DRIED FISH PROCESSING
Lecture 2: Dried Fish Processing

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Outline

1. Reasons for processing fish
2. Fish Spoilage
3. Dried-Salted Fish
4. Fish Drying Principles
5. Fish Drying Methods
6. Basic Good Manufacturing Practices (GMP)
7. Dried Fish Processing and important control points
8. Defects of Dried Fish
9. Philippine National Standards
Reasons for processing Fish

✓ To supply food that is safe;
✓ To minimize loss/waste;
✓ To meet quality standards and consumer preferences;
✓ To sell and make a profit by adding value and increasing convenience to the consumer, and
✓ To extend the shelf life of the foods so that the food can be made available out of season or when it is not possible to catch or purchase fresh food.

Source: South Pacific Commission, 1997
Fish Spoilage

Factors/Causes:
• Enzyme reaction
• Bacterial growth
• Physical damage due to poor handling
• Oxidation
  ➢ Occurs when oxygen reacts with oil or fat in the flesh of the fish that leads to sour or stale, unpleasant smell or taste.

Prevention:
• Proper handling – 3CQ
  ✓ Care
  ✓ Cool
  ✓ Clean
  ✓ Quick
• Proper storage
• Preservation methods
  ➢ Chilling and Freezing
  ➢ Fermentation
  ➢ Thermal processing
  ➢ Drying and Dehydration

Source: South Pacific Commission, 1997
Dried-Salted Fish

• Traditional products of the Philippines locally known as *tuyong isda*.
• Philippines is the largest producer of dried salted fish next to Indonesia.
• Two common market forms:
  - Split type (*daing*)
  - Whole (*tuyo*)

Source: Alonzo & Alano-Budiao, 2014
Fish Drying Principles

- Drying is a process in which the moisture content of fish is decreased to appropriate required characteristics under controlled hygienic conditions.
- ↓ moisture content = ↓ water activity
- In combination with salting.
- Treatment with an Osmotic agent (Salt)
  ➢ Adding salt either directly or by soaking in brine of a particular concentration to draw out part of the moisture and allow absorption of salt to add flavor and act as preservative.
- From an initial 80%, the water content of the fresh fish is reduced to 35 to 40% after drying.

Source: FAO (2016)
Fish Drying Methods

- Exposure of fish to open air under the heat of sun.
- Raw materials for drying are laid out on mesh trays and are left under the sun.
- Prone to contamination.

- It has a transparent material that covers the structure to prevent contamination (e.g. Solar tent dryer).
- Protects from sudden changes in the weather.

- Also called as artificial or mechanical drying.
- Removing moisture from the fish in an enclosed chamber under controlled temperature, airflow and humidity.

Source: Philippine National Standard (PNS/BFAD 04:2006)
Factors Affecting Fish Drying

Dryer Properties
- Type of dryer and design
- Air velocity
- Air temperature
- Relative humidity

Properties of the Raw Material
- Surface area
- Size/Thickness, Shape
- Nature of fish
- Initial moisture content

<table>
<thead>
<tr>
<th>Types of drying</th>
<th>Thickness</th>
<th>Temp.</th>
<th>Air speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow drying</td>
<td>thick</td>
<td>low</td>
<td>slow</td>
</tr>
<tr>
<td>Fast drying</td>
<td>thin</td>
<td>high</td>
<td>fast</td>
</tr>
</tbody>
</table>

Source: Murali, 2019; FAO, 1995; Chamberlain and Titili, 2001
Current Good Manufacturing Practices (cGMP) is a quality assurance system aimed at ensuring that products are consistently manufactured, packed, repacked, or held to quality standards appropriate for the intended use.

Food Safety Act of 2013 (R.A. 10611)
Bakit higit na mabuti ang magpatupad ng GMP?

