

**Vocational Higher Secondary  
Education (VHSE)**

**Second Year**

**MARINE FISHERIES &  
SEA FOOD PROCESSING**

*Reference Book - Teachers' Version*



Government of Kerala  
Department of Education

State Council of Educational Research and Training (SCERT),  
KERALA  
2016

## **Foreword**

Dear Teachers

This reference book (**Teachers' Version**) is intended to serve as a transactional aid to facilitate classroom transaction and as a ready reference for teachers of Vocational Higher Secondary Schools. It offers some guidelines for the transaction of the course content and for undertaking the practical work listed in the course content. As the curriculum is activity based, process oriented and rooted in constructivism focusing on the realisation of learning outcomes, it demands higher level proficiency and dedication on the part of teachers for effective transaction.

In the context of the Right- based approach, quality education has to be ensured for all learners. The learner community of Vocational Higher Secondary Education in Kerala should be empowered by providing them with the best education that strengthens their competences to become innovative entrepreneurs who contribute to the knowledge society. The change of course names, modular approach adopted for the organisation of course content, work-based pedagogy and the outcome focused assessment approach paved the way for achieving the vision of Vocational Higher Secondary Education in Kerala. The revised curriculum helps to equip the learners with multiple skills matching technological advancements and to produce skilled workforce for meeting the demands of the emerging industries and service sectors with national and global orientation. The revised curriculum attempts to enhance knowledge, skills and attitudes by giving higher priority and space for the learners to make discussions in small groups, and activities requiring hands-on experience.

The SCERT appreciates the hard work and sincere co-operation of the contributors of this book that includes subject experts, industrialists and the teachers of Vocational Higher Secondary Schools. The development of the teachers' version of reference books has been a joint venture of the State Council of Educational Research and Training (SCERT) and the Directorate of Vocational Higher Secondary Education.

The SCERT welcomes constructive criticism and creative suggestions for the improvement of the book.

With regards,

**Dr. J. Prasad**  
Director  
SCERT, Kerala

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## **COURSE: MARINE FISHERIES AND SEAFOOD PROCESSING (MFSP)**

### **ABOUT THE COURSE**

Vocational education, a dream of Mahatma Gandhi, was realized by the central government in the year 1983 to address the problem of massive unemployment among the youth in our country. Among the different vocational courses introduced, Fisheries courses have great relevance. Being a country with a coastline of about 8000 km, fishing and allied industries play an important role in providing employment to majority of the population, as well as sustaining the economy with the foreign exchange earned from the export of various fisheries products. Among the maritime states of India, Kerala holds a remarkable position in fisheries sector. That is why the importance of fisheries in the economic development of Kerala was emphasized by Dr. APJ Abdul Kalam.

The course '**Marine Fisheries & Sea food Processing**' (MFSP) is a two year vocational course introduced in Kerala VHSE curriculum as an updated, modified, multi skilled course. Since Kerala is having a large coast line and an active fishing community relying on the marine fisheries, the course will enable the students to acquire various skills needed for the industry. It offers scope in studying new technologies, and help to improve the fishing industry, which directly or indirectly helps improve the standard of living of fisher folk and also generate employment opportunities.

Since the sea food processing industry is deeply connected with marine fish resources, the introduction of multi skilled modular based '**Marine Fisheries & Sea food Processing**' course with four modules **viz. Fishing Technology, Fish Processing Technology, Fish Quality Control and Inspection Systems, Fishery Value added and Byproducts** has great importance in vocational education.

## JOB ROLES (CAREER PATH)

GOVT./SEMI GOVT. SECTOR	PRIVATE SECTOR	SELF EMPLOYMENT
Ñ Laboratory Technical Assistant in VHSE	Ñ Quality control supervisors in Fish processing plants	Ñ Fish drying unit
Ñ Field assistants in Fisheries Institutions like MATSYAFED	Ñ Production assistants in Fish meal plants, Chitosan plants	Ñ Fish pickle unit
	Ñ Microbiology lab assistants in fish processing plants	Ñ Fish meal production
	Ñ Supervisors in value added fishery products manufacturing units	Ñ Chitin/ chitosan production
		Ñ Fish cutlet unit
		Ñ Fish trading
		Ñ Preprocessing units

## MAJOR SKILLS (with sub-skills)

After completing the course, the learners achieve the following skills:

## 1. Quality Control and Inspection system

- Describes bacterial cell structure, growth phases, and classification
- Describes the different growth phase of a bacteria and plots the growth curve
- Sampling methods for microbial examination, methods of sterilization, identifies different media for bacterial culture and TPC of fishery products
- Identifies pathogenic and non pathogenic bacteria
- Practices quality control standards
- Identifies different lab equipments used in microbiological laboratory
- Identifies and handles different glasswares used in fishery microbiology lab
- Acquires expertise in Personal hygiene, Factory hygiene, judges temperature maintenance during processing, observes online processing
- Observes freezing and packing related to production and process control
- Employs cleaning schedule, estimation of available chlorine, chlorination levels of different areas of processing plant
- Lists National and International standards in sea food industry, explains Various Inspection systems
- Describes Hazard Analysis and Critical Control Point in Sea food industry
- Identifies different records maintained in processing plants

## 2. Fishery Value added and Byproduct

- Prepares fish marinades, fish /clam/prawn pickle, fish /clam/ prawn cutlet, Fish wafers, Fish sausage, Fish Ball, Fish Finger, Fish momos, Fish Protein Concentrate, Fish soup powder, Dried Prawn pulp, Masmin flakes
- Prepares various fishery byproducts like chitin & chitosan, shrimp extract, Fish meal, Fish body oil, Pearl essence, Isinglass, Fish silage



- Describes processing of various aquatic products like Algin, Agar agar, Carrageenan, Beche-de-mer, Ambergris
- Packaging of sea foods
- Identifies packing materials like glass containers, metal cans, types of paper packages, cellophane, LDPE, HDPE, aluminium foil and retort pouch
- Packs IQF products and block frozen Products
- Explains vacuum packing, packing on stand pouch, packing in polythene covers.
- Packs various value added fishery products and byproducts.
- Describes the packaging of canned fish and fish pickle
- Describes modern packing methods like MAP, CAP, Vacuum packing

## **LEARNING OUTCOMES**

After completing the course, the learner.....

