MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

FISH PROCESSING

AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)

BATTERED AND BREADED PRODUCTS

- Fish fingers
- Fish portions
- Fish cake

Staple battered and breaded products

Ready-to-cook →convenience of high consumer value
→also called as "Convenience foods"

COATED PRODUCTS

- Also called as **enrobed product**
- If a **food material** is coated with **another foodstuff**
- A coating will be referred to as the **batter and/or breading**

COATED PRODUCTS

Batter- D'ned as➔ **liquid mixture composed** of water, flour, starch and seasonings into which food products are dipped prior to cooking.

Breading: normally bread-based crumb, small potato chips, puffed grain such as rice

FUNCTIONS OF COATING

- Enhance the appearance of food products
- Enhance the taste characteristics by providing food products with more crispy texture
- Improve the nutritional value of the product
- Provide the more desirable colour
- Acts as a moisture barrier and minimise moisture loss during frozen storage and microwave reheating
- Acts as food sealant by preventing natural juices from flowing out and seal in the flavour

COATING INGREDIENTS

1. **Polysaccharides** -wheat ,corn flour, starch, farinaceous material, modified derivatives of cellulose and gums
2. **Proteins –** milk powder, milk protein fractions, egg albumin, cereal flours & seed proteins
3. **Fats and hydrogenated oil**
4. **Seasonings –** sugar, salt, pepper, other spice extractives
5. **water**

1. NON-WHEAT STARCH

- Rice, corn, soy and barely
- Corn starch- is a source of natural yellow carotene pigment and hence it can supplement browning agents like reducing sugars and milk powder to impart a golden brown colour to the coatings
- Cornstarch is also used as a carrier of spices
- Helps to improve the crispiness of the coatings
- Helps to reduce the brittleness of the gluten protein
- Helps to form wide range of viscosities

2. MODIFIED STARCHES

The simplest & common modification —pre-gelatinsation

- Starch +water -→heated➔ gelitnize ---dried to a powder

Extensive modification

---changes in the degree of branching (variation in amylose & amylopectin content)

----change in average chain length

----the extent of cross-linking

*** Extensively modified starch➔ known to increase the adhesion of breading with the product

3. LEAVENING AGENTS

- Sodium carbonte ➔used to produce CO2, the leavening gas, in puff or tempura batter
- Mixture of acid/ salt—controls the release of CO2
- Some produce gas at an ambient temperature and other at high temperature
- Neutralising value: D'n ➔as the parts of leavening acid required to react completely with 100 parts of sod. Carbonate
- Eg: Tartaric acid, potassium hydrogen tartrate, monocalcium phosphate monohydrate, monocalcium phosphate anhydrous, sodium acid phosphate, dicalcium phospahte dihydrate and sodium aluminium sulpahte

3. Egg

- Egg contains albumin → heat coagulable protein that is useful in binding both breading and batter to the product and to itself
- Yolk protein contains lecithin→ an emulsifier ---batter stability
- Addition of egg to batter will tend to darken the product
- Also add characteristic eggy falvour

4. MILK AND WHEY

- Added as liquid or dry powders
- Milk and whey protein provides lactose-reducing sugar==involved in browning reactions
- Structural ability

5. SPICES

- Many species –particularly pepper (3-5%)
- Paprika – **added—colour**
  ---- flavouring
- Spices are not known to interfere with the functionality of the batter / breading ingredients

5. SALT AND SUGAR

Salt

1º →as a flavouring agent

→salt compete with flour proteins—slow the rate of protein hydration

Sugar

----compete for water

--flavouring agent

6. GUMS

- Many of the **hydrocolloidal** substances known as **gums**
- Gum controls viscosity
- water holding capacity (WHC)
- Participate in a gel or film formation (strengthens coating)
- <2% (0.5% -often)
- *Eg: Xanthan*

7. SHORTENINGS AND OIL

- Contributes to the overall flavour & mouth feel

- ➢ Tenderizes the coating
- ➢ Moisture barriers
- ➢ Emulsifiers
- ➢ Anti-staling agent
- ➢ Breading is often encapsulated with fat to produce a “fried-like” flavour to oven or microwave reconstituted coatings

8. PREPARED BREADINGS

- Prepared breadings are material applied to battered food products

- Enhances the appearance
- Improves organoleptic qualities
- Maintain the integrity of batter
- Size, colour, flavour & compatibility with the existing processing system

