Applying Basic Principles of Fish Processing (PRACTICLE MANUAL)

Institute of Adult Education

Applying Basic Principles of Fish Processing

PRACTICAL MANUAL

Institute of Adult Education

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About this module

This Practical Manual on fish processing procedures has been produced by Institute of Adult Education. All modules produced by Institute are structured in the same way as outlined below.

How this Module is structured

The course overview

The module overview gives you a general introduction to the module. Information contained in the module will help you determine:

- If module is suitable for you
- What you already need to know
- What you can expect from the module
- How much time you will need to invest to complete the module

The overview also provides guidance on:

- Study skills
- Where to get help
- Unit assignment and assessment
- Activity icons
- Unit

We strongly recommend that you read the overview carefully before starting your study.

The module content

The module is broken down into unit. Each unit comprises:

- An introduction to the unit content
- Unit outcome.
- Unit reflection
- Unit assignment

Resources

For those interested in learning more on this subject we provide you with a list of additional resources at the end of this module; may be books, articles or web sites.

Your comments

After completing this module we would appreciate it if you could take a few moments to give us your feedback on any aspect of this module. Your feedback might include comments on:

- Module contents and structure
- Module reading materials and resources
- Unit assignments
- Module assessment
- Module duration
- Module support (Assigned tutor, technical help, etc)

Your constructive feedback will help us to improve and enhance this module.

Module overview

Welcome to this module

Dear learner, Welcome to Module II on the practical session of Basic Principles of Fish Processing. I appreciate your positive perception in Module I of the same course, however, let's go together to widen our practical knowledge, skills and relevant terms of reference in processing of fish and fish related value added products.

General competence

By the end of this module you should be able to:-

- Demonstrate ability to preserve fish by setting and conducting fish processing experiment using traditional fish processing techniques,
- Develop a wider range of fish value added products to win the most rewarding markets, and
- Optimize the usage of fish wastes in production of usefully by-products including animal feed and natural plant fertilizer for crop production.

Study skills

As an out of school learner your approach to learn will be different to that from your school days: you will choose what you want to study, you will have professional and/ or personal motivation for doing so and you will most likely be fitting your study activities around other professional or domestic responsibilities.

Essentially you will be taking control of your learning environment. As a consequence, you will need to consider performance issues related to time management, goal setting, stress management, etc. Perharps you will also need to learn about essay planning, coping with examination and using the web as learning tools.

We recommend that you take time now – before starting your self-study – to familiarize yourself with these issues. There are number of excellent resources on the web. A few suggested links are:

- http://www.how-to-study.com/

  The "How to study" web site is dedicated to study skills resources. You will find links to study preparation (a list of nine essentials for a good study place), taking notes, strategies for reading text books, using reference sources, test anxiety.

- http://www.ucc.vt.edu/stdysk/stdyhlp.html

  At that link you will find links to time scheduling (including a "where does the time go?" link), a study skills checklist, basic concentration techniques, control of the study environment, note taking, how to read essay for analysis, memory skills ("remembering").

Need help?

Dear leaners, in the course of your study, you might need help in various issues such as the location and how to get support from resource centres, clarification of various issues pertaining to your study materials (module) and so on. If this happens, you are advised to ask for the help from your centre coordinator or facilitator. You can also visit the website of the Institute of Adult Education which is www.iae.ac.tz or ask for help by using phone no. +255 22 2150838.

Module assessment

After each unit, you will be required to attempt one unit assignment. These are not meant for submission rather for reflection on what you have learned in the whole module. You will be guided by your module facilitator. You will also sit for moc examination to accomplish your continuous assessment.

Getting around this module

Margin icons

While working through this module you will notice the frequent use of margins icons. These icons serve to "sign post" a particular piece of text, a new task or change in activity; they have been included.

A complete icon set is shown below. We suggest that you familiarize yourself with the icon and their meaning before starting your study.

			
Activity	Assessment	Assignment	Case study
			
Discussion	Group activity	Help	Note it!
			
Outcomes	Reading	Reflection	Summary
			
Terminology	Time	Tip	

Unit 1: Tradition Methods of Fish Processing

Introduction

Dear learner, this is unit one of this module in which you will have the opportunity to explore on the practical aspects of fish processing using different traditional techniques such as hot smoking, dry and wet salting, fermentation, frying and grilling which are commonly applicable in our society. I would like to wish you a fruitful study of the unit for a better understanding of fish processing at a small scale level.

Learning Outcome

Upon completion of this unit you should be able to:

1. Identify different materials and equipment required for sun drying, salting, smoking, fermenting, grilling and frying of fish;
2. Set and conduct experiment on fish processing using traditional method; and
3. Describe application of traditional method in preserving fish.

An Overview of Fish Processing

Dear learner, let's be aware that, fish as food we eat comprises with both macro and micro nutrients. Fish is a vital source of digestible proteins as well as minerals and vitamins which fall in a group of macro and micro nutrients respectively. However, at a fresh state such nutrients are susceptible to spoilage due to adequate proportion of moisture contents which trigger microbial growth and enzymatic activity. As a result fish get spoiled quickly.