- Upang mapanatili ang tiwala at kumpiyansa ng mga mamimili.
- Upang itaguyod at pangalagaan ang karangalan ng kumpanya o establisyamento bilang tagagawa ng mataas na kalidad na produkto.
- Upang maiwasan ang mga pagsasauli ng mga depektibong produkto, kahihiyan dulot ng mababang uri ng produkto, at posibleng demanda sanhi ng pagkalason o pagkakasakit ng mamimili.
- Upang hindi maging matagal at madalas ang pagkaantala ng produksyon.
- Upang hindi mabilis ang pagkasira ng mga kagamitan
- Upang hindi mabinbin o maantala ang pagbawi ng puhunan
### Food Hazards

<table>
<thead>
<tr>
<th>Physical</th>
<th>Biological</th>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Also called as <strong>foreign objects</strong> that can cause mild to severe injuries in consumers.</td>
<td>Organisms, or substances produced by organisms, that pose a threat to human health (infection, intoxication)</td>
<td>Can contaminate food if not stored properly.</td>
</tr>
<tr>
<td>• Glass</td>
<td>• Bacteria</td>
<td>• Food additives</td>
</tr>
<tr>
<td>• Metal</td>
<td>• Molds</td>
<td>• Insecticides</td>
</tr>
<tr>
<td>• Plastic</td>
<td>• Yeast</td>
<td>• Pesticides</td>
</tr>
<tr>
<td>• Bone</td>
<td>• Virus</td>
<td>• Vet drugs</td>
</tr>
<tr>
<td>• Human/Animal hair</td>
<td>• Parasites</td>
<td>• Natural toxins</td>
</tr>
<tr>
<td>• Bird’s feather</td>
<td>• Pests/Insects</td>
<td>• Chemical cleaning agents</td>
</tr>
</tbody>
</table>
Components of cGMP

- Organization
- Premises
- Equipment
- Sanitation and Hygiene
- Production & Process Controls
- Documentation
- Quality Audits
- Warehousing & Distribution
- Production Recall
- Retention Samples
- Sub-contracting of Manufacture
Components of cGMP

Sanitation and Hygiene

• Personnel

  • Do not handle foods if you are sick
  • Always tell your employer when you are feeling ill.

Proper Attire

DO’S

- Hair should be properly tucked inside the cap
- Clean face mask
- No outer pockets
- Neat and clean clothes
- No wrist watch/rings
- Cover all wounds
- Nails should be short and clean.
- Torn clothes should be repaired or replaced
- Wear closed shoes

DON'TS

- Hair coming outside the cap
- Earring and necklace/chains
- Outer pocket and contents
- Dirty clothes
- Wrist watch/rings
- Open and bleeding wounds
- Long and painted nails
- Torn clothes
- Bare foot or open shoes

Source: FB page of PAFT, Alpha
Components of cGMP
Sanitation and Hygiene
• Hygienic Practices
  ✓ Handwashing

Areas Most Often Missed During Hand Washing

1. Wet hands and apply soap
2. Rub hands palm to palm
3. Fingers interlaced, rub palm to palm and then right palm to back of left hand and vice versa
4. Cusp back of fingers into opposing palm and rub side to side
5. Clesp right hand around left thumb and rub thumb in rotational manner and vice versa
6. Rotational rubbing, backwards and forwards by placing fingertips of right hand in left palm and vice versa
7. Rinse hands under running water
8. Dry hands thoroughly
9. Sanitise
<table>
<thead>
<tr>
<th>Raw Materials</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Fresh fish</td>
<td>✓ Tamban</td>
</tr>
<tr>
<td>✓ Tamban</td>
<td>✓ Snapfish</td>
</tr>
<tr>
<td>• Salt (Food grade)</td>
<td>• Potable Water</td>
</tr>
</tbody>
</table>

**Appearance**
- ✓ Scales are strongly adhere
- ✓ Shiny skin
- ✓ No blood spots on gill covers
- ✓ Firm; should spring back to its original shape once pressed
- ✓ Slightly slimy skin

**Smell**
- ✓ Mild fresh smell at exterior and gills

**Eyes**
- ✓ Clear, not sunken nor wrinkled

**Gills**
- ✓ Uniform red gills
- ✓ No foul smell
<table>
<thead>
<tr>
<th>Equipment/Utensils</th>
<th>Packaging Materials and Equipment</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Industrial weighing scale</td>
<td>• Top loading balance (for retail</td>
<td>• Red-unscented Zonrox</td>
</tr>
<tr>
<td>• Chopping board</td>
<td>packaging purposes)</td>
<td>(sanitizer)</td>
</tr>
<tr>
<td>• Stainless steel knives</td>
<td>• Sealer (impulse sealer or any</td>
<td>• Facemask</td>
</tr>
<tr>
<td>• Kitchen scissors</td>
<td>available sealer)</td>
<td>• Hairnet</td>
</tr>
<tr>
<td>• Stainless steel ladle</td>
<td>• Polyethylene bags (0.002 inch</td>
<td></td>
</tr>
<tr>
<td>• Stainless steel/ plastic large basins</td>
<td>thickness)</td>
<td></td>
</tr>
<tr>
<td>• Soaking / Brining tubs</td>
<td>• Disposable gloves</td>
<td></td>
</tr>
<tr>
<td>• Stainless steel strainer or colander</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cabinet Dryer with drying trays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Cheese cloth (<em>katsa</em>)</td>
<td>• 100 mL graduated Cylinder or</td>
<td></td>
</tr>
<tr>
<td>• 100 mL graduated Cylinder or plastic drinking bottle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Salinometer</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>
Dried Fish Processing Operation