Eg: Bread crumbs & corn flakes

BATTER

1. Adhesive batter

- Always associated with a supplemental breading or bread crumb
- 1º Purpose: *to increase the adhesion*
- By acting as an interface b/n the food & the subsequent coating
- uniformity & thickness ➔acceptability of the finished product
- The formulation & viscosity of the batter determine the amount of coating pickup
- Consistent batter➔ produce uniformly coated products
- Batter viscosity→ *depends on the ratio of the flour to water*
  → *the temperature of mixing*
- Typical ratio of batter mix to water is 1:2
- Quick set

- Batter→ stored at cool temperature –microorganism
  --viscosity (fall)

BATTER

Tempura batter

- Purpose: to provide aerated crisp coating with or without the application of any other coating , a combination of wheat & corn flour are used along with a chemical raising agent
- Tempura batters →used at very high viscosity levels and containing raising agents
- Batter mix- powder-reconstituted with water--desired viscosity
- Final texture –frying the coated product in oil at 180º-220ºC
- Mixing – agitation
- Disadvantage: flesh will flash off as steam & blow off the batter surrounding the void
- Submersion is used rather than overflow batter application

BATTER

Adhesive

1. Always used with a supplemental breading or bread crumb
2. Purpose: to increase the adhesion
3. A typical adhesive batter mix to water is 1:2
4. Viscosity level is comparatively low
5. Disadvantage: storage of batter at low temperature and the fish to coated frozen, the batter may freeze on the conveyor belt

Tempura

1. Always used with or without application of any other coating, a chemical wheat & corn four are used along with a chemical raising agent
2. Purpose: to provide aerated crisp coating
3. A typical tempura batter mix to water is more than 1:2
4. Viscosity level is very high
5. Disadvantage: if too much air happens to be incorporate in the batter, the small air bubbles will agglomerate and coalesce into a large bubble on the surface of the fish leading to blown off upon frying

BREADINGS

- The secondary coating is referred to as ‘breadings’ (not be derived from bread always)
- Original crumbs –ground dry bread— major secondary coating
- Variety of breading materials----in different sizes & colours
- Used –alone or combined with various crumbs, fours, starches & flavouring materials (herbs, spices and seeds)
- Breadings are: thermally processed cereal based product though non-cereal products like potato are also used to provide different textures and appearance to the end product
- Particle size important : in terms of appearance, texture and pickup

BREADING CHARACTERISTICS

The functional characteristics of breadings depends upon :

**the specific physical

**the chemical attributes built into the particular breading

Important considerations:

Particle size

Area to volume relationship

Browning rate

Moisture absorption

Colour

Texture &

Oil absorption

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BREADING CHARACTERISTICS

1. Mesh size:

- Breadings are made into different particle sizes –finer to coarser

- The proportion of various fractions governs the final appearance of the product
- The proportion of finer to coarser also affect the rate of absorption of moisture from the batter or from the fish itself on the processing line
- The finer particles rapidly absorb moisture in few seconds from any batter
- The larger particles provides visual appeal & textural impact

BREADING CHARACTERISTICS

2. Area to volume relationship

Natural food– particular area to volume relationship

Some are sliced or formed into various shapes and the ratio of their area to volume can be adjusted

A high area to volume relationship permits a good coverage to be applied

Cubiod: area to volume relationship unfavourable

→*difficult to apply coatings*

→*difficult to ensure pickup at economical levels*

BREADING CHARACTERISTICS

3. Browning rate

- Amount of browning is identified with *the product quality in coated products*
- *Browning rate :* reducing sugars used in their manufacture
  corny syrup solids, whey powder, milk powder, lactose
- Browning takes place during frying the coated products in oil
- Fast browning rates will permit high processing speeds as also the choice of low frying temperature

BREADING CHARACTERISTICS

4. Moisture absorption

- The rate of absorption of moisture by breading is a function of its particle size , porosity and gelation

- Smaller granules will move rapidly to point where it can be handled conveniently

- Larger granules – improve appearance an texture of the product

  -- will protrude from the surface of the coating protruding peaks provide colour highlights as well

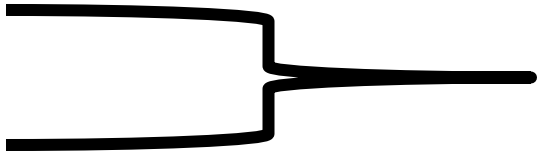
**Porosity & mesh size➔ determines the moisture absorption