- Ñ Describes bacterial cell structure, growth phases, classification
- Ñ Identifies pathogenic bacteria, employs microbial examination and TPC
- Ñ Identifies media for bacterial culture, microbial limits and colony characters
- Ñ Practices quality control standards
- Ñ Prepares various value added fishery products

- Ñ Prepares various fishery by products
- Ñ Prepares various aquatic products
- Ñ Employs modern packing techniques

#### COURSE STRUCTURE

Module No.	Module Name	No. of periods
III	FISH QUALITY CONTROL AND INSPECTION SYSTEMS	340
IV	FISHERY VALUE ADDED AND BYPRODUCTS	340

#### SYLLABUS

#### **Module 3: FISH QUALITY CONTROL AND INSPECTION SYSTEMS**

Unit No.	Name of units	Periods
3.1	<b>Basic Microbiology</b> Ñ Bacterial structure Ñ Growth of bacteria Ñ Classification of bacteria (based on shape, temperature, oxygen requirement, salt requirement, Nutrient requirement, Gram staining) Ñ Pathogenic and non pathogenic bacteria	60
3.2	<b>Fishery Microbiology</b> Ñ Sampling methods Ñ Media used for bacterial culture Ñ Colony characters of basic pathogenic bacteria Ñ Total Plate Count Ñ Laboratory equipments such as hot air oven, autoclave, incubator, colony counter, thermometer, glass wares	90
3.3	<b>Public health microbiology</b> Ñ <i>Clostridium botulinum</i> Ñ <i>Salmonella typhi</i> Ñ <i>Vibrio cholerae</i> Ñ <i>Vibrio parahaemolyticus</i> Ñ <i>Escherichia coli</i> Ñ <i>Staphylococcus aureus</i> Ñ <i>Streptococcus</i> Ñ <i>Shigella</i> Ñ Microbial limits	50
3.4	<b>Hygiene and Sanitation in Fish Processing Plants</b> Ñ Sanitation Standard Operating Procedures (SSOP) Ñ Good Manufacturing Practices (GMP)	70

3.5	<b>Inspection Systems</b>	
	Ñ National and International standards	
	Ñ In plant Quality Control (IPQC)	70
	Ñ Hazard Analysis Critical Control Point (HACCP)	
	Ñ European Union Standard (EU standard)	
	Ñ Records maintained in processing plants	
	<b>TOTAL</b>	<b>340</b>

#### Module 4: FISHERY VALUE ADDED AND BYPRODUCTS

Unit No.	Name of units	Periods
4.1	<b>Value Added Fishery Products</b>	
	Ñ Fish marinades	
	Ñ Fish cutlet	
	Ñ Fish wafers	
	Ñ Fish sausage	
	Ñ Fish ball	
	Ñ Fish finger	
	Ñ Fish momos	
	Ñ FPC	
	Ñ Fish soup powder	
	Ñ Dried Prawn pulp	
Ñ Masmin flakes		
		150

4.2	<b>Fishery Byproducts</b> Ñ Chitin and chitosan Ñ Shrimp extract Ñ Fish meal Ñ Fish body oil Ñ Pearl essence Ñ Isinglass Ñ Fish silage	130
4.3	<b>Miscellaneous Aquatic Products</b> Ñ Algin Ñ Agar agar Ñ Carrageenan Ñ Beche-de-mer Ñ Ambergris	10
4.4	<b>Packaging of fishery products</b> Ñ Packing materials Ñ Packaging of frozen products Ñ Packaging of dried products Ñ Packaging of value added fishery products and byproducts Ñ Modern packaging techniques <b>TOTAL PERIODS</b>	50      <b>340</b>

### LEARNING OUTCOMES OF THE COURSE

After the completion of the third and fourth module of the course the learner.

3.1.1 Describes the structure of a bacterial cell

- 3.1.2 Describes the different growth phase of a bacteria and plots the growth curve
- 3.1.3 Classifies bacteria based on shape, temperature tolerance, oxygen requirement, salt requirement, nutrient requirement, Gram's staining
- 3.1.4 Differentiates pathogenic and non pathogenic bacteria
- 3.2.1 Employs sampling methods for microbial, physical, organoleptic and chemical examination
- 3.2.2 Identifies different culture media such as Stock buffer, Nutrient Agar, B P Agar, T 7 agar, Alkaline Peptone Water, TCBS Agar, Peptone water, Lactose Broth, BS Agar / X L D Agar, Mac Conkey broth
- 3.2.3 Employs the methods of sterilization such as heat sterilization, chemical sterilization, filtration and radiation sterilization
- 3.2.4 Employs TPC of fishery products
- 3.3.1 Observes the characters and identifies source of contamination, disease and symptoms of *Clostridium botulinum*
- 3.3.2 Observes the characters and identifies the source of contamination, disease and symptoms of *Salmonella typhi*
- 3.3.3 Observes the characters and identifies the source of contamination, disease and symptoms of *V. cholerae*
- 3.3.4 Observes the characters and identifies the source of contamination, disease and symptoms of *V. parahaemoliticus*
- 3.3.5 Observes the characters and identifies the source of contamination, disease and symptoms of *E. coli*
- 3.3.6 Observes the characters and identifies the source of contamination, disease and symptoms of *Staphylococcus aureus*
- 3.3.7 Observes the characters and identifies the source of contamination, disease and symptoms of *Streptococcus*
- 3.3.8 Observes the characters and identifies the source of contamination, disease and symptoms of *Shigella*
- 3.3.9 Lists microbial limits of different fishery products
- 3.3.10 Identifies and operates different lab equipments used in microbiological laboratory such as: Autoclave, Hot air oven, Incubator, Colony counter, Water bath, Water still, BOD incubator.
- 3.3.11 Identifies and handles different glasswares used in Fishery microbiology lab
- 3.4.1 Role-plays personal hygiene

**3.4.2** Teaches factory hygiene

**3.4.3** Evaluates the quality of raw material in a processing plant

**3.4.4** Practices online processing

**3.4.5** Records temperature maintenance during processing

**3.4.6** Experiments freezing and packing related to production and process control

**3.4.7** Experiments packing and storage of frozen foods

**3.4.8** Observes shipment of processed material

**3.4.9** Lists key points on SSOP

**3.4.10** Sketches chlorination chart

**3.4.11** Estimates available chlorine in process water

**3.4.12** Practices the cleaning schedule in a processing plant

**3.5.1** Lists National and International standards in sea food industry

**3.5.2** Evaluates various inspection systems

**3.5.3** Constructs HACCP in Sea food industry

**3.5.4** Writes different records maintained in processing plants like Hazard analysis work sheet, HACCP plan form, Tunnel freezer register, Plate freezer registers, Consolidated daily production register, Daily sanitation check list, Check list for personal hygiene, Chlorination register, Register for analytical report, Raw material evaluation register, Register for pre-processing summary and Register for processing.

**4.1.1** Prepares cooked fish marinades

**4.1.2** Prepares fried marinades

**4.1.3** Prepares fish /clam/ prawn cutlet

- 4.1.4 Prepares Fish wafers
- 4.1.5 Prepares Fish sausage
- 4.1.6 Prepares Fish Ball
- 4.1.7 Prepares Fish Finger
- 4.1.8 Prepares Fish momos
- 4.1.9 Describes the preparation of Fish Protein Concentrate
- 4.1.10 Prepares Fish soup powder
- 4.1.11 Prepares Dried Prawn pulp
- 4.1.12 Describes the preparation of Masmin flakes
- 4.2.1 Prepares chitin & chitosan
- 4.2.2 Prepares shrimp extract
- 4.2.3 Prepares Fish meal
- 4.2.4 Prepares Fish body oil
- 4.2.5 Describes the preparation of Pearl essence
- 4.2.6 Describes the preparation of Isinglass
- 4.2.7 Prepares Fish silage
- 4.3.1 Explains the source and importance of Algin
- 4.3.2 Explains the source and importance of Agar agar
- 4.3.3 Explains the source and importance of Carrageenan
- 4.3.4 Explains the source and importance of Beche-de-mer
- 4.3.5 Explains the source and importance of Ambergris
- 4.4.1 Identifies packing materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch
- 4.4.2 Practices packing of Frozen Material like IQF products, Block frozen Products.



