➤ Production is slow (batch operation-limited capacity)
➤ Greater flexibility	
➤ Produces whole meal including solubles	

Fish meal quality

- **Oxidation:** Oxidative rancidity mainly affects the quality of fish meal. Addition of an antioxidant such as ethoxyquin at 700ppm is desirable for oily species. Natural antioxidants such as α -tocopherol also used in order to retard the oxidation process.
- **Salmonella:** The end product should be free from salmonella contamination. Salmonella should never be detected in fish meal. The contaminated lots must be disinfected for example in special apparatus in which the meal is heated at about 90°C with live steam for 10-15 min. Alternatively biocides such as formic acid and propionic acid can be used to treat infected fish meal.
- **Colour:** Fish meal is brown powder. A very dark brown colour especially if accompanied by an arid “scorched” smell may be the result of over heating.
- **Particle size:** The general practice for meals to have less than 10% that will pass through a 1mm sieve and more than 90% passing through a 10 mm sieve.