BREADING CHARACTERISTICS

6. Oil absorption

Absorption of oil

Effective rate of heat transfer



Higher in porous than in dense granules

All the major characteristics of breadings *interact to produce* a wide ranging textural and colour preferences of the consumers of the breaded products

BREADING TYPES

A wide variety of breading material– **different sizes & colours**

Used –alone or combination with other types crumbs, flavours, starches & flavouring materials

Breading types:

1. Reclaimed bread crumbs
2. Industrial crumbs
3. Japanese style crumbs
4. Extruded crumbs
5. Cracker meal

1. RECLAIMED CRUMBS

These are prepared from ordinary

The drying process ---carried out deliberately at a high temperature ➔ to give an effect of toasting and to reduce the bacterial load

2. INDUSTRIAL CRUMBS

This are factory- **baked in large volumes**

Used as crumb coatings in **fish fingers/sticks and other products**

→**as a raising agent**

→**uses lower qt of water**

→**natural colouring agents like paprika or turmeric ---**to impart an appetising appearance

→Industrial crumbs have harder texture & higher density than the 1st

→During baking a crust develops on the surface of the loaf

This is darker & harder than the rest of the crumbs

3. JAPANESE CRUMBS

- Also called as '**oriental or panko crumb**'
- Has characteristic flake-like elongates structure → excellent visual & provides unique surface structure when fried
- It has an open & porous texture→imparts a light tender crispiness
- **Baked**→ Electrical induction heating process

  → one half the time taken for conventional baking

  →results in a loaf –crust-free & of low density

  → loaves are cooled, shredded through specially designed mills and dried to low final moisture level

3. EXTRUDED CRUMBS

•Extruded crumbs are produced by a **continuous process** where high starch ingredients are cooked under high pressure

•When the pressure is suddenly released, the moisture expands rapidly as steam and the extradate expands

•In the **extrusion cooking process** the heated dough exists from the extruder die as a fully cooked glassy material is quickly flashes off and, in effect, there is no drying system required

•Because of its lighter density the extruded crumbs have a tendency to float in oil, potentially **leading to contaminating black spots** in the fryer and rapid deterioration of oil quality

4. CRACKER MEAL

•The flour is made into dough with water and is rolled into thin sheet and baked

•The amount of effective cooking is adjusted not only by the baking time and temperature, but also by the dough thickness and the water to solid ratio in the dough itself

• The baked sheets are then crumbled through a **granulating mill** or a **slow speed grinder –appropriate granulation specifications**

• →**then dried** (M-8%)

•--> →used for deep fat fried for longer periods--fish

• →does not develop colour as quickly as other

• **breadings**

APPLICATION OF COATING MATERIAL

Seafood specialities ---fish portions (raw or precooked)
--- shrimps
----scallops
---fillets

Battered and ~~Breaded~~

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

1. Pre-dusting

— to create a surface more conducive to the physical adhesion of a wet batter

---also provide a rough surface which helps the batter to coat the product evenly and obtain the desired pickup

--- usually composed of a cereal flour or flour mixture, spices & seasonings for both functional and flavouring purposes

2. Application of the batter

-- Total submersion or overflow batter application

-- Low viscosity batters →applied in an overflow batter application

-- Medium viscosity batters →total submersion system

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

2. Application of the batter

- The pre-dusted product is conveyed to the batter applicator and transferred to the next conveyor

- The fish portion is totally submitted in the batter as it is drawn through it

- Other applicators may use a pour –on application in addition to the submission method. Irregular shaped products should be placed on the line with any concave surface offered to prevent air pockets from inhibiting batter pickup

- Line speed is a very critical factor affecting better pickup

- An exclusively fast line speed will reduce the batter pickup. The battering may become incomplete. There may not be enough time for the excess batter to drip off, and this excess batter will be blown off during pre-frying. The blown off batter will get deposited in the fryer.
- Too low a line speed also can result in excessive better adherence the better weight in the pre-fried product is adjusted to be equivalent to fish flesh weight in most seafood products

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

2. Application of the batter (contin....)

- Excess batter is carried over the breading section will cause formation of lumps and can cause blockages in the breading machine. This will also cause formation of shoulders and tails on the edges of the product and contaminate subsequent breading application

- Therefore to overcome these problems the excess batter is removed after coating by blowing air over the product. The position of the air blower should be as close to the product as possible to control the air flow across the product