4.4.3 Practices packing methods like packing on stand pouch, packing in polythene covers.

4.4.4 Categorizes the packing of various value added fishery products and byproducts.

4.4.5 Classifies the packaging of canned fish and fish pickle

4.4.6 Evaluates modern packing methods like MAP, CAP, Vacuum packing

### SCHEME OF WORK

#### MODULE 3: FISH QUALITY CONTROL AND INSPECTION SYSTEMS

Unit No.	Month	Name of Units	Periods
3.1	JUNE	BASIC MICROBIOLOGY	60
3.2	JUNE/JULY/AUGUST	FISHERY MICROBIOLOGY	90
3.3	AUGUST	PUBLIC HEALTH MICROBIOLOGY	50
3.4	SEPTEMBER	HYGIENE AND SANITATION IN FISH PROCESSING PLANTS	70
3.5	OCTOBER	INSPECTION SYSTEMS	70
		<b>TOTAL</b>	<b>340</b>

#### MODULE 4: FISHERY VALUE ADDED AND BYPRODUCTS

Unit No.	Month	Name of Units	Periods
4.1	NOV/DEC	VALUE ADDED FISHERY PRODUCTS	150
4.2	DEC	FISHERY BYPRODUCTS	130
4.3	JAN	MISCELLANEOUS FISHERY PRODUCTS	10
4.4	JAN	PACKING OF FISHERY PRODUCTS	50
		<b>TOTAL</b>	<b>340</b>

#### STRUCTURE OF MODULE - 3

Unit No.	Unit Name	Periods
3.1	BASIC MICROBIOLOGY	60
3.2	FISHERY MICROBIOLOGY	90
3.3	PUBLIC HEALTH MICROBIOLOGY	50
3.4	HYGIENE AND SANITATION IN FISH PROCESSING PLANTS	70
3.5	INSPECTION SYSTEMS	70

<b>TOTAL</b>	<b>340</b>
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#### STRUCTURE OF MODULE - 4

<b>Unit No.</b>	<b>Name of Units</b>	<b>Periods</b>
4.1	VALUE ADDED FISHERY PRODUCTS	150
4.2	FISHERY BYPRODUCTS	130
4.3	MISCELLANEOUS AQUATIC PRODUCTS	10
4.4	PACKAGING OF FISHERY PRODUCTS	50
	<b>TOTAL</b>	<b>340</b>

#### CLASSROOM ACTIVITIES

- Ñ General discussions
- Ñ Seminars
- Ñ Group discussions
- Ñ Debate
- Ñ Interaction with industrial experts

- Ñ Power point presentation
- Ñ IT enabled audio visual aids
- Ñ Exhibitions – charts, diagrams
- Ñ Assignments
- Ñ Projects

### **PRACTICAL ACTIVITIES**

- Ñ Lab works
- Ñ Field visits
- Ñ Survey
- Ñ Case study
- Ñ PTC/OJT

### **OVERVIEW OF MODULE – 3**

Bacteria are widely distributed in nature. They are present in animals, plants, soil, air and waters. There are both useful and pathogenic bacteria; the former one brings changes including decomposition of dead tissues of both plants and animals and the latter causes various types of diseases.

Indian marine products are preferred in the markets of developed countries due to our constant efforts in quality maintenance. Various quality inspection systems are being enforced in our country to ensure seafood quality. These regulations are intended to ensure that the marine products are wholesome, safe and produced under hygienic conditions.

This module highlights both the basic and applied aspects of fishery microbiology and quality assurance in sea food processing and equips the learners with understanding on microbial hazards and appropriate control measures.

## MODULE- III: FISH QUALITY CONTROL AND INSPECTION SYSTEMS

### UNIT 3.1 BASIC MICROBIOLOGY

Microbiology is the study of microscopic organisms and how they interact with humans and environment. This unit describes the structure of a bacterial cell, different growth phases of bacteria, classifies the bacteria based on shape, temperature tolerance, oxygen requirement, nutrient requirement, salinity tolerance, and gram staining. This unit also deals with pathogenic and non pathogenic bacteria.

<b>Ideas/Concepts/ skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
Bacterial structure	<b>3.1.1</b> Describes the structure of a bacterial cell	General discussion on structure of bacterial cell Drawing the structure of a bacterial cell	Assessment of previous knowledge by quiz
Growth of bacteria	<b>3.1.2</b> Describes the different growth phase of a bacteria and plots the growth curve	Chart preparation on the different growth phase of bacteria Describe the different growth phase of bacteria	Practical record, Involvement in discussion Observation on practical record
Classification of bacteria	<b>3.1.3</b> Classifies bacteria based on shape, temperature tolerance, oxygen requirement, salt requirement, nutrient requirement, Gram's staining	General discussion on the classification of bacteria based on temperature tolerance, shape, oxygen requirement, salt requirement and Gram's staining	Drawings in practical record ( shape of bacteria )

Pathogenic and non pathogenic bacteria

**3.1.4** Differentiates pathogenic and non pathogenic bacteria

Discussion on pathogenic and non pathogenic bacteria  
Film show based on pathogenesis of bacteria

Involvement in discussion  
Report of the show

## **Additional information**

**According to arrangement** bacteria can be classified as

### **Cocci – division in one plane**

1. Diplococci – These arrangements occur when a cell divides and the pair stay together after division.
2. Streptococci – After division, the cells stay together and form a chain of cells.

### **Cocci – division in multiple planes.**

3. Tetrads – Tetrads are produced when cellular division occurs in 2 planes and the cells remain together (4 cells)

Sarcinae – Sarcinae are described as packets or cube like bundles of cells. (8 cells)

Staphylococci – When division occurs in multiple planes and a grape like bunch of cells is formed.

Bacilli – division occurring across the short axis.

Diplobacilli – 2 bacilli that are paired together

Strepto bacilli – cells form a chain.

## **Classification based on oxygen requirement**

Ñ **Facultative anaerobes** – These bacteria are capable of grow in both in the presence and absence of oxygen. Eg. *E. coli*

Ñ **Obligate anaerobes** - They survive in the absence of oxygen, but when exposed to oxygen they die.

Ñ **Micro aerophilic** – These bacteria require extremely low concentration of oxygen for their growth. Eg. *Lactobacillus casei*

## ***Temperature and bacteria***

The lowest temperature at which a particular species will grow is the minimum growth temperature, while the maximum growth temperature is the highest temperature at which they will grow. The temperature at which their growth is optimal is called the optimum growth temperature.