1. Receiving of Fish
   • Fish should be of good quality in terms of appearance, color, and texture.

2. Sorting and Grading
   • Grade according to size to facilitate uniform brining and drying.

3. Eviscerating and Splitting (if necessary)
   • Cut the fish longitudinally – the base of the tail to the tip of the head.
   • Remove gills, internal organs.
   • Properly split into butterfly (for better appearance).

Image Source: Chamberlain and Titili, 2001
Dried Fish Processing Operation

4. Washing
- Using clean/potable water, completely remove remaining viscera and blood clots.

5. Brining
- In the soaking tub, put the fish and brine solution – fish should be fully soaked.
- Place a weight on top of the fish to prevent them from floating.
- Soak for appropriate time, depending on the fish used. Drain.
Dried Fish Processing Operation

Preparation of soaking brine

<table>
<thead>
<tr>
<th>Fish Species</th>
<th>%Brine Concentration</th>
<th>Soaking time (hour)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tamban (whole)</td>
<td>25%</td>
<td>2-3</td>
</tr>
<tr>
<td>Bisugo (split)</td>
<td>20%</td>
<td>1</td>
</tr>
<tr>
<td>Loro o Yabot (split)</td>
<td>20%</td>
<td>1.5</td>
</tr>
<tr>
<td>Danggit (split)</td>
<td>20%</td>
<td>1</td>
</tr>
</tbody>
</table>

*Soaking time varies depending on the market form (split or whole type) and size.
Dried Fish Processing Operation

**Preparation of soaking brine**

20% brine solution = 0.250 Kg salt + 1 L water

25% brine solution = 0.333 Kg salt + 1 L water
Dried Fish Processing Operation

Preparation of soaking brine

- Salinometer (brine hydrometer)
  - Device use to measure the salinity (percentage of dissolved salt) in a solution.

Source: https://www.britannica.com/technology/salinometer
Dried Fish Processing Operation

6. Washing

• Rinse salted fish by dipping the fish in water for about 30 seconds to remove surface salt. Drain again.
• **Failure to rinse will result on the formation of tiny salt crystals on the surface.**

7. Laying on drying trays

• For split type: spread / lay salted fish with the skin down.
• For whole fish: laid flat on the trays.
• Right spacing to maximize the area
  • Arrange the fish by laying heads and tails alternately, avoiding each fish pieces from touching each other.
Dried Fish Processing Operation

8. Drying
- Initial drying temperature for the first 4-8 hours of drying is 40-45°C, the adjusted to 50 to 60°C thereafter, until the end of drying period.
- For even drying, invert fish.

9. Cooling and sweating
- In a perforated container and well ventilated area, allow the dried fish to cool down to room temperature for at least 6 hours.
- Packaging the product while hot will allow the moisture from the product to condense inside the package; thus, leading to mold growth.
Dried Fish Processing Operation

10. Packaging, Sealing, Labelling

- Suitable packaging bags:
  - ✓ Inert
  - ✓ Good barrier property
  - ✓ Puncture resistant
  - ✓ Scratch resistant
  - ✓ Static free
  - ✓ Translucent/transparent
  - ✓ Easily-sealed

- Accurate weighing scale (calibrate)
- Proper sealing
- Correct weight per pack
Dried Fish Processing Operation

10. Storing

• Store dried fish in cool, dry, well ventilated storage area.
• At least 15 cm from the floor.
• Do not stack them directly on the floor.
## Defects of Dried Fish During Storage