- Carry over from the pre-dusting operation also is critical where pre-dust is carried over the viscosity of subsequent batter will increase leading to an increase in pickup

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

3. Application of breadings

- There are many types of breading applicators available and the appropriate machine depends on the ingredients used

- The speed of the breading machine is so adjusted to closely match the belt speed of the batter applicator

- For soft products the crumb depth should be maintained as thin as possible to avoid product *damage when leaving the breading machine however frozen or hard products should have a deep bed of crumb*

- Pressure rollers are used to apply sufficient force to press crumbs onto the battered products. But the *pressure should not be high* to distort the product shape or push the product through the crumb bed causing marks in marks on the underside when the product may contact the breading conveyor

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

- Floor buildings have a tendency to **compact and build up on the conveyors**. They also tend to bridge and cake causing uneven flow through the breading machine which can result in **inconsistent product quality**. Due to their fine particle size floor breadings tend to contaminate the frying oil with a residue so fine that it cannot be removed by normal filter system

- Japanese style comes with their low bulk density and large granule size make the crumb pickup difficult by the normal batter systems

- Special batter formulations, sometimes containing raising agents, may have to be used at medium viscosities for a desired level of pickup of crumbs

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

4. Prefrying:

Purpose:

*Sets the batter coating on the fish portions so that it can be further processed by freezing

*Develops the product colour

*Forms a characteristics crust typical of fried foods

*provide the product a fried (oily appearance)➔inhibits freeze dehydration and contribute to taste

5. Frying : 180-190ºC for 30 sec

Excess batter➔ called “tags”, “crumbs” or “crunchies”

STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

5. Freezing:

--stabilises coating
--resistant to physical abuse
--Prefried fish portions are generally frozen ---two steps

1. Initial quick freezing- using liquid nitrogen or carbon dioxide
2. Freezing -using mechanical freezer

Freezing is continued until the internal temperature attained is around -12 to -15ºC