Application of traditional techniques in processing fish is among of the intervention strategies that could be used to reduce such moisture content in fresh fish. Hence, increase of shelf life stability as well as availability of fish nutrients in food supply chain.

The Sun Drying Techniques

In module I of Basic principles of fish processing you learnt about sun drying techniques as one of traditional fish processing method. Its principles and applicability. Let us now gain skills on how the sun drying process is carried out.

Materials & equipment

i) Raw fish (*at a fresh or frozen state*).

ii) Table salt.

iii) Spices (*ginger, garlic, lemon* etc) depending on the customer preference.

iv) Container (*buckets or washbasin*).

v) Knife.

vi) Perforated racks.

Procedure

i) At frozen state, fish has to be thawed first using natural or mechanical methods.

ii) Dress the fish by making a small cut using a knife between anal and pelvic fins to remove the internal organs (Gutting).

iii) Thereafter, open a gill cover to remove the gills or just cut the head (Deheading).

iv) Make use of knife remove scales, then wash the fish using a clean water.

v) For the sake of increasing shelf life, prepare a brine solution at 5 or 10% salt concentration and immerse the fish in brine solution for about 30 or 15 minutes respectively.

vi) Lay the fish into the racks to allow dripping of water and expose on the sun light to proceed with drying in a raised platform.

vii) Record the weight change in fish (drying trends) at every morning and evening until it reach a point whereby no further change in weight is attained (constant weight) which indicate the fish is well dried.

The plastic cover can be applied on top of raised racks to protect the fish during the rain seasons

Computation of brine solution: Brine concentration % = $\frac{(x)}{(x + y)} * 100$

Whereby: x = Weight of salt and y = Weight of fish.

Figure 1. *Small pelagic fish (sardines) in a raised racks exposed for open sun drying*

NOTE: Examples of natural methods for thawing fish are: Expose the fish in open area or immerse the fish in water at room temperature.

The Dry Salting Techniques

Dry salting (*Kenching*) is another traditional techniques widely used to preserve fish. Its principles and applicability in preserving fish summarized as follows:

Materials and equipment

i) Raw fish at a (*fresh or frozen state*).

ii) Table salt (*Mixture of granular and fine powdered*).

iii) Buckets or washbasin.

iv) Perforated container.

v) Knife.

vi) Perforated raised racks.

vii) Processing table (*Stainless steel highly preferred*).

viii) Water (clean water).

Procedures

Application of dry salt on the fish surface creates deference in salt concentration between inner and outer part of the fish body. Consequently, moisture contents from the inner part of fish is drained out by osmosis. Salting method cane be done using two techniques which are dry salting (Kenching) and wet salting (Pickling). Procedure for each techniques summarized as follows:

Dry Salting (Kenching)

i) Clean the fish by removing scales, fins, guts, tail and head.

ii) For the large pelagic fish species, split the fish to increase the surface area to facilitate drying.

iii) Weigh the fish after dressing to determine the net weight.

iv) Calculate the amount of salt to be used which range from 30 - 40% of the net weight of fish. Then make a mixture of granular and fine powdered salt at a ratio of 1:1.

v) Prepare a perforated bin which will be used to carry the fish.

vi) Spread a salt layer to the perforated bin followed with a layer of fish, then salt layer on top to cover the fish repetitively.

vii) Allow the fish to stay in a perforated bin for three consecutive days (72 hours), thereafter takeout the fish and lay on the raised racks with an intention of exposing the fish into the sun light to proceed with further drying process.

viii) Take the daily records on fish drying trends until constant weight is attained which signposts the efficiency of the drying process.

ix) Finally, make use of the desired packaging materials to pack salted fish properly and store in ambient temperature ready for consumption.

Figure 2: *Fish covered with a salt layer in container perforated at the bottom*

The Wet Salting Techniques

Wet salting (Pickling) is another traditional techniques widely used to preserve fish. Its principles and applicability in preserving fish summarized as follows:

Materials and equipment

i) Raw fish at a (*fresh or frozen state*).

ii) Table salt (*Mixture of granular and fine powdered*).

iii) Buckets or washbasin.

iv) Closed containers / jars.

v) Spices and preservative (ginger, garlic and lemon) depends on customer preference.

vi) Knife.

vii) Perforated raised racks.

Procedures

i) Dress the fish by removing scales, fins, guts, tail and head and determine its net weight.

ii) For the large pelagic fish species, split the fish to increase the surface area to facilitate drying.

iii) Calculate the amount of salt to be used which range from 30 - 40% of the net weight of fish. Then make a mixture of granular and fine powdered salt at a ratio of 1:1.

iv) Prepare a closed bin (water tight container) which will be used to carry the fish.

v) Spread a salt layer to the closed bin followed with a layer of fish, then salt layer on top to cover the fish repetitively.

vi) Spices such as garlic and ginger as well as preservatives including lemon can be added to improve flavour and increase shelf life of fish.

vii) Allow the fish to stay in a closed bin for three consecutive days (72 hours), whereby the salt penetrate into the fish muscles and drain water to form a liquid brine (pickle) which cover the fish until it bath.