<table>
<thead>
<tr>
<th>Defects</th>
<th>What to observe</th>
<th>Cause(s)</th>
</tr>
</thead>
</table>
| 1. Mold growth       | Black, blue or white cottony out-growth on the surface of the product          | • Insufficient drying  
                          |                                                                                                   | • Unsuitable package/storage condition  
                          |                                                                                                   | • Inadequate cooling/sweating before packaging |
| 2. Pinking or reddening | Pink and/or red discoloration, putrid odor, soft and mushy texture            | • Growth of salt loving bacteria due to the use of impure salt                                     |
| 3. Sourcing           | Sour, bitter taste, foul odor, moist and soft texture                         | • Poor raw material  
                          |                                                                                                   | • Insufficient salt intake  
                          |                                                                                                   | • Insufficient drying  
                          |                                                                                                   | • Poor storage conditions |
## Defects of Dried Fish During Storage

<table>
<thead>
<tr>
<th>Defects</th>
<th>What to observe</th>
<th>Cause(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Case hardening</td>
<td>Dry, brittle and hard surface but still moist inside</td>
<td>• Uneven dryness due to high drying temperature</td>
</tr>
<tr>
<td>5. Rancidity</td>
<td>Development of rancid odor and flavor; yellowing of fish flesh</td>
<td>• Oxidation of fat content of the fish, improper package and storage condition</td>
</tr>
<tr>
<td>6. Insect infestation</td>
<td>Presence of holes, bites and fragments; weight loss</td>
<td>• Infestation during processing, packaging, storage and transport</td>
</tr>
<tr>
<td>7. Dun or peppery spots</td>
<td>Chocolate brown peppery spots on the damp surface of the product</td>
<td>• Bacterial growth due to the use of impure salt</td>
</tr>
</tbody>
</table>

• Contamination
## Defects of Dried Fish During Storage

<table>
<thead>
<tr>
<th>Defects</th>
<th>What to observe</th>
<th>Cause(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. Stains</td>
<td>Back blood stains, remains of kidney on skin and flesh, black membrane on the belly cavity</td>
<td>• Poor cleaning and washing</td>
</tr>
<tr>
<td>9. Tough texture</td>
<td>Hard and over dried texture (desiccation)</td>
<td>• Over drying</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Excessive moisture loss during storage/transport</td>
</tr>
</tbody>
</table>
Dried Fish Standard

SCOPE
This standard prescribes quality and safety requirements and specification for all commercial dried, salted fish in the country. It shall apply to those engaged in the manufacture, labeling, repacking, trade, exportation, importation and distribution of the above products.
Physicochemical Requirements

- **Water activity** – 0.78
- **Salt content** (as Sodium Chloride) – 12% min.*
- **Histamine content** – 200 ppm as max. (edible portion)
- No significant mechanical damage.
- No discolored skin and flesh.
- No salt crystals on the surface.
- No intestines, blood and other foreign matter.
- No rancid/putrid odors in dried and cooked forms.
- Firm and dry texture; not brittle/moist.

*Salt content may vary provided that the prescribed water activity is not exceeded.

Source: Philippine National Standard (PNS/BFAD 04:2006)
## Microbiological specifications for dried, salted fish

<table>
<thead>
<tr>
<th>Analyses</th>
<th>n</th>
<th>c</th>
<th>m</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic plate count</td>
<td>5</td>
<td>2</td>
<td>100,000</td>
<td>500,000</td>
</tr>
<tr>
<td>(cfu/g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yeasts and molds counts</td>
<td>5</td>
<td>2</td>
<td>1,000</td>
<td>10,000</td>
</tr>
<tr>
<td>(cfu/g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total coliforms</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>(MPN/g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Escherichia coli</em></td>
<td>5</td>
<td>2</td>
<td>--</td>
<td>11</td>
</tr>
<tr>
<td>(MPN/g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Staphylococcus aureus</em></td>
<td>5</td>
<td>2</td>
<td>--</td>
<td>1,000</td>
</tr>
<tr>
<td>(MPN/g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

where

- n is the number of samples to be analyzed per volume product
- c is the number of samples that may exceed m but not M;
- m is the maximum count achievable under GMP; and
- M is the maximum count beyond which product safety / quality may be affected.

Source: Philippine National Standard (PNS/BFAD 04:2006)
Maraming Salamat!!!

Joanna Marie F. Ramos
Science Research Analyst
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January 28-29, 2021
Basic Product Costing
(Dried Fish)
Note: In the computation of selling price (per 100 grams), it was assumed that the yield from 3 Kg raw fish is 1.2 Kg after drying - producing 12 packs. The selling price (production cost + Mark-up) is divided by 12.
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