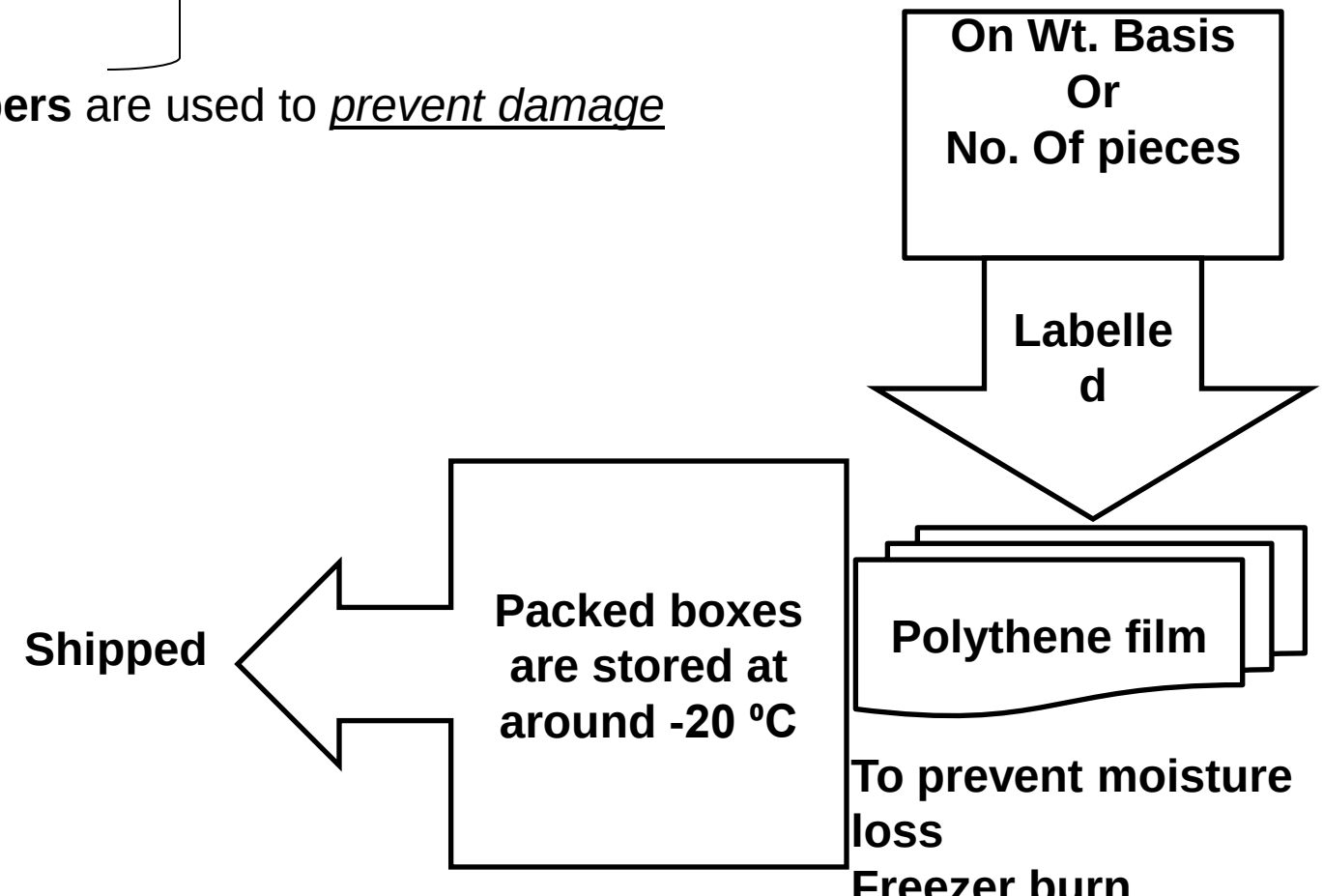
STEPS INVOLVED IN THE PRODUCTION OF A COATED FISH PRODUCTS

5. Packaging and storage

- Fish fingers
- Fish portions
- Fish cutlet

Individually packed into small boxes

→**waxed papers** are used to *prevent damage*



SHEEDAL

Salt-free fermented fish products

Technology believed to be originated before 1824

It was exclusively made from *Puntius* spp.

Presently *Setipinna phasa* is also used

Sheedal is solid, bilaterally compressed and pasty with strong odour - a characteristic smell of sheedal

Quality deteriorates very fast once exposed to air outside the fermenting container

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Punti-sheedal of different NE states


Assam


Mizoram


Tripura

Phasa-sheedal of different NE states


Mizoram


Nagaland


Tripura

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NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH

Sheedal Technology

Raw materials (dried puntius or phasa)

⬇

Manual sorting/screening

⬇

Drying under sun (optional, if raw material is improperly dried)

⬇

Water washing/soaking for about 5-10 min

⬇

Partial drying by spreading on bamboo mat overnight

⬇

Filling of oil smeared container with fish up to neck portion

⬇

Primary sealing of the container with cover paste

⬇

Final sealing of container with a thick layer of mud

⬇

Treatment of cracks (if appeared) with fresh mud for about a week

⬇

Cover the mud with polythene sheet after 5-6 days

⬇

Keeping the container undisturbed for 3-5 months at ambient temperature for fermentation

⬇

Punti/phasa sheedal

RAW MATERIAL FISHES

Puntius spp.
Setipinna phasa

Right time of Sheedal production

Actually dry Puntius and phasa fish are available in the market from December. Therefore, December to February is the right time for production of Sheedal. This may be extended upto April, before onset of rainy season.

SOURCE OF RAW MATERIALS

Raw materials of Sheedal, i.e., dry Puntius and phasa fish are available in the local market. But for large scale producers, it is profitable to buy from Jagiroad Dry fish Market of Assam or from the source of production. Usually, dry Puntius fish are imported from UP, MP, Gujarat, Maharashtra etc. and dry phasa fish from West Bengal.

CONTAINERS USED FOR FERMENTATION

Matka or hundi are local names of earthen made pear shaped container used for fermentation

Neck dia. 8 inch, middle 24 inch, ht. 36 inch, cap. 40 kg.

The best quality matkas are made from very fine black soil, due to the fact that these matkas absorb very less amount of oil during oil processing and they also provide very less air permeability.

PROCESSING OF MATKA

Before use, matkas are smeared with oil in order to close the micropores present in its wall to make it almost non-permeable to air and vapour.

Oil extracted from Puntius fish is generally preferred by fishers and commercial producers if it is available in plenty.

In case of large scale production of shidal, vegetable oil especially mustard oil is preferably used.

Oil is smeared in both inner and outer walls of the matka followed by drying in the sun.

The oil smearing and subsequent drying process is continued for 7 to 10 days in case of new matka, until they become fully saturated with oil and unable to absorb any more oil even after a fresh drying.