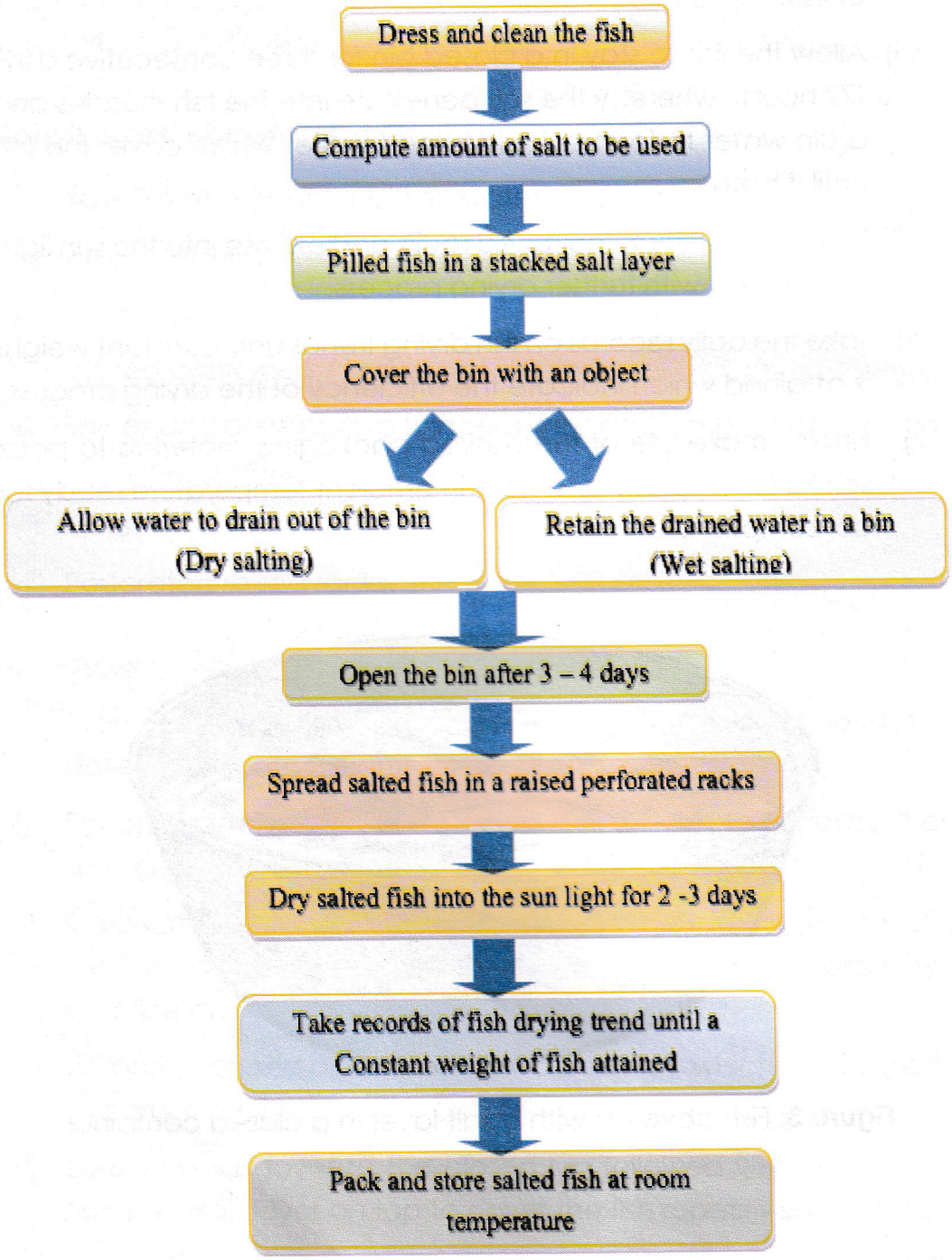
viii) Spread the fish on the raised racks and expose into the sun light to proceed with further drying process.

ix) Take the daily records on fish drying trends until constant weight is attained which indicate the efficiency of the drying process.

x) Finally, make use of the desired packaging materials to pack salted fish properly and store in ambient temperature ready for consumption.

Figure 3: Fish covered with a salt layer in a closed container

Flow Chart for Dry & Wet Salting Techniques



The Smoking Techniques

Smoke impaction and smoking in general is among of the traditional techniques widely used to preserve fish. Its principles and applicability in preserving fish summarized as follows:

Materials and equipment

i) Raw fish at a (*fresh or frozen state*).

ii) Table salt (*fine powdered*).

iii) Buckets or washbasin.

iv) Spices and preservative (*ginger, garlic and lemon*) depends on customer preference.

v) Smoking kiln.

vi) Perforated raised racks.

vii) Knife.

viii) Energy source from different sources including (*Charcoal, coconuts husk or sugar can leafs*).