Most bacteria thrive at temperatures at or around that of the human body 98.6°F (37°C), and some, such as *Escherichia coli*, are normal parts of the human intestinal flora. These organisms are mesophiles (moderate-temperature-loving), with an optimum growth temperature between 77°F (25°C) and 104°F (40°C). Mesophiles have adapted to thrive in temperatures close to that of their host.

Psychrophiles, which prefer cold temperatures, are divided into two groups. One group has an optimal growth temperature of about 59°F (15°C), but can grow at temperatures as low as 32°F (0°C). These organisms live in ocean depths or Arctic regions. Other psychrophiles that can also grow at 32°F (0°C) have an optimal growth temperature between 68°F (20°C) and 86°F (30°C). These organisms, sometimes called psychrotrophs, are often those associated with food spoilage under refrigeration.

Thermophiles thrive in very hot environments, many having an optimum growth temperature between 122°F (50°C) and 140°F (60°C), similar to that of hot springs in Yellowstone National Park. Such organisms thrive in compost piles, where temperatures can rise as high as 140°F (60°C). Extreme thermophiles grow at temperatures above 195°F (91°C). Along the sides of hydrothermal vents on the ocean bottom 217 mi (350 km) north of the Galapagos Islands, for example, bacteria grow in temperatures that can reach 662°F (350°C).

**Symbiotic bacteria** – These are bacteria which obtain food by association with other organism. Eg. Rhizobium bacteria in leguminous plants. Here the bacteria fix nitrogen in roots by absorbing it from air. This nitrogen acts as fertilizer to plant in return they take nutrition from the same plant.

**Saprophytic** – These are bacteria survive by eating rotten materials. They get their nutrition by consuming dead and decaying material

Some types of bacteria, called extreme or obligate halophiles, are adapted to—and require—high salt



concentrations, such as found in the Dead Sea, where salt concentrations can reach 30%. Facultative halophiles do not require high salt environments to survive, but are capable of tolerating these conditions. Halophiles can grow in salt concentrations up to 2%, a level that would inhibit the growth of other bacteria. However, some facultative halophiles, such as *Halobacterium halobium* grow in salt lakes, salt flats, and other environments where the concentration of salts is up to seven times greater than that of the oceans.

4. Depending on the Requirement of Water and Salt for Growth:

**(a) Halophobic Bacteria:**

They die at salt concentrations above 1%. They are the salt-hating bacteria.

**(b) Halophilic Bacteria (Halophiles):**

They require at least some salt (NaCl) for their growth.

Eg. *Serratia salinaria*

**They are of three types as follows:**

**(i) Mild halophiles:**

These halophiles require NaCl at low concentrations of 1-6% for their growth. Example: *Vibrio fischeri*

**(ii) Moderate halophiles:**

They require NaCl at moderate concentrations of 6-15% for their growth.

**(iii) Extreme halophiles:**

These bacteria require NaCl at high concentrations of 15-30% for their growth. Example: *Halobacterium salinarum*

**(c) Halotolerant Bacteria (Halotolerants):**

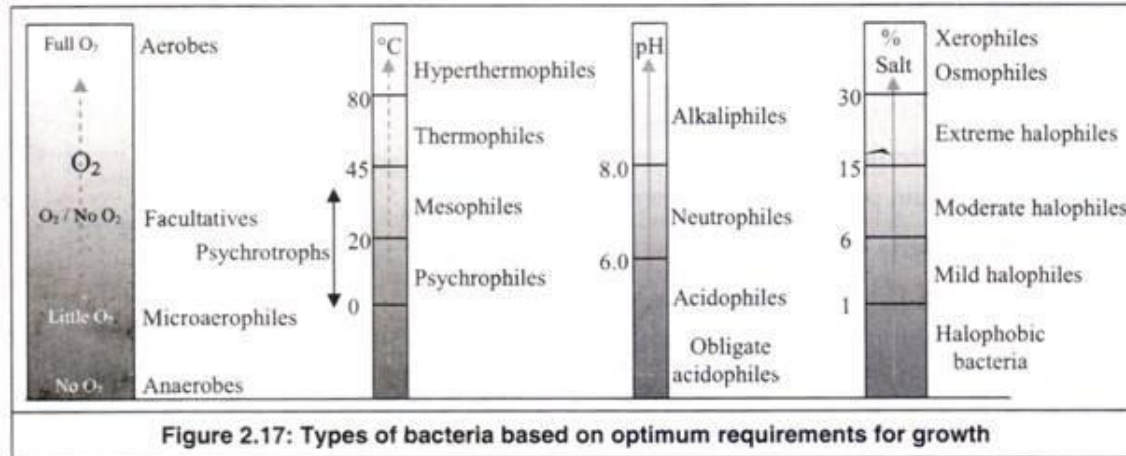
They can tolerate and grow at some concentrations of salt, but growth is best in absence of salt. Example: *Staphylococcus aureus*.

**(d) Osmophilic Bacteria (Osmophiles):**

These bacteria are able to grow in high osmotic environments, which contain high concentration of solutes (salt or sugar).

**(e) Xerophilic Bacteria (Xerophiles):**

They can grow in very dry environments.



Read more: [Bacteria - Characteristics Of Bacteria, Bacterial Growth, Physical And Chemical Requirements For Bacterial Growth, The Role Of Bacteria In Fermentation - Aerobic and anaerobic bacteria - JRank Articles](#)

### **Assessment activity**

Preparation of a bacterial cell model

Draw and label the parts of a bacterial cell

Draw the growth curve of bacteria and identify the phase

Quiz based on the classification of bacteria

Group discussion on pathogenic and non pathogenic bacteria

### **PORTFOLIO**

1. Bacterial cell model

2. Chart on growth phase of bacteria

3. Report on classification of bacteria

4. Discussion report on film show

### Unit 3.2 Fishery microbiology

In this unit the learners get an idea about the different strains of bacteria present in fish and fishery products. The sampling methods for microbial examination practised in a fish processing plant, assessing the total plate count, colony characters of various pathogenic bacteria, different media used for bacterial culture and the safe limits of different bacteria in sea food are dealt with. The learners and teachers should be very cautious while handling the microbes in the laboratory as they are contagious.

Ideas/Concepts/skills	Learning outcomes	Suggested activities	Assessment
Sampling methods	<b>3.2.1</b> Employs sampling methods for microbial, physical, organoleptic and chemical examination	General discussion OJT/ field visit	Involvement in sampling of fishery products OJT & OJT Report on methods of sampling for microbial examination
Media used for bacterial culture	<b>3.2.2</b> Identifies different media for bacterial culture	Familiarize different bacterial culture media used in fishery microbiology laboratory Preparation of stock buffer Preparation of working buffer	OJT & OJT Report Practical work record on working buffer preparation
Methods of sterilization	<b>3.2.3</b> Employs the methods of sterilization	General discussion on methods of sterilization Familiarize different methods of sterilization used in fishery microbiology laboratory	Report on methods of sterilization OJT & OJT Report on methods of sterilization

Total plate count

**3.2.4** Employs TPC of  
Fishery products

Employs TPC of Fishery  
products

Practical work on TPC  
OJT & OJT Report on TPC

### **Additional Information**

For every individual unit produced in a processing plant there should be a code slip containing the following information:

- Approval number of the unit
- Name of the product and size grade
- Date, month and year of production

Approval No. 123

CFWC 5/7

16 A 1

CFWC - Cuttle Fish Whole Cleaned

5/7 - Size grade

16 A 1 - 2016 January 1<sup>st</sup>

### **Assessment activity**

Preparation of Stock buffer and working buffer

Sample collection for, physical, chemical, bacteriological and organoleptic analysis

## Port folio

Discussion report

Chart on bacterial media

### Unit 3.3 Public health microbiology

Certain micro organisms are pathogenic and cause diseases to man, animals and plants.