Matka is now ready for filling of fish. In case of re-use of matka, 2 to 5 days of oil smearing and subsequent drying is required.

PREPARATION OF FISH FOR SHEEDAL

After procurement, dry fish need further drying under sun for 3-5 days.

This is done to remove moisture from the fish to maximum possible extent and also to drive away the maggots, if any.

The dry fish are then cleaned by sorting broken pieces and adhering dusts etc. Fish with already sign of infestation is not taken for Sheedal production.

Water washing-cum-soaking

Dried and cleaned fish are taken in porous bamboo baskets

Traditionally dried fish are water soaked while washing in running water, i.e., in river at shallow depth. But due to poor quality of water in the shallow zone of river, there remains chances of contamination of dry fish with pathogens and other dirt present in the river water.

For hygienic production it is advisable to construct cement cisterns with inlet-outlet provision and use of drinking water for water washing-cum-soaking.

This step is very crucial for Sheedal production and also to some extent depends on the total period of fermentation as desired by the producer.

Usually, for fermenting fish for 3-4 months, the duration of washing is approx. 3-5 minutes.

And for fermenting fish for less than 3 months, washing is done for approx. 5-7 minutes.

However, the duration of water washing-cum-soaking depends on the producers experience and is determined by previous experience depending on the quality of dried fish, period of fermentation desired and shelf-life of the end product.

In case of washing in cistern, it is advisable to change water frequently (after washing of 1-2 lots) to prevent adding of dirt removed from one lot of fish to other lots.

Absorption of water becomes higher and quicker due to previous drying of fish.

POST-WASHING DRYING OF FISH

After water washing-cum-soaking, wet fish are spread over cleaned bamboo mattress (preferably) or in cemented floor under shade overnight for drying.

Evening hours is the best time for water washing-cum-soaking, because the subsequent drying of water soaked fish for 10 to 12 hours passes without any nuisance activities from flies and birds.

FILLING OF MATKA

Before filling, the oil processed matka is placed by digging a hole in the ground in such a way that one third of the belly portion of matka remains buried in the ground.

This is done to ensure fixing of matka in vertical position and also to allow the matka to withstand the pressure during filling of fish with compaction.

Clean gunny bags are spread surrounding the matka to avoid any spilled raw material getting contaminated with the soil underneath while filling.

After fixing matka in the ground, the partially dried fish are spread in a layer of about 4-5 inches in height and uniform pressure is applied with bare hand or feet (in case of large mouth matka).

Once the layer is tightly packed, subsequent layers are put in a similar manner till the layer reach near to neck.

Sometimes wooden stick is also used along with hand or feet for almost air tight packing.

About 35 to 37 kg of Initial sealing with c/paste
dried fish is required to fill one 40 kg capacity matka.

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Cover paste

A cover paste with semi-solid consistency is made by grinding left over materials after sorting and cleaning of dried fish, with addition of little water.

INITIAL SEALING OF MATKA

Once the matka is filled upto the neck portion, it is primarily sealed with a cover paste.

After proper sealing with cover paste, seal is covered with broad leaves.

FINAL SEALING OF MATKA

The matka is finally sealed by a layer of wet mud made from clay soil.

This soil is usually collected from the pond bottom. Care is taken that sealing is perfect.

This mud layer is checked on and often for about a week for any crack and is repaired immediately by wet mud again.

The final mud seal is then covered by a polythene sheet and tied, to prevent damage of the seal by rodents etc.

FERMENTATION SHED

The filled matkas are lifted to the surface and left undisturbed under a shed for maturation/fermentation.

The fermentation shed should be such that the matkas will get minimum sunrays and rain.

In traditional practice, the ground of the fermentation shed is muddy and both roof and sides are made with bamboo fenches.

Entry of dogs, rodents etc. in the fermentation shed should be prohibited.

The usual period of maturation is 3-5 months. From third month onward 2-3 matkas of each lot is tested for checking the maturity or quality of Sheedal.

About 40-42 kg Sheedal is obtained from each matka.

The filled matkas can be sold during fermentation also after packing in gunny bags in erected position.

SELLING OF SHEEDAL

Usually, the quality of Sheedal, both smell and texture, are lost rapidly after taking out from the matka.

Therefore, while retailing Sheedal is instantly taken out and sold.

MACHINERIES FOR FISH PROCESSNIG

Gutting Machine

Wash Master

Scale Master

Vaccum Packaging Machine

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