Procedures

i) Dress the fish by removing scales, fins, guts, tail and head and determine its net weight.

ii) For the large pelagic fish species, split the fish to increase the surface area hence facilitate drying.

iii) Prepare a brine solution at 5% or 10% salt concentration equivalent to the weight of dressed fish.

iv) Immerse fish into the brine solution for 15 or 30 minutes to allow penetration of salts into the fish provided the level of salt concentration used is 10% or 5% respectively.

v) Arrange the fish into raised racks to allow dripping, of moisture.

vi) Prepare a smoking kiln, setting the fire and let the wood, charcoal or coconut husks burn.

vii) Place the dripped fish into the smoking kiln at a temperature range 30 – 40 °C for a period of quarter to half an hour until smoke flavour and golden yellow colour imparted into the fish.

viii) Rise the kiln temperature to 80°C for one hour to allow proper cooking of the inner part fish, inactivate enzymes and destroy a wider range of microbes.

ix) Dry the fish by rising the kiln temperature between 102 - 105 °C for about one hour to ensure successive removal of moisture in fish body.

x) Finally, allow the smoked fish to cool at room temperature, packed and stored appropriately ready for consumption.

Figure 4: Fish smoking operations undertaken in a kiln

NOTE:

a) The time taken for a fish to be immersed in a brine solution depends on the salt concentration used.

b) Smoke impaction offer antimicrobial effects to fish hence prevent microbial growth.

c) Smoky flavour as well as golden colour as an output of smoke impaction add value to organoleptic attributes of smoked fish.

The Fermentation Techniques

Generally, fermentation refers to an alteration of organoleptic attributes of food materials due to action of endogenous enzymes or microorganism to produce product with desirable attributes. Fermentation process can takes place naturally or under controlled conditions whereby fermentative microorganism are introduced to breakdown the food nutrients.

With regards to fish, fermentation intends to breakdown muscles proteins into amino acids and smaller peptides which increase availability of nutrients for further microbial growth. A wider range of fermented fish product including fish sauce can be produced and consumed at a small scale level to meet the demands of the domestic markets.

Fish Sauce Production

Material and equipment

i) Fish fillets.

ii) Table salt.

iii) Closed container.

iv) Filter.

v) Knife.

Procedures

i) Dress the fish by removing scales, fins, guts, tail and head and determine its net weight.

ii) Prepare a fillet from a dressed fish which is free from bones and skins, then cut it into small pieces of your desired shapes.

iii) Prepare a table salt and mix with pieces of fish in a jar at a ratio of (3:1) for pieces of fish meat and salt respectively.

Unit Reflection

After the completion of this unit reflect on the following:-

1. To what extent this unit is important to you?
2. Which parts of this unit seems to be useful to you?
3. Do knowledge and skills gathered in this unit related to your routine fish processing activities? How

Unit Assignment

Attempt the following questions and remember to keep proper records of your work in portfolio

1. State any four traditional method used to preserve fish

(a)_____ (b)_____
(c)_____ (d)_____

2. Describe briefly how each method above operates.
3. What indicator would you use to assess the efficient of each preservation methods described above?
4. _____ and _____ are types of salts commonly used in fish salting?
5. Suggest the best ratio when the two type of salts mentioned above used at a time_____
6. Compute amount of salt to be used to brining 5kg of fish using a brine concentration of 5% and 10%.
7. Differentiate between wet and dry salting?
8. 8. What happen when the fish get bath in wet salting?

9. Suggest the best temperature range to be applied in each session of fish smoking process:

   a) Smoke impaction _____ ^{0}C

   b) Cooking _____ ^{0}C

   c) Drying _____ ^{0}C

10. _____ is the desired colour of fish smoked properly.

Unit 2: Modern Method of Fish Processing

Introduction

Dear learner, congratulation for completing with a great success unit one of module II of practical aspect of basic principles of fish processing. I hope you had enjoyable moment get a better understanding on how processing of fish can be done at a small scale level using simple local method.

In this unit we are going to put more emphasize on some of the modern techniques which employ cold heat treatment and in some cases high heat treatment in processing and preserving fish. Such modern techniques includes: chilling, freezing and canning which are commonly applicable in our daily life. Please, joine me on application of modern method of fish processing to have a closer picture on what happening in industrialization of fish processing world.

Learning Outcome

Upon completion of this unit you will be able to:

1. Identity modern techniques used to process and preserve fish;
2. Describe the mechanism of modern techniques in processing and preservation of fish; and
3. Apply modern techniques in processing and preserving fish.

An Overview of Modern Processing Techniques

Dear leaner, let's remained you that, the body of whole fish containing enzymes and microorganism. The guts, gills and skins contains a sufficient proportion microbes which does not harm live fish due to presence of natural defensive mechanism within a fish body.

However, once the fish died, the enzymes and microbes start to digest the food contents within the guts and proceed with a self-digestion of the nutrients found within the fish body. Consequently, alter the organoleptic attributes of fish including texture, colour and smell which indicate signs of fish spoilage.