This unit gives an idea about some of the pathogens of public health importance, its disease symptoms and control measures. Using the lab facilities in our school the microbial load in the house hold / open waters and the quality of ice from the nearby ice plants can be checked, thereby our PTC can be made service oriented also.

Ideas/Concepts/skills	Learning outcomes	Suggested activities	Assessment
<i>Clostridium botulinum</i>	<b>3.3.1</b> Observes the characters and identifies source of contamination, disease and symptoms of <i>Clostridium botulinum</i>	General discussion on characters, source of contamination, disease and symptoms of <i>Clostridium botulinum</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>Clostridium botulinum</i>
<i>Salmonella typhi</i>	<b>3.3.2</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>Salmonella typhi</i>	General discussion on characters, source of contamination, disease and symptoms of <i>Salmonella typhi</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>Salmonella typhi</i>
<i>Vibrio cholerae</i>	<b>3.3.3</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>V. cholerae</i>	General discussion on characters, source of contamination, disease and symptoms of <i>V. cholerae</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>V. cholerae</i>

<i>Vibrio parahaemoliticus</i>	<b>3.3.4</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>V. parahaemoliticus</i>	General discussion on characters, source of contamination, disease and symptoms of <i>V. parahaemoliticus</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>V. parahaemoliticus</i>
<i>Escherichia coli</i>	<b>3.3.5</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>E. coli</i>	General discussion on characters, source of contamination, disease and symptoms of <i>E. coli</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>E. coli</i>
<i>Staphylococcus aureus</i>	<b>3.3.6</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>Staphylococcus aureus</i>	General discussion on characters, source of contamination, disease and symptoms of <i>Staphylococcus aureus</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>Staphylococcus aureus</i>
<i>Streptococcus</i>	<b>3.3.7</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>Streptococcus</i>	General discussion on characters, source of contamination, disease and symptoms of <i>Streptococcus</i>	Report on general discussion on characters, source of contamination, disease and symptoms of <i>Streptococcus</i>
<i>Shigella</i>	<b>3.3.8</b> Observes the characters and identifies the source of contamination, disease and symptoms of <i>Shigella</i>	General discussion on characters, source of contamination, disease and symptoms of <i>Shigella</i>	Report on general discussion on characters, source of contamination, disease and symptoms <i>Shigella</i>
Microbial limits	<b>3.3.9</b> Lists microbial limits of different fishery products	Collection of data through field visit, internet etc.	Vocational diary on microbial limits

Laboratory equipments	<p><b>3.3.10</b> Identifies and operates different lab equipments used in microbiological laboratory such as: Autoclave Hot air oven Incubator Colony counter Water bath Water still BOD incubator</p> <p><b>3.3.11</b> Identifies and handles different glasswares used in Fishery microbiology lab</p>	<p>General discussion on the working principles of different lab equipments such as Autoclave, Hot air oven, Incubator Colony counter, Water bath, Water still, BOD incubator</p> <p>Handling of glass wares in the lab/ OJT/ Field visit</p>	<p>Report on the working principle of lab equipments</p> <p>Drawings and practical record on Autoclave Hot air oven Incubator Colony counter Water bath Water still BOD incubator Observations on identification and handling of glasswares OJT Report</p>
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## **Additional Information**

### **COLONY CHARACTERS**

<i>Staphylococcus aureus</i>	Small black shiny colonies surrounded by an area of clear zone in BP (Baird Parker) Agar.
<i>E. coli</i>	Lime yellow colonies with rust brown centre and a yellow zone around in T 7 (Tergitol 7) agar.
<i>Vibrio cholerae</i>	Large colonies (2- 3 mm dia), smooth yellow slightly flattened with opaque centres and translucent peripheries in TCBS (Thiosulphate – Citrate – Bile – Salts – Sucrose) Agar.
<i>Salmonella</i>	Brown to black colonies with metallic sheen in BSA (Bismuth Sulphite Agar). Red colonies with or without black centres in XLDA (Xylose Lysine Desoxy Cholate Agar).
<i>V. parahaemolyticus</i>	Round 3- 5 mm colonies green or blue in colour with blue or green centres in TCBS Agar.
Coliform bacteria	Yellow colour with gas production in Mac Conkey Broth.

## **Assessment activity**

Chart preparation on colony characters of pathogenic organisms

Write up on laboratory equipments

## **Port folio**

Charts

Report

### **Unit 3.4 Hygiene and sanitation in fish processing plants**

In the early stages the quality of products processed and exported by our sea food industry was heterogeneous in nature due to the lack of quality standards. This unit highlights the quality aspects like GMP which includes factory hygiene, personal hygiene; SSOP and chlorination schedule.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
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GMP	<p><b>3.4.1</b> Role-plays personal hygiene</p> <p><b>3.4.2</b> Teaches factory hygiene</p> <p><b>3.4.3</b> Evaluates the quality of raw material in a processing plant</p> <p><b>3.4.4</b> Role-plays online processing</p> <p><b>3.4.5</b> Records temperature maintenance during processing</p> <p><b>3.4.6</b> Experiments freezing and packing related to production and process control</p> <p><b>3.4.7</b> Experiments packing and storage of frozen foods</p> <p><b>3.4.8</b> Observes shipment of processed material</p>	<p>General discussion on Personal hygiene Questionnaire on personal hygiene</p> <p>General discussion on Factory hygiene Field visit to understand Factory hygiene Exhibition on Factory hygiene aspects</p> <p>Discussion on raw material quality in a processing plant</p> <p>Discussion on online processing Actual work during OJT</p> <p>Discussion on temperature maintenance during processing Discussion on freezing and packing related to production and process control</p> <p>Discussion on packing and storage of frozen foods. Discussion on shipment of processed material</p>	<p>Report on General discussion on personal hygiene</p> <p>Report on General discussion on Factory hygiene Posters on Factory hygiene Report on visit to processing plant Survey report on Factory hygiene Report on raw material quality</p> <p>Seminar report on online processing OJT Report on Production and Process control Report on visit to processing plant Discussion notes and OJT reports</p> <p>Discussion notes and OJT reports</p> <p>Discussion notes and OJT reports</p> <p>Discussion notes and OJT reports</p>
SSOP	<p><b>3.4.9</b> Lists key points on SSOP</p>	<p>Discussion on key points on SSOP</p>	<p>Report on key points on SSOP</p>

Chlorination	<p><b>3.4.10</b> Sketches chlorination chart</p> <p><b>3.4.11</b> Estimates available chlorine</p>	<p>Discussion on the chlorination chart on processing plant.</p> <p>Estimation of available chlorine using the titration method</p>	<p>Chart on Chlorination Schedule</p> <p>Record on Estimation of available chlorine</p>
Cleaning Schedule	<b>3.4.12</b> Practices the cleaning schedule in a processing plant	Discussion on the cleaning schedule in a processing plant	Report on the cleaning schedule in a processing plant

### **Assessment Activities**

Preparation of questionnaire on personal hygiene and factory hygiene

Summarize the cleaning procedure followed in processing plants

Handling of apparatus in lab while titration

Calculation of available chlorine

### **Port folio**

Report on field visit

Questionnaire

### Unit 3.5 Inspection Systems

In order to assure the quality of sea foods various inspection systems are in use. The guidelines by these inspection agencies ensures that marine products are safe to consume and produced under hygienic conditions. This unit highlights the various aspects of inspection systems in India and abroad.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
National and International standards	<b>3.5.1</b> Lists National and International standards in sea food industry	Discussion on National and International standards in sea food industry	Report on the national and international standards in sea food industry
Various Inspection systems	<b>3.5.2</b> Evaluates various inspection systems	Discussion on Various Inspection system	Report on Various Inspection system
Hazard Analysis Critical Control Point (HACCP)	<b>3.5.3</b> Constructs HACCP in Sea food industry	Discussion on the principles of HACCP Understand HACCP in detail during OJT	OJT Report on HACCP

Records maintained in processing plants	<b>3.5.4</b> Writes different records maintained in processing plants like: Hazard analysis work sheet HACCP plan form Tunnel freezer register Plate freezer registers Consolidated daily production register Daily sanitation check list Check list for personal hygiene Chlorination register Register for analytical report Raw material evaluation register Register for pre-processing summary Register for processing	Discussion on records maintained in processing plants. Preparation of copy of Records and registers maintained in processing plants	Report on discussions  Assignment on Preparation of copy of Records and registers maintained in processing plants
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### **Additional Information**

#### **HACCP**

##### **Preliminary steps**

###### ***General information***

Record the name address of processing unit on Hazard Analysis Worksheet and HACCP plan form.

###### ***Describe the food***

Identify the market name or scientific name of the fishery component of the product.

Examples

Ñ Tuna/ Euthynnus affinis

Ñ Shrimp/ *Penaeus monodon*

Fully describe the finished product

Examples

Ñ Individually quick frozen shrimp

Ñ Fresh tuna steaks

Describe the packaging type

Examples

Ñ Bulk in wax- coated paperboard box

Ñ Vacuum packaged plastic bag

Record this information in the space provided on the first page of Hazard Analysis Worksheet and HACCP plan form.

***Describe the method of distribution and storage***

Identify how the product is distributed and stored after distribution

Examples

Ñ Stored and distributed as frozen

Record this information in the space provided on the first page of Hazard Analysis Worksheet and HACCP plan form.

***Identify the intended use and consumer***

Identify how the product will be used by the end user or consumer

Examples

Ñ To be heated and served

Ñ To be fully cooked before consumption

Identify the intended consumer or user of the product

Examples

Ñ By the general public

Ñ By another processing facility



Ñ To hospitals and nursing homes

Record this information in the space provided on the first page of Hazard Analysis Worksheet and HACCP plan form.

### ***Develop a flow diagram***

The purpose of the diagram is to provide a clear, simple description of the steps involved in the processing of fishery product and its associated ingredients as they flow from receipt to distribution.

### **Hazard Analysis Worksheet**

#### ***Set up Hazard Analysis Worksheet***

Record each processing steps, from the flow diagram, in the column 1 of the Hazard Analysis Worksheet.

The following facts are examined to assess the hazards

The likely occurrence of hazards and severity of their adverse health effects.

The qualitative or quantitative evaluation of the presence of hazards.

Survival or multiplication of micro organisms of concern.

Production of toxins, chemicals or physical agents, and conditions leading to the above.

#### ***Identify the potential species related hazards***

Determine whether it has a potential hazard or not. If so record the potential hazard (s) in column 2 of the Hazard Analysis Worksheet at each processing step.

#### ***Identify potential process related hazards***

Record the potential hazard (s) in column 2 of the Hazard Analysis Worksheet at each processing step.

#### ***Complete the hazard analysis worksheet***

There may be more than one CCP at which control is applied to address the same hazard. The determination of CCP in the HACCP can be facilitated by the application of decision tree. If a hazard has been identified at this step where control is necessary for safety, no control measure exists at that step, or any other, then the product or process should be modified at that step or at any earlier or later stage, to include a control measure.

#### ***Complete the HACCP plan form and establish monitoring procedure***

Most monitoring procedures for CCP will have to be done rapidly because they relate to online process. Physical and chemical measurements are often preferred to microbiological testing because they may be done rapidly and can often indicate the microbiological control of the product.

#### ***Establish corrective actions***

Specific corrective actions must be developed for each CCP in the HACCP system. The action must ensure that the CCP has been brought under control.

#### ***Establish verification procedures***

Establish procedure for verification and auditing methods. The frequency of verification should be sufficient to confirm that the HACCP system is working effectively.

***Establish Documentation and Record Keeping***

Efficient and accurate record keeping is essential to the application of HACCP system. HACCP procedures should be documented. Documentation and record keeping should be appropriate with regard to the operational procedures.

**Assessment activities**

- Ñ Identification of hazards
- Ñ Identification of CCP
- Ñ Identification of various records
- Ñ Unit test

**Port folio**

- Ñ Assignment on inspection systems and quality standards
- Ñ Charts on physical, chemical and biological hazards
- Ñ Answer scripts

**EXTENDED ACTIVITY**

Seminar on Contamination, Spoilage, Preservation and Processing of Fish and other Sea foods

Water analysis of adjacent water bodies for TPC and coliforms

Quality inspection of ice from ice plants, PTC can be made service oriented

**OVERVIEW OF MODULE 4**

Ready to eat and ready to cook fishery based products have not been popularised among consumers in India. It can be produced with out much investment and sophisticated technology. Production of fishery based products can be

included in the rural development programmes. Encouraging the production and marketing of fishery byproducts through cottage industries can create self employment opportunities at village level. This will enhance living standards of the rural poor of India.

Hence this module highlights the importance of fish and other sea foods by familiarizing and developing skills in the production of various fish byproducts and other sea foods.