In order to slow down or avoid such action of enzymes and microorganism, the fish body temperature has to be altered to the extent of creating unfavourable condition for enzymatic action or microbial activities to take place. Thus, application of modern techniques in preserving fish including icing (chilling & freezing) and canning found to have a potential role to play.

Fish Icing

Materia and equipment

i) Fresh fish.

ii) Ice (*flake or block*).

iii) Cooler box or Insulated container.

Procedure

i) Weigh the fish to determine its net weight.

ii) Weigh the ice equivalent to the weight of fish.

iii) If the ice is in a block form, break to reduce its size into small particles.

iv) Make a layer of ice into a bottom surface of a cooler box or insulated container followed with a layer of fish.

v) Keep repeating such arrangement until the container is full and on top covered with an ice layer.

NOTE:

By lowering fish temperature closer to 0 C most of enzymatic and microbial activities slow down, hence shelf life of fish increased.

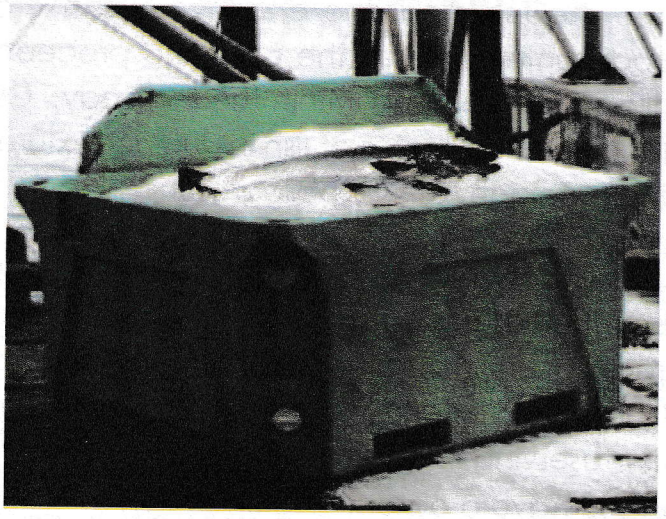


Figure 6: *Iced fish in a container*

Ice and fish has to be in a ratio of (2:1) implies that quantity of an ice should be twice than quantity of fish to be iced.

Fish Canning

Material and equipment

i) Fresh fish.

ii) Weak acid (Citric acid).

iii) Can & lid or glass bottles.

iv) Sterilizer (Auto clave or Pressure cooker).

v) Salts.

vi) Salts washing basin.

Procedures

i) Select raw fish of better quality and weigh to determine its weight.

ii) Dress the fish by removing scales, fins, guts, tail and head if necessary, then determine its net weight.

iii) For the large pelagic fish species make fillets and cut into pieces of desired size.

iv) Pack the fish into the jar or container up to three quarter of its total volume.

v) Add weak acids (lemon juice) and desired spices such a ginger and garlic into the container.

vi) Cover the jar or container using a self-sealing lid.

vii) Sterilize the jar or container using boiling water, an autoclave or pressure canner at a temperature range 116 - 130 ^{0}C for 15 minutes.

viii) Allow the jar or container to cool and store ready for consumption.

NOTE:

1. Efficiency of canning process determined by the sterilization temperature used. The temperature bellow standard range (116 – 130 ^{0}C) for 15 minutes cannot assure the shelf life of canned food.
2. The sealing of can and lid has to be undertaken in a great care to avoid cross contamination from external environment.

Application of canning techniques intends to preserve fish by destroying enzymes and microorganism using heat treatment above 100 ^{0}C. Also, the presence of self-sealing lids protect sterilized fish from other contaminants found in surrounding environments.

Unit Reflection

After the completion of this unit reflect on the following:-

1. To what extent this unit is important to you?
2. Which parts of this unit seems to be useful to you?

Do knowledge and skills gathered in this unit related to your routine fish processing activities? How

Unit Assignment

Attempt the following questions and remember to keep proper records of your work in portfolio:

1. Mention at least two modern techniques used to process and press fish at industrial level

   a)_____b)_____

2. List common type of an ice used to preserve fish

   a)_____ b)_____

3. Suggest the best ratio of an ice and fish to be used when icing fish _____

4. Describe how icing practices preserve the fish?_____ _____ _____

5. Explain the role of canning practices in preserving the fish _____ _____

6. Briefly explain why do we sterilize the canned fish prior storage? _____

Unit 3: Fish Value Added Product

Introduction

Dear learner, I hope you enjoyed matters discussed in previous units. In this unit you will learn on how to add value to un-utilized fish by developing a wider range of ready to eat food product that fulfil the need of ultimate consumer. I hope you will participate effectively, enjoy the lesson and familiarize yourself with the world of food formulation related to fishery and fish products.

Learning Outcomes

Upon completion of this unit you will be able to:

1. Identity different ingredients required in formulation of fish value-added product;
2. Formulate and develop wider range of ready to eat fish value added products; and
3. Describe storage and preservation of value added product.