## **ABOUT THE UNITS**

### **UNIT 4.1 Value Added Fishery Products**

Value addition is the most talked about word in the processing industry. Besides, value addition is one of the possible approaches to raise the profitability of fish processing industry, which now lays greater emphasis on quality assurance. A large number of value added and diversified fish products both for export and internal market based on shrimp, lobster, squid, cuttle fish, bivalves and minced meat from low priced fish have been identified by the industry.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>

Fish marinades	<p><b>4.1.1</b> Prepares cooked fish marinades</p> <p><b>4.1.2</b> Prepares fried fish marinades</p>	<p>General discussion on different fishery value added products</p> <p>Discussion on preparation of cooked fish marinades</p> <p>Preparation of fried fish marinades</p>	<p>Report on different fishery value added products</p> <p>Report on preparation of fish marinades</p> <p>Involvement in the preparation of the product</p> <p>Observation and calculation in practical record</p>
Fish Cutlet	<b>4.1.3</b> Prepares fish /clam/ prawn cutlet	<p>Discussion on preparation of fish /clam/prawn cutlet</p> <p>Preparation of fish /clam/prawn cutlet</p> <p>Evaluate the economics in preparation of fish /clam/prawn cutlet</p>	<p>Report on preparation of fish /clam/prawn cutlet</p> <p>Involvement in the preparation of the product</p> <p>Observation and calculation in practical record</p>
Fish wafers	<b>4.1.4</b> Prepares Fish wafers	<p>Discussion on preparation of fish wafers</p> <p>Preparation of fish wafers</p>	<p>Report on preparation of Fish wafers</p> <p>Involvement in the preparation of the product</p> <p>Observation and calculation in practical record</p>
Fish sausage	<b>4.1.5</b> Prepares Fish sausage	<p>Discussion on preparation of Fish sausage</p> <p>Preparation of Fish sausage</p>	<p>Report on preparation of Fish sausage</p> <p>Involvement in the preparation of the product</p> <p>Observation and calculation in practical record</p>
Fish Ball	<b>4.1.6</b> Prepares Fish Ball	Discussion on preparation of Fish Ball	Report on preparation of Fish Ball

Fish Finger	<b>4.1.7</b> Prepares Fish Finger	Discussion on preparation of Fish Finger  Preparation of Fish Finger	Report on preparation of Fish Finger  Involvement in the preparation of the product Observation and calculation in practical record
Fish momos	<b>4.1.8</b> Prepares Fish momos	Discussion on preparation of Fish momos  Preparation of Fish momos	Report on preparation of Fish momos  Involvement in the preparation of the product Observation and calculation in practical record
Fish Protein Concentrate	<b>4.1.9</b> Discusses the preparation of Fish Protein Concentrate	Discussion on preparation of Fish Protein Concentrate	Report on preparation of Fish Protein Concentrate Involvement in the preparation of the product
Fish soup powder	<b>4.1.10</b> Prepares Fish soup powder	Discussion on preparation of Fish soup powder  Preparation of Fish soup powder	Report on preparation of Fish soup powder  Involvement in the preparation of the product Observation and calculation in practical record
Dried Prawn pulp	<b>4.1.11</b> Prepares Dried Prawn pulp	Discussion on preparation of Dried Prawn pulp  Preparation of Dried Prawn pulp	Report on preparation of Dried Prawn pulp  Involvement in the preparation of the product Observation and calculation in practical record

Masmin flakes	<b>4.1.12</b> Describes the preparation of Masmin flakes	Discussion on preparation of Masmin flakes	Report on preparation of Masmin flakes
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### **Additional information**

Lakshadweep is well known for its rich tuna fishery. Almost the entire tuna landed here is converted by a special method into 'Masmin', a heavily smoked, hard-dried product. The method of preparation is very primitive so that the product lacks the qualities expected of it. Since the masmin industry contributes a major share to the economy of the islands and the product is esteemed as a delicacy in Sri Lanka, Singapore and Malaysia, improvement in the quality of the product is sure to find better acceptability and in turn improve the islands' economy.

### **Production of fish mince**

Mince can be prepared either from gutted fish or whole fish. Mince from gutted fish will be better in colour, appearance and flavour. For best quality minces it is desirable to use only a single species of fish so that mince of different quality and stability do not mix together. The freshness of the raw material profoundly influences the quality of the mince. The mince will contain all the components like the enzymes, lipids, haem pigments etc. in the fish that affect its shelf stability. The mince is frozen and stored.

### **Assessment activity**

Group discussion

Class test

Calculation of the economics of fish cutlet prepared through PTC.

Marketability skill of fish cutlet

Write up on Fish sausage, Fish balls, Fish fingers, Fish momos , FPC

**. Port folio**

Charts on different Fishery products like Fish marinades, Fish cutlet, Fish wafers, Fish sausage, Fish ball, Fish fingers, Fish momos

**UNIT 4.2 Fishery Byproducts**

Fish offal and trash fishes are the major sources for the production of fish byproducts. Fish flesh on an average contains 15-20 per cent protein. Some species of fish contain very high amounts of body oil. Few species of fish like shark, cod etc. are good sources of liver oil. Fish processing and filleting industries turn out large quantities of fishery waste. All these are good sources of high quality protein, fat, minerals etc. and are used to produce different fishery byproducts.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
Chitin & chitosan	<b>4.2.1</b> Prepares chitin & chitosan	Discussion on preparation chitin & chitosan Preparation of chitin & chitosan  Field visit to a chitosan plant	Report on preparation of chitin & chitosan Involvement in the preparation of the product Observation and calculation in practical record  Field visit report

Shrimp extract	4.2.2 Prepares shrimp extract	Discussion on preparation of Shrimp extract	Report on preparation of shrimp extract
Fish meal	4.2.3 Prepares Fish meal	Discussion on preparation fish meal Preparation of fish meal  Field visit to a fish meal plant.	Report on preparation of fish meal Involvement in the preparation of the product Observation and calculation in practical record Field visit report
Fish body oil	4.2.4 Prepares Fish body oil	Discussion on preparation Fish body oil Preparation of Fish body oil	Report on preparation of Fish body oil Involvement in the preparation of the product Observation and calculation in practical record
Pearl essence	4.2.5 Describes the preparation of Pearl essence	Discussion on preparation of Pearl essence	Report on preparation of Pearl essence
Isinglass	4.2.6 Describes the preparation of Isinglass	Discussion on preparation of Isinglass	Report on preparation of Isinglass
Fish silage	4.2.7 Prepares Fish silage	Discussion on preparation Fish Silage Preparation of Fish Silage	Report on preparation of Fish silage  Involvement in the preparation of the product Observation and calculation in practical record

### Assessment activities

Quiz

Draw flow chart for preparation of chitin



Draw flow chart for preparation of fish meal by wet rendering method.