Theme of Fish Value Addition

Just have a closer look on the harvested fish catch, you will find different types and sizes of fish species with huge variation in marketing value. The fish species thought to have a low value with limited usage in food supply chains, are the ones to be taken in production of value added products. Therefore, the focus of fish value addition is to reduce physical post-harvest losses by producing nutritious fish products for human consumptions at an optimum level.

Fish Finger

Material and equipment

i) Minced fish.

ii) Round Potatoes.

iii) Onions.

iv) Spices (*ginger, garlic and cumin seeds*).

v) Additives *(Table salt, sugar, pepper and vinegar)*.

Procedures

i) Clean the fish by removing scales, fins, guts, tail and head.

ii) Split the large pelagic fish, remove the skin, bones to obtained skinless fillet and cut it into a piece of finger size.

iii) Prepare a paste involving a mixture of boiled round potatoes, grounded onions and variety of spices.

iv) Mix the finger size fillets with a paste of boiled potatoes, grounded onions and spices.

v) Make use of the bread crumbs / biscuit powder to give a finger shaped fish meat a round shape.

vi) Prepare a solution of an egg white and immerse the fish finger shaped meat into egg white.

vii) Make use of the bread crumble to give a firm shape of fish finger shaped meat.

viii) Fry or bake the fish finger meat properly until the brown coloration is attained.

ix) Finally, allow the fried fish finger meat to drain oil, cool and ready for packaging.

Remember:

It is not necessary for the fish finger to be cooked (*baked or fried*) immediately after being prepared. It can be stored in a refrigerated or frozen condition for future use.

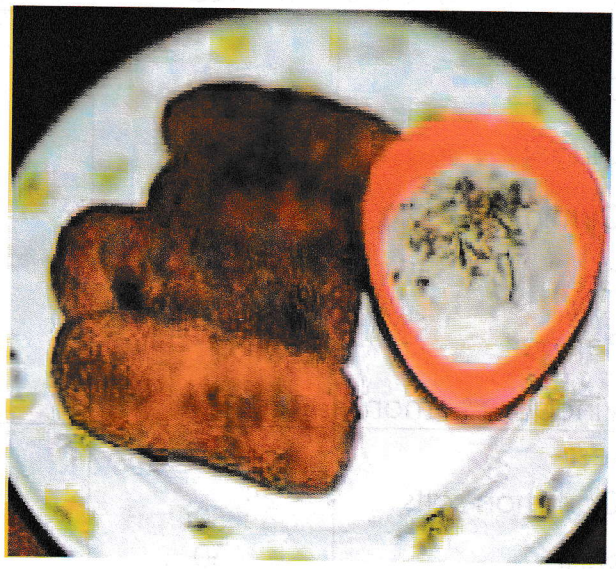


Figure 7: *Baked fish finger*

NOTE:

The shelf life of baked or fried food is so limited. Thus the product is advised to be consumed immediately before it loses its organoleptic character.

Table : Fish Finger formulation

No	Materials / Ingredients	Weight (g)	Percentage (%)
1	Minced fish meat	650	65
2	Potato	100	10
3	Onions	100	10
4	Spices:-		
	· Garlic	10	1
	· Ginger	15	1.5
	· Cumin seeds	5	0.5
	· Green chill	5	0.5
	· Pepper	5	0.5
	· Vinegar / Lemon	10	1
5	Additives:-		
	· Common salts	50	5
	· Sugar	30	3
	· Egg white	20	2
Total		1,000 (g)	100

NOTE: Other ingredient such as *biscuit powder, bread crumble and oil will be used as per needed.*

Fish Ralls / Ball

Material and equipment

i) Minced fish.

ii) Round Potatoes.

iii) Wheat flour and cheese.

iv) Spices *(ginger and garlic)*.

v) Additives *(Table salt, sugar, pepper and vinegar)*.

vi) Fryer or oven.

Procedures

i) Clean the fish by removing scales, fins, guts, tail and head.

ii) Split the fish to increase the surface area and remove the bones and skins to obtain skinless fillet.

iii) Grind the fillets to obtain soft minced.

Figure 8: *Baked fish rolls*

iv) Split the fish to increase the surface area and remove the bones and skins to obtain skinless fillet.

v) Prepare a mixture of paste containing: Wheat flour, cheese, onions, eggs, salt and spices including garlic, ginger.

vi) Make a soft dough using a minced fish and mixture of paste and keep it in a refrigerated temperature for an interval of 15 – 30 minutes.

vii) Cut the soft dough into small pieces and mold into a round or rolled shape.

viii) Fry or bake the fish finger / roll meat properly until the brown coloration is attained.

ix) Finally, allow the fish balls to drain oil, cool and ready for packaging.

Table : Fish balls formulation

No	Materials / Ingredients	Weight (g)	Percentage (%)
1	Minced fish meat	700	70
2	Onions	100	10
3	Spices:- · Garlic · Ginger · Cumin seeds · Green chill · Pepper · Vinegar / Lemon	 10 15 5 5 5 10	 1 1.5 0.5 0.5 0.5 1
4	Additives:- · Common salts · Sugar · Egg white	 50 30 20	 5 3 2
TOTAL		1,000 (**g**)	100

NOTE: Ingredient such as *oil will be used as per needed.*

Fish Samosa / Pie

Material and equipment

i) Minced fish.

ii) Wheat flour.

iii) Spices (*ginger, garlic and green chill*).

iv) Additives *(Table salt, sugar, pepper and vinegar).*

v) Vegetable oil, tomatoes and bread crumbles.

vi) Fryer.

Procedures

i) Clean the fish by removing scales, fins, guts, tail and head.

ii) Split the fish to increase the surface area and remove the bones and skins to obtain skinless fillet.

iii) Grind the fish fillets to obtain soft minced.

iv) Make a paste of shallow oil fried spices containing garlic, ginger, green chili powder and onions.

v) Add all major spices into mustard and stir slowly to attained a brown coloration.

vi) Add the minced fish into a spiced paste to make a mixture.

vii) Fry the ingredients into medium heat for 10 minutes and allow them to cool.

viii) Make a dough using a wheat flour, roll into a small round size, spread a dough into thin sheet and cut into a desired shape.

ix) Pour all fried material into a thin sheet shaped dough, fold diagonally and warm for some time.

x) Deep fry the samosa until brownish colour appears.

xi) Finally, allow the fish balls to drain oil, cool and ready for packaging.

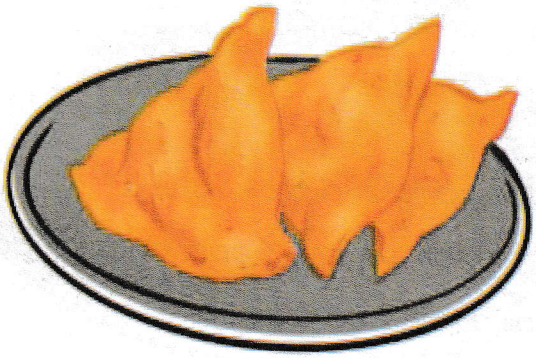


Figure 9: Fried samosa / pie

Table : Fish samosa formulation

No	Materials	Weight (g)	Percentage (%)
1.	Minced fish meat	650	65
2.	Onions	180	18
3.	Tomato	30	3
4.	Spices:-		
	· Garlic	10	1.0
	· Ginger	20	2.0
	· Turmeric	10	1.0
	· Chilly powder	5	0.5
	· Pepper	5	0.5
5.	Additives:-		
	· Common salts	50	5
	· Bread crumbles	40	4
Total		**1,000 (g)**	**100**

NOTE: Ingredient such as *oil will be used as per needed.*

Fish Cake / Cuticles

Material & Equipment

i) Minced fish.

ii) Potatoes.

iii) Onions.

iv) Spices (*ginger, garlic and green chill*).

v) Additives *(Table salt, sugar, pepper and vinegar).*

vi) Vegetable oil and bread crumbles.

vii) Oven.

Procedures

i) Clean the fish thoroughly by removing the scales, fins, guts, tail and head.

ii) Split the fish to increase the surface area and remove the bones and skins to obtain skinless fillet.

iii) Worm the fillet and boil the round potatoes.

iv) Mix thoroughly the wormed fish fillet, boiled potatoes and mixture of spices paste containing garlic, ginger, onions, pepper, green chilly, salt and cumin to make a soft dough.

v) Cut a soft dough into a small round and mold to give a desired cutlet / cake shape.

vi) Prepare an egg white and bread crumbs then deep the cutlet into egg white then breaded.

vii) Make use of the hot oil to fry breaded cutlet until brown coloration is attained to get a fish cuticle or bake the breaded cutlets into an oven to get a fish cake.

viii) Finally, allow the fish cuticles / cake to cool and ready for packaging.

Figure 10: *Baked fish cake / cuticle*

Table : Fish cake / cuticle formulation

No	Materials / Ingredients	Weight (g)	Percentage (%)
1.	Minced fish meat	650	65
2.	Potato	150	15
3.	Onions	70	7
4.	Spices:-		
	· Garlic	10	1.0
	· Ginger	10	1.0
	· Cumin seed	10	1.0
	· White pepper	5	0.5
	· Green chill	5	0.5
5.	Additives:-		
	· Common salts	50	5
	· Bread crumbles	40	4
Total		**1,000 (g)**	**100**

NOTE: *Ingredient such as egg white and oil will be used as per needed.*

Fish Sausage

Material and equipment

i) Minced fish.

ii) Potatoes.

iii) Onions.

iv) Spices (*ginger, garlic and green chill*).

v) Additives *(Table salt, and vinegar)*.

vi) Food colour.

vii) Molder / Sausage case.