Draw flow chart for preparation of fish body oil

Seminar on fishery byproducts

Unit test

**Port folio**

Report on the preparation of chitin and chitosan

Report on Shrimp extract preparation

Report on Fish meal preparation

Report on Fish body oil

Report on Pearl essence

Report on Isinglass and their uses

Fish silage

Field visit report

### UNIT 4.3 MISCELLANEOUS AQUATIC PRODUCTS

Sea weeds are the major plant item from sea and have higher content of important minerals like calcium and iron. For centuries seaweeds of various kinds have been put in to several uses in the countries of south and south east Asia. A total of nearly 700 species of marine algae have been identified from different parts of Indian coasts, of these about 50 species are commercially important. A variety of products from marine environment are also available for commercial use. This unit highlights the important plant and animal based aquatic products and their uses.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
Algin	<b>4.3.1</b> Explains the source and importance of Algin	General discussion on Algin	Report on Algin
Agar agar	<b>4.3.2</b> Explains the source and importance of Agar agar	General discussion on Agar agar	Report on Agar agar
Carrageenan	<b>4.3.3</b> Explains the source and importance of Carrageenan	General discussion on Carrageenan	Report on Carrageenan
Beche-de-mer	<b>4.3.4</b> Explains the source and importance of Beche-de-mer	General discussion on Beche-de-mer	Report on Beche-de-mer
Ambergris	<b>4.3.5</b> Explains the source and importance of Ambergris	General discussion on Ambergris	Report on Ambergris

#### **Assesment activity**

Write up on miscellaneous aquatic products

#### **Port folio**

Report on Algin, Agar agar, Carrageenan, Beche-de-mer, Ambergris

### UNIT 4.4 PACKAGING OF FISHERY PRODUCTS

Packaging may be defined as the means of ensuring the safe delivery of a product to the end consumer in sound condition at the minimum overall cost. Food packaging is an external means of preservation of food during storage , transportation and distribution. It forms an integral part of production and has to be provided at the production center itself. Packaging materials protect the product from contamination or loss. The printing on the exterior of the package helps to identify the brand and attract the buyer's attention.

<b>Ideas/Concepts/skills</b>	<b>Learning outcomes</b>	<b>Suggested activities</b>	<b>Assessment</b>
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Packing Materials	<p><b>4.4.1</b> Identifies packing materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch</p>	<p>Discussion and Identification of packing materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch</p> <p>Exhibition on packing materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch</p>	<p>Report on packaging materials like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch</p> <p>Exhibits like Glass containers, Metal cans, Types of paper packages, Cellophane, LDPE, HDPE, Aluminium foil and Retort pouch</p>
Packaging of Frozen Material	<p><b>4.4.2</b> Practices packing of Frozen Material like IQF products, Block frozen Products.</p>	<p>Discussion on Packing of Frozen Material like IQF products, Block frozen Products.</p> <p>Employs the Packing of Frozen Material like IQF products, Block frozen Products.</p>	<p>Report on the Packing of Frozen Material like IQF products, Block frozen Products.</p> <p>Record on the Packing of Frozen Material like IQF products, Block frozen Products.</p> <p>OJT report on the Packing of Frozen Material like IQF products, Block frozen Products.</p>

Packaging of Dried Products	<b>4.4.3</b> Practices packing methods like, packing on stand pouch, packing in polythene covers.	Discussion on packing methods like packing on stand pouch, packing in polythene covers.  Employs packing on stand pouch, packing in polythene covers.	Report on packing methods like packing on stand pouch, packing in polythene covers.  Record on packing methods like packing on stand pouch, packing in polythene covers
Packaging of value added Fishery products and by products	<b>4.4.4</b> Categorizes the packing of various value added fishery products and byproducts	Discussion on the packaging of various value added fishery products and byproducts  Employs the packaging of various value added fishery products and byproducts	Report on the packing of various value added fishery products and byproducts  Record on the packing of various value added fishery products and byproducts
Packaging of canned fish and fish pickle	<b>4.4.5</b> Classifies the packaging of canned fish and fish pickle	Discussion on packaging of canned fish and fish pickle  Employs packaging of canned fish and fish pickle	Report on Packaging of canned fish and fish pickle  Record on packaging of canned fish and fish pickle through PTC/OJT
Modern Packaging Methods	<b>4.4.6</b> Evaluates modern packing methods like MAP, CAP, Vacuum packing	Discussion on modern packing methods like MAP, CAP, Vacuum packing  Assignment on methods and materials used in packing of Fishery based products	Report on modern packing methods like MAP, CAP, Vacuum packing  Assignment on methods and materials used in packing of Fishery based products

## **Additional Information**

**Casing, sausage casing, or sausage skin** is the material that encloses the filling of a sausage. Casings are divided into two categories, natural and artificial.

**Natural sausage casings** are made from the sub-mucosa, a layer of the intestine that consists mainly of naturally occurring collagen. This should not be confused with collagen casings, which are artificially processed from collagen derived from the skins of cattle. Natural casings are derived from the intestinal tract of farmed animals, are edible and bear a close resemblance to the original intestine after processing. The outer fat and the inner mucosa lining are removed during processing.

A large variety of sausage is produced world-wide using intestines of pigs, sheep, goats, cattle and sometimes horses. Although the intestines were previously flushed, scraped and cleaned by hand, more recently, machinery has been used for large scale production

**Artificial casings** are made of collagen, cellulose, or even plastic and may not be edible. Artificial casings from animal collagen can be edible, depending on the origin of the raw material.

**Collagen casings** are mainly produced from the collagen in beef or pig hides, and the bones and tendons. It can also be derived from poultry and fish.

**Plastic casings** are extruded like most other plastic products. Plastic casings are not commonly used due to health hazards. Plastic casings are generally made from polymers such as Polyamide, Polypropylene or Polyethylene.

**Assessment activity**

Evaluate the personal skill of learners on packaging of various frozen fishery products.

Packaging of dried fishery products

Packaging of value added Fishery products

Packaging of fish pickle

**Port folio**

Report on modern packaging techniques

Collection and exhibition of packing materials

## EXTENDED ACTIVITY

Seminar on Prospects of Battered and Breaded products in Indian Sea food industry

Project preparation for setting up a small scale “Value added fishery product unit”

## ON-THE-JOB-TRAINING

OJT is an essential part of vocational education to impart technical skills in the specific areas. It gives a good platform for students to learn the working condition and work culture. OJT helps the learner to identify the skill needs of the industry. It is the place where the students acquire and polish their vocational skill. The students get familiarized with the administrative background of the institution where they undergo training. This will contribute the managerial skill in future. A total one month OJT can be scheduled as per the modules in related industries.

**OJT centres include private organizations, Govt. /Semi govt. organizations:**

- ABAD Fisheries, Vizhinjam, Thiruvananthapuram
- KING MARINE PRODUCTS, Uliyakovil, Kollam
- SAN MARINE Exports, Sakthikulangara, Kollam
- CAPITHAN Exports, Sakthikulangara, Kollam
- IAP, Sakthikulangara, Kollam
- NETTOS Exports, Sakthikulangara, Kollam
- Dry Fish Compex, Dept. of Fisheries, Sakthikulangara, Kollam



- Nalapakam, Dept. of Fisheries, Sakthikulangara, Kollam
- MATSYAFED Chitosan Plant, Neendakara
- CHARLY'S Fisheries, Neendakara, Kollam
- KING Fisheries, Neendakara, Kollam
- VERONICA Exports, Neendakara, Kollam
- MATSYAFED Fish Meal Plant, Alapuzha
- NIFPHATT, Ernakulam
- CIFT, Wellington Island, Ernakulam
- MATSYAFED Ice & Freezing Plant, Kochangadi, Ernakulam
- UNIROYAL Marine Exports, Vengalam, Kozhikode
- MATSYAFED Fish Meal Plant, Azheecode, Kodungalloor,  
Thrisur
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