Procedures

i) Clean the fish thoroughly by removing the scales, fins, guts, tail and head.
ii) Split the fish to increase the surface area and remove the bones and skins to obtain skinless fillet.
iii) Grind the fish fillet to get a soft minced.
iv) Boil the round potatoes and smash to get a soft mashed potatoes.
v) Mix thoroughly the soft minced fish and smashed potatoes to make a soft paste.
vi) Add liquid / powdered food colour to improve flavour and appearance of the sausage.
vii) Fill the colored soft paste into a sausage case (molder) to give the shape.
viii) Finally make use of the hot oil to fry or hot water to boil the sausage ready for consumption.

NOTE:

Prior cooking, fresh sausage can be preserved in frozen or refrigerated temperature.

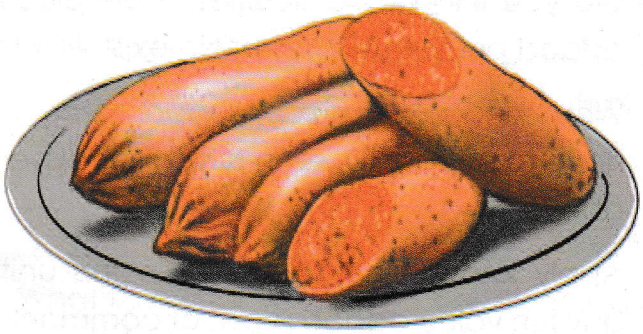


Figure 11: *Boiled fish sausage*

Table : Fish sausage formulation

No	Materials / Ingredients	Weight (g)	Percentage (%)
1.	Minced fish meat	900	90
2.	Onions	10	1
3.	Spices:- Garlic Ginger Cumin seed White pepper Green chill	 10 10 10 5 5	 1 1 0.5 0.5 0.5
4.	Additives:- Common salts Food colour	 50 5	 5 0.5
Total		**1,000 (g)**	**100**

NOTE: Ingredient such as oil will be used as per needed.

Unit Reflection

Based on what you have learnt so far in this unit, you can reflect by responding to the following questions:-

1. What was your most favourable fish value added product? Give reason to support your answer?
2. Did you find any difficulties in developing fish value added product? If Yes or No explain why?
3. What kind of technical support would you likely to have to encounter such difficulties experienced in (2) above
4. Apply knowledge gathered in this unit to develop any fish value added product commonly used in your community

Unit Assignment

Please, attempt the following question to test your understanding on the subject matters fish value added products. Remember to keep records of your work in portfolio:-

1. Mention any three examples of spices used in production fish value added products

   a)_____ b)_____ c)_____

2. What is the role of spice in formulation of fish value added product?_____

   _____

3. Why spices does not exceed 5% of the product formulation?_____
4. Why spiced are advised to be used at a solution and not dry powdered form?_____
5. Give an examples of fish value added product which can be store in the following condition:-

   a) Room temperature _____

   b) Refrigerator _____

   c) Freezer _____

6. State the role of bread crumbs and biscuit powder in production of fish value added product _____

   _____

   _____

   _____

7. What indicator would you use to assess efficiency of frying or baking of fish value added food products?

Unit 4: Fish Meal and Silage Production

Introduction

Dear learner, I hope you had a worthy exposure and enjoyed previous unit about production of fish value added product. In this unit you will learn on the best techniques to utilize fish waste by transforming into usefully by-product such as plant fertilizer and animal feed.

Learning Outcomes

Upon completion of this unit you should be able to:

1. Apply basic principal in treatment of fish waste;
2. Produce useful by-product from fish waste; and
3. Utilize by-product of fish waste in production animal feed and plant fertilizers.

The Concept of Fish Waste Treatment

Processing of any food material is associated with waste production. Likewise in fish, about 70% of waste from guts, gills, head, bones and tail estimated to be produced when a whole fish processed.

Such waste contains wider range of nutrients which can be utilized to produce by-product such as fish meal and silage useful for other living creatures including plants and animals.

Thus, in this unit basic techniques will be applied to capitalize on the nutritional benefit of fish waste to produce nutritious by-product for the health benefit of our plants and animals.

Fish Meal Production

Material and equipment

i) Fish offals.
ii) Cooking port.
iii) Siever or filter.

iv) Drier.
v) Grinder.
vi) Cooker.

Procedures

i) Collect raw material from fish offal's including carcass, bones, head and by-catch of fish.

ii) Cook the raw materials at a temperature range between 90 – 95^{0}C for an interval of half an hour until all material become soluble. Hence become easier to separate the dry matter with oil and soluble.

iii) Separate the soluble material with a dry matter by pressing the cooked raw materials to form a press cake and liquid mixture of water and oil with adequate proportion of water contents.

iv) Make use of a drier to dry a press cake at relevant temperature sufficient to destroy spoilage microbes without affecting the nutritional profile of the cake.

v) Finally, grind the dried cake to ensure all remaining solid particles including parts of bones are converted into powder form. Then, pack and store the fish meal ready for use.

Fish Silage Production

Material and equipment

i) Fish waste.
ii) Weak acids (*formic acids*).
iii) Grinder.
iv) Mixing & Storage Tank.
v) Cooker.
vi) Cooking port.
vii) Wooden peddle.

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http//www.ingvar.is/LeanFish/LeanFishPage